



**SCHOOL OF ECONOMICS
AND MANAGEMENT**

Lund University
Department of Informatics

**Impact of SOA Adoption with regard to Business Value:
A study from South East Asia Bank**

Master thesis, 15 credits, INFM02 , in Informatics

Presented: June, 2010

Authors: Ida Bagus Sutawijaya

Silvia Chiok

Supervisor: Odd Steen, Nicklas Holmberg

Examiners: Agneta Olerup, Magnus Wärja

Title	Impact of SOA Adoption with regard to Business Value: A study from South East Asia Bank
Authors	Ida Bagus Sutawijaya Silvia Chiok
Publisher	Department of Informatics
Supervisor	Odd Steen, Nicklas Holmberg
Examiners	Agneta Olerup, Magnus Wärja
Presented	June, 2010
Thesis type	Master thesis
Language	English
Keywords	Service-Oriented Architecture, SOA, SOA Adoption, business value, business agility, cost, IT architecture, informatics.

ABSTRACT

In today's rapid changing environment organisations are required to quickly adapt to the new market conditions. As a result, organisations strive to be flexible and be agile in order to cope with these conditions. Moreover, the introduction of new technologies and information systems has increased the number of middleware in IT architectures, which are considered monolithic and inflexible. SOA is an emerging architectural style that attempts to solve these problems.

The concept of SOA is a relatively new concept and there is currently an increase interest in SOA, both from academic researchers and industry practitioners. It is being argued that SOA has many different interpretations which can be regarded as ambiguity and confusion. Moreover, there is little knowledge on SOA adoption and the impact of SOA adoption in an organisation. As a result this study will answer the following research question: what is the impact of SOA adoption?

In order to answer the research question, this study will first explain some concepts related to SOA and present an overview of SOA adoption by conducting a literature review. The literature review results in a research framework and it is use thereafter to conduct an empirical study. Empirical data has been collected from two sources: SOA adoption project documentation and interviews with different key persons from a Large South East Asia Bank.

Our preliminary findings suggest that from a business value perspective, SOA impact an organisation from two dimensions: business agility and costs. Business agility factors include: system integration, alignment between IT and business goals, response to market changes & customer demands, data flow, and customer services; while cost factors comprises: application development cost and time, reuse of existing applications and operation costs. Other factors identified during the empirical study were: increase human-resource productivity as well as increase in application reliability. This study concludes by proposing a model as a basis for future SOA adoption studies.

Acknowledgements

Firstly, we would like to thank to God the almighty. Only with His mercy, that made us able to finish this thesis on time.

We also give special appreciation to the CIO of the Large South East Asia Bank and all the interviewees for their support and valuable input for our research study. A special thanks also goes to our supervisors Odd Steen and Nicklas Holmberg, who have provided us with insightful guides and useful comments to our study.

Finally, we thank to our family and people around us who have supported us during the hard time.

Sutawijaya and Silvia

Table of Contents

1	Introduction	1
1.1	Background.....	1
1.2	Research Focus.....	2
1.3	Purpose of the Study	4
1.4	Target Group.....	4
1.5	Limitations and Delimitations.....	4
2	Theoretical Framework.....	5
2.1	Service Oriented Architecture.....	5
2.1.1	Understanding SOA	5
2.1.2	SOA Technology	8
2.1.3	SOA Challenges	9
2.2	SOA Adoption	10
2.3	IT Architecture.....	10
2.4	SOA and IT Architecture	11
2.5	SOA Impact Frameworks.....	12
2.5.1	Erl (2005) Framework.....	12
2.5.2	Patrick (2005) Framework.....	14
2.5.3	Beiberstain et al (2005) Framework	14
2.5.4	Yoon and Carter (2007) Framework.....	15
2.5.5	Fink and Neumann (2007) Framework.....	16
2.6	Results of Literature Review	17
3	Method.....	20
3.1	Research Strategy	20
3.2	Research Process.....	22
3.2.1	Defining the Research Question.....	22
3.2.2	Literature Review	23
3.2.3	Selection of Case Company.....	24
3.2.4	Empirical Study.....	24
3.2.5	Analysis of Empirical Data.....	26
3.3	Generalization	26
3.4	Quality Aspects	28
3.4.1	Reliability.....	28

3.4.2	Internal Validity.....	28
3.4.3	External Validity.....	29
3.4.4	Bias.....	29
3.5	Ethics.....	30
3.6	Critiques of Research Approach.....	31
4	Presenting Empirical Data.....	33
4.1	Brief about the Case Company.....	33
4.2	Empirical Data from Project Documentation.....	34
4.2.1	The Drivers of SOA Adoption.....	34
4.2.2	SOA Adoption Strategy.....	36
4.2.3	SOA Reference Architecture.....	37
4.3	Empirical Data from the Interviews.....	39
5	Empirical Analysis.....	41
5.1	SOA Adoption Context.....	41
5.1.1	SOA Adoption Process.....	41
5.1.2	IT Architecture Fitness.....	42
5.2	The Impact of SOA Adoption.....	44
5.2.1	Business Agility.....	44
5.2.2	Cost.....	49
5.2.3	Other Factors.....	51
5.2.4	Summary of the Impact of SOA adoption.....	53
5.3	Combined Analysis.....	54
6	Conclusion.....	57
6.1	The Impact of SOA Adoption in the Case Company.....	57
6.2	Study Limitation.....	59
6.3	Further Studies.....	60
	Appendices.....	61
Appendix A:	List of Abbreviations.....	61
Appendix B:	Interview Guides.....	62
Appendix C:	Interview with the Bank’s Deputy General Manager.....	63
Appendix D:	Interview with the Bank’s SOA co-project Manager.....	64
Appendix E:	Interview with the Bank’s SOA Implementer.....	69
	References.....	71

List of Figures

Figure 2.1 Relation between business logic, service, and application (Erl, 2005, pp. 50)	6
Figure 2.2 SOA Impact in Organization based on Erl (2005)	13
Figure 2.3 SOA impact in Enterprise Information Architecture based on Patrick (2005)	14
Figure 2.4 SOA impact in Enterprise System, Organization Structures, and Individuals based on Beiberstain et al. (2005)	15
Figure 2.5 SOA Impact in Organization based on Yoon and Carter (2007)	16
Figure 2.6 IT Architecture Impact on Organizational Agility based on Fink and Neumann (1994)	17
Figure 2.7 Research Framework	18
Figure 3.1 Research Strategy	20
Figure 3.2 Study non convergence of evidence Adapted from Yin (2003), page 100.	22
Figure 4.1 SOA Reference Architecture (SOA Architecture Workshop Report, 2007, pp. 37) ...	38
Figure 5.1 SOA Adoption Process	41
Figure 5.2 IT Architecture Fitness	42
Figure 5.3 The Similarities between the Bank's SOA initiatives and Research Framework	55
Figure 6.1 Refinement Research Framework	59

List of Tables

Table 2-1 Descriptions of SOA	7
Table 2-2 Common SOA Characteristics (Erl, 2005).....	8
Table 2-3 SOA Technological Elements (Krafzig et al., 2005).....	9
Table 2-4 Enterprise SOA Stacks (Woods and Mattern, 2006)	12
Table 3-1 Quality aspect of the research	28
Table 4-1 The Bank's Business Goals for SOA adoption	35
Table 4-2 The Bank's IT Goals for SOA adoption	36
Table 5-1 IT Architecture Fitness	43
Table 5-2 SOA Adoption Impact on System Integration.....	45
Table 5-3 SOA Adoption Impact on Alignment IT and Business Goals	46
Table 5-4 SOA Adoption Impact on Response to Market Changes or Customer Demands	47
Table 5-5 SOA Adoption Impact on Data Flow	47
Table 5-6 SOA Adoption Impact on Customer Service.....	48
Table 5-7 SOA Adoption Impact on Application Development Time and Cost.....	49
Table 5-8 SOA Adoption Impact on Re-usability of Applications	50
Table 5-9 SOA Adoption Impact on Operational Cost.....	51
Table 5-10 Discovered SOA Adoption Impact	52
Table 5-11 Summary of The Impact of SOA Adoption.....	53
Table 5-12 The Impact of SOA adoption for the Bank.....	56

1 Introduction

1.1 Background

The rapid changing business environment organizations face today, puts pressures on the organizations' flexibility and adaptability capabilities (Papazoglou & Van den Heuvel, 2006). Introduction of new technologies, merger & acquisitions, and legacy systems are examples of drivers for change in business environments. Continual innovation, competitive action and agility are nowadays becoming core elements of strategic thinking in many contemporary organizations. Consequently, the increase use of information systems has driven many organizations to reevaluate their strategies and also to re-examine information technologies role in shaping their business strategies (Sambamurthy et al., 2003).

Ross (2003) implies that IT are often large investment that account for at least 4,2 % of the annually revenues of an organization. The expenditure on IT-infrastructure is approximately 55% of the enterprise IT budget. Moreover, there seems to be a general consensus of the importance of an organisation IT-infrastructure, as well as the value of a flexible information technology infrastructure. For example, Davenport and Linder (1994) suggest that flexible IT infrastructure is a "new competitive weapon" while Byrd and Turner (2001) imply that effective IT infrastructure is a pre-requisite for doing business globally. As a result, all of these suggest the importance of IT-infrastructure in an organization.

It has been argued that flexibility and adaptability of an organizations' IT infrastructure constitute one of the components of a company's competitiveness. In order to achieve competitiveness, it is important to have robust IT infrastructure that allows organizations' to quickly implement changes (Byrd & Turner, 2001). More recently, Fink and Neumann (2007) study of the IT-infrastructure capabilities suggest that IT infrastructure has a strategic value for an organization because it is associated with the organization's ability to adapt successfully to changes in the external environment.

IT architecture has been studied in various academics studies. Some of these focus on the technical resources –hardware that comprises the IT, while other focuses on the IT capabilities that are deployed in order to support business processes. IT infrastructure and IT architecture are often used as synonyms, and they are considered to be an arrangement of hard technical components. These components include platforms (operating systems and hardware), data, telecommunications and network as well as core applications. IT architecture could also be regarded as a collection of shared IT services. Despite the different views on what IT architecture is and what it comprises, there is a common view that the IT infrastructure is shared across an organization (Fink & Neumann, 2007; Joachim et al., 2009).

IT architecture provides the connection, or integration, of information systems by supporting their communication. Thus, one of the main purposes of the IT architecture is to integrate the

different systems and make information available throughout an organization. Problems arise when information is not being stored in a single data store, and instead it is located in different individual silos (Patrick, 2005). The existence of different silos, also referred to as package applications (i.e. ERP systems and Supply Chain Management systems), create difficulties in accessing data sources, integrating information and transforming information. In order to solve these problems, organizations are now turning to Service Oriented Architecture (SOA), as a system integration approach (Yoon & Carter, 2007).

SOA is an emerging approach that addresses the problems related to requirements of loosely coupled, standards-based, and protocol-independent information systems, thus facilitating the integrations of information systems. Erl (2005) suggests that SOA can be viewed as a way to promote the communication of different systems; a common practice in SOA adoption is the use of Enterprise service bus (ESB), which handles system communication and integration (Erl, 2005; Beimborn, et al., 2008).

A study done by Forrester Research, a well known technology and market research company, suggests that North-American, European and Asian-Pacific companies have increased the use of Service-Oriented Architecture from 44% to 63% (Heffner, 2008). Since 2002 there are several conferences that specifically deal with the concept of SOA. Some of these include: International Conference on Web Services (ICSOC), the IEEE International Conference on Web Services (ICWS), the International Conference on Services Computing (SCC) and the European Conference on Web Services (ECOWS). Accordingly, there is a significant SOA awareness within academic researchers and industry practitioners, and many organizations are believed to be "doing something related to SOA" (Luthria et al., 2009).

1.2 Research Focus

Despite the fact that SOA is a relatively new approach, a study by Ren & Lyytinen (2008) suggests that there is a growing acceptance of SOA in practice, mainly due to the increasing number of SOA adoptions. Moreover, many organizations are currently considering migrating towards a Service-Oriented Architecture, yet there is still no common understanding of what Service-Oriented Architecture is (Erl, 2005).

A common misconception is that SOA and Web Services are two related concepts, which at times are being used indistinctively. Web Services are typically application systems that perform business functionality, for example, a service-based computing model, while a Service-Oriented Architecture provides for the IT-infrastructure in order to facilitate system interaction and communications between services. (Luthria et al., 2009).

Erl (2005) argues that the concept of SOA has led to confusion. He suggests that SOA's "apparent ambiguity" has resulted in different interpretations from vendors, IT professionals and the media. This in conjunction with the increasing interest from both academia and industry practitioners, discussed in sub-chapter 1.1, indicates that there seems to be an increase need to further explore the concepts of SOA.

Recent SOA related studies deal with different perspectives and aspects of SOA. Some studies examine the business value of SOA related to SOA adoption on electronic supply chains (Kumar et al. 2007a; Kumar et al. 2007b). Oh et al. (2007) revise the interrelation between competitive advantage, organizational integration and SOA. SOA adoption patterns and paths of SOA adoption are examined by Hanies and Haseman (2009). A multiple case study conducted by Schelp and Aier (2009), focuses on the sustainable contributions of SOA to corporate agility. Beinborn et al. (2008) and Yoon and Carter (2007) studies look at the business value of SOA adoption. Despite the increase number of academic works related to SOA, it is being argued that the academic literature is still “fragmented and immature in terms of explaining why and to what extend organizations adopt SOA” (Joachim et al., 2009). Moreover, there is limited research that concentrates on the impact SOA adoption in an organisation.

In summary, the *apparent ambiguity* about what SOA suggests that there is a need to further clarify theories around its concepts. Moreover, the limited research on the effects of SOA adoption makes this topic an interesting starting point for this study. As a result, we formulate this following research question for our study:

What is the impact of SOA adoption?

The term *impact* according to Oxford Dictionary (2010) refers to marked effect or influence, or can be regarded as a change which is a result of an action. For the relevance of this study, the context of action is the SOA adoption.

The term *adoption* refers to the decision to make full use of an innovation (Joachim et al., 2009). In this study the terms *SOA adoption* will be related to the decision of adopt implemented SOA, the process of implementing different SOA technologies and finally the operationalization of the new IT Architecture.

This research aims to answer the research questions following the premises:

1. This study focuses on the business value of SOA adoption. Business value examines the organizational performance impacts of SOA. In IT academic research, these impacts are usually related to productivity enhancement, profitability improvement, cost reduction and competitive advantage (Melville et al., 2004).
2. SOA is regarded as an IT architectural style.

1.3 Purpose of the Study

Taking into consideration the research focus area presented above, the main purpose of this to discover the impact of SOA adoption in organization with regard to business value. Whereas the second purpose of this study is to clarify the context of SOA adoption in organization.

1.4 Target Group

By further study of the concepts around SOA we hope to get a deeper understanding of SOA and the relationship between SOA and IT-architecture. We hope that by studying this relationship, we can provide decision makers with better grounds to understand what SOA is and how it can effect an organization. Thereby, providing decision makers with information for help them to decide whether or not to adopt SOA in an organization. Finally, taking into consideration the increase interest in SOA among academia, it is also our hope that this study will increase the academic interest towards SOA and IT-architecture.

1.5 Limitations and Delimitations

The focus of this study is Service Oriented Architectures, where the architecture has an IT-infrastructure enabler role in an organization. IT architecture is described as an arrangement or the combination of technical components, like systems platforms, core applications and networks (Fink & Neumann, 2007). Thus, the unit of study of this paper is an organization IT architecture.

The adoption of SOA involves a transformation process that affects the technological and social structure of organizations. As a result, SOA adoption involves a radical transformation of the IT architecture (Joachim et al. 2009).

As it was mentioned before, the purpose of this study is to discover the effects caused by SOA adoption in an organization. In order to narrow down the scope of this study, we will focus on the SOA adoption from a business perspective. Some technical concepts and details will be presented in this study, but its purpose is to give a general view about SOA and its complexity. We also delimit our study by not covering the impact of SOA adoption from the social structure aspect of organization.

2 Theoretical Framework

In this chapter, we present key concepts and areas based on the literature review. In order to answer the research question: what is the impact of SOA adoption? it is important to have a clear understanding of what SOA is. Therefore the first part of this chapter starts with theories concerning SOA and some of its technological characteristics. The second part of this chapter presents the term of SOA adoption. In the third part, we will present the relationship between SOA and IT architecture, starting with a broad definition of IT architecture. Next, in order to get some insights about the impact of SOA adoption, different frameworks of the benefits and impact of SOA adoption will be presented. This chapter concludes by making a summary of the literature review where our research framework will be developed and described.

2.1 Service Oriented Architecture

2.1.1 *Understanding SOA*

The term “service-oriented” has been used within IT/IS for some time and it has been used in many different contexts and for different purposes. Despite the different utilizations of the term service-oriented, there is a common perspective in which it represents a special approach to separate concerns as a way to solve large problems. Service orientation is a paradigm that allows the required logic to solve the problem to be divided into individual and inter-related smaller units of logic or service (Erl, 2005; Papazoglou & Van den Heuvel, 2005). From the perspective of IT/IS, the service orientation paradigm suggest that organization needs to re-define their businesses such as business task, business entity, or business process into fine grained service granularity. A fine grained service ensures their independence and makes them easier to be composed and orchestrated with other services.

A service is an individual units of logic that remotely accessible and exists autonomously but not isolated from other services (Erl, 2005; Krafzig et al., 2005). From the organization IT system perspective, services encapsulated all the functionalities and logic for organization’s specific business contexts such as business task, business entity, or business process (Erl, 2005). A service also provides abstraction and encapsulates application (Erl, 2005). The following figure depicts the relation between business logic, service, and application.

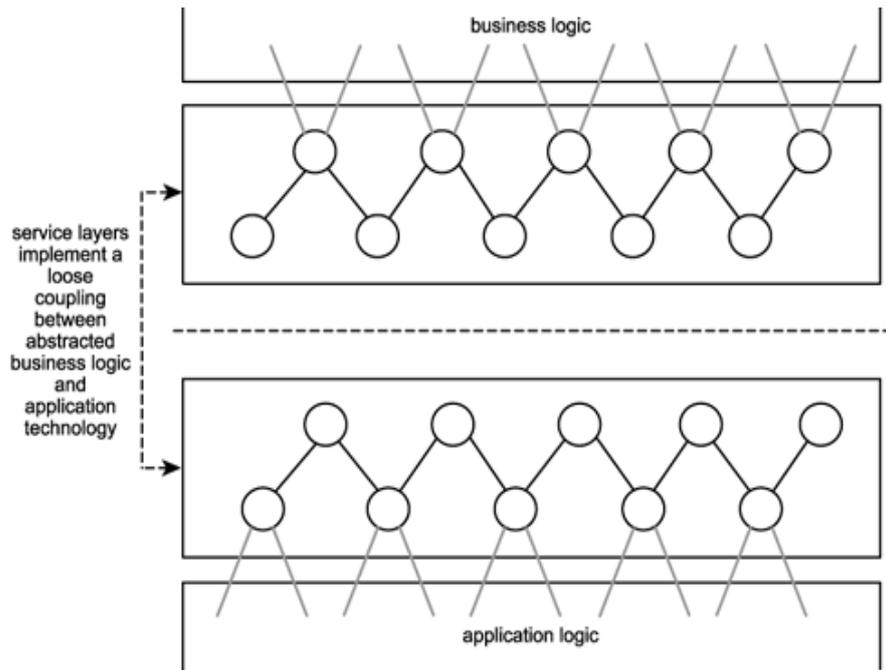


Figure 2.1 Relation between business logic, service, and application (Erl, 2005, pp. 50)

SOA has evolved from the principles of service orientation and Web Services. It provides new way to captures a new logical way of designing software systems that allows enterprise to develop, integrate and maintain enterprise applications in a flexible architecture (Papazoglou & Van den Heuvel, 2007). Some of the advantages often related to SOA include: organization agility, facilitation of enterprise system integration and federation (Erl, 2005). As it was mention in chapter 1.2, SOA has been conceptualized from different perspectives leading to some misconceptions on what SOA is. Table 2.1 summarizes some of the common descriptions of SOA.

Table 2-1 Descriptions of SOA

Author	Concept	Perspective
Bieberstein et al. (2005)	SOA is an integration framework from business and IT infrastructure that follows services orientation principal.	<input checked="" type="checkbox"/> Business <input checked="" type="checkbox"/> Technology <input checked="" type="checkbox"/> Service Orientation
Krafzig et al. (2005)	SOA is a construct of four key elements (application frontend, service, service repository, and service bus) that support service orientation	<input type="checkbox"/> Business <input checked="" type="checkbox"/> Technology <input checked="" type="checkbox"/> Service Orientation
Erl (2005)	SOA initially is as an abstract paradigm represented a baseline for distributed architecture that has no reference for its implementation (traditional form), then it evolves as an architectural style that delivers service orientation through the use of web services (contemporary form).	<input type="checkbox"/> Business <input checked="" type="checkbox"/> Technology <input checked="" type="checkbox"/> Service Orientation
Erl (2005), pp. 54	formal definition: "SOA is a form of technology architecture that adheres the principles of services orientation"	<input type="checkbox"/> Business <input checked="" type="checkbox"/> Technology <input checked="" type="checkbox"/> Service Orientation
McGovern et al. (2006)	SOA as component based software modules that provide service to other modules.	<input type="checkbox"/> Business <input checked="" type="checkbox"/> Technology <input checked="" type="checkbox"/> Service Orientation
SOA Manifesto (2010)	"SOA is a type of architecture that results from applying service orientation".	<input type="checkbox"/> Business <input checked="" type="checkbox"/> Technology <input checked="" type="checkbox"/> Service Orientation

The above mentioned descriptions have different perspectives in conceptualizing SOA, for example Bieberstein et al. (2005) view SOA from business and technical viewpoints, Erl (2005) initially perceived SOA as abstract paradigm from distributed architecture perspective, and McGovern et al. (2006) view from component based software perspective. However, they all share some common principles:

- Service orientation as a paradigm that allows services decomposition and orchestration,
- SOA is an architectural style that resulted from applying and following service orientation paradigm.
- There are set of technologies available to realize SOA (e.g.: web services and enterprise service bus).

As we have discussed above about different definitions of SOA as well as the common principals about those definitions, understanding the common characteristics of SOA is necessary to distinguish it with other concepts of IT architecture. According to Erl (2005), SOA has nineteen common characteristics, which are presented in table 2.2:

Table 2-2 Common SOA Characteristics (Erl, 2005)

No.	SOA Characteristic	Description
1.	Service-oriented computing	SOA represents architecture that supports Service-Oriented Computing platform.
2.	quality of service (QOS)	SOA ensuring QOS (security, reliability, performance, and integrity)
3.	autonomous	Independent and self-contained character of services.
4.	open standards	SOA leverages open, vendor-neutral data communication framework
5.	vendor diversity	SOA supports vendor diversity and not bounded to proprietary technology.
6.	discovery	SOA supports service directory throughout organization and their parties.
7.	intrinsic operability	Open standards, vendor diversity, & discovery constructed SOA intrinsic operability which is essential system-integration endpoints.
8.	federation	SOA supports federation by facilitating encapsulation of legacy and non-legacy system by exposing through service.
9.	architectural composability	SOA supports automation of business process through composability of service.
10.	inherent reusability	SOA establishes environment that facilitates service re-usability, a service can later be used for larger service composition.
11.	extensibility	SOA allows extensibility of service functionalities without breaking the established interface.
12.	service-oriented business modelling	SOA facilitates service to be modelled for expressing business logic.
13.	layers of abstraction	Service encapsulating and abstracting application logic as well as technology resources.
14.	loose coupling	SOA facilitates a service to be independent and provides loosely coupled services environment.
15.	agility	Organizational agility can be increased by leveraging loose coupling between business logic and application through its service layer.
16.	building block	SOA provides standard architectural platform for enterprise.
17.	evolution	SOA is an evolution from distributed system architecture.
18.	still maturing	The support for some features for enterprise-service level computing is not fully available yet.
19.	achievable ideal	A full adoption of SOA throughout enterprise is a state that enterprise would like to achieve.

2.1.2 SOA Technology

As it was mentioned in the previous chapter, there are a set of underlying technologies that can be used to adopt SOA. Krafzig et al. (2005) study on SOA best practices, presents a model to identify the technological elements usually included in SOA adoption projects: application

frontend technology, services technology, services directory technology, and services bus technology. Table 2.2 present a short description of these elements.

Table 2-3 SOA Technological Elements (Krafzig et al., 2005)

Element	Description	Example
Application Frontend	Presentation layer that can be used to interact with services within SOA	<ul style="list-style-type: none"> • Web based client • Desktop client • Mobile client
Services	<p>From technological view, a service is a software component that encapsulated functionalities and encapsulates logic for specific business contexts. Service has this following properties:</p> <ul style="list-style-type: none"> • Contract: provides standard for service specification (e.g. functionality, constraints, and usage). • Interface: exposes functionality of service to the client through network. Interface should be standardized to ensure the compatibility and easy communication between services. • Implementation: implements physical business logic and provides data. • Business Logic: handles logic of process between presentation layer and data. • Data: provides data-centric services. 	<ul style="list-style-type: none"> • XML • SOAP • WSDL
Service Directory	Provides standardization for services catalogue format that can be used to discover particular service and gives information how to use intended service.	<ul style="list-style-type: none"> • WSDL • UDDI
Service Bus	Platform that provides communication standards between services. Services bus enables the entire services within SOA to communicate each other and perform collaboration.	Enterprise Service Bus

2.1.3 SOA Challenges

SOA is a relatively new architectural style to build information systems. As such, there are new technologies and new families of applications. Furthermore, SOA has contribute to the new concepts and new technologies. As it was mentioned before, SOA adoption often leads to radical changes in the IT architecture of an organisation, especially in those cases that are considered “wide scale SOA applications” As such; the adoption of SOA involves some of the following challenges (Ren & Lyytinen, 2008; Joachim et al., 2009):

1. Security and dynamic manipulation of data, integration with external partners requires extra security protocols.
2. New design methodologies when designing IT architecture for loosely coupled systems, where normal development methodologies does not take into consideration service-orientation and uncertainties related to how to implement SOA principles.
3. Transformation of business functions into services, which is one of the main challenges of SOA. This involves the process to choose which business functions would be

transform to services as well as the degree of granularity (e.g. one big service that encompasses other services or detail decomposition of a specific service).

4. Organisational changes such as organization restructuring, because to take the full benefits of SOA, organization is required to change the way their work and often it requires new roles in the organizational structure.
5. Lack of standardizations of domain specifications in SOA, as SOA is still a new concept, there are not well establish standards.
6. SOA governance, e.g. SOA impact on responsibilities and operations methods in the IT department.

2.2 SOA Adoption

The terms adoption and implementation of an information technology, are sometimes used indistinctively. For example, Beimborn et al. (2008) in a study on the drivers and inhibitors of SOA business value state that *“organisations will only implement SOA (or: “adopt” the technology), if they perceive that SOA will increase their business value”*.

Joachim et al. (2009) suggests that the term *adoption* refers to the decision to make full use of an innovation. An early review of empirical research by Finch (1992), presents the concept of “organizational adoption of an innovation”, as the process of adopting an innovation, or technology, over a period of time. The author further develops this concept, and suggests that the use of a technology involves the interaction of individuals within the system that fits in some larger organizational process. Thus, the adoption of a technology, in this case, is done within a given organization context.

The adoption of SOA involves a transformation process that affects the technological and social structure of organizations. This transformation process involves the introduction of new technologies, concepts and principles on software development, IT management and IT architecture. Consequently, it has been argued that SOA adoption introduces radical transformation of an organisation’s IT architecture (Joachim et al. 2009).

According to Joachim et al.(2009), term *adoption* refers to the decision to make full use of an innovation. To make a decision for full use of innovation, organization needs to have motivations or drivers as rationale that underlying their decision.

2.3 IT Architecture

Fink and Newman (2007) quantitative study on the role of IT infrastructure capabilities, offered a broad view on what IT infrastructure is and makes a distinction on what IT infrastructure is from two different perspectives. The author’s first perspective of IT infrastructure includes the orchestration of components such as platforms (e.g. hardware and operating systems), networks, communication frameworks, data, and applications that are shared throughout organization. The

second perspective, suggests that IT infrastructure can be regarded as the IT architecture that includes the collection of shared IT services that support an organization's business process.

The main difference between the above mentioned perspectives is that the first gives emphasis on the static technical components that constructed the IT infrastructure, e.g. servers, computers, and network; while the second definition puts more focus on IT architecture, related to software applications that provide business services be shared and used throughout the entire organization. Although these are two different perspectives, they still have in common that IT infrastructure and IT architecture are shared through the entire organization (Fink and Newman, 2007).

For the purpose of this study, IT architecture will be defined as the collection of IT services that support organization's business process, called IT architecture from now on. The following are the IT architecture capabilities (Weill et al., 2002; Fink and Newman, 2007):

- ability to facilitate communication between IT components (e.g. core applications, platforms, and networks)
- ability to facilitate system integration as well as orchestration between different IT components (e.g. multi channel application orchestration, and unified view of data management)
- ability to provide IT-governance for all the IT components (e.g. facilities management, security and risk management, and standardization)

2.4 SOA and IT Architecture

As it was discussed in chapter 2.1.1, SOA contribute to a higher degree of system federation, more flexible system integration and improve organisational agility (Erl, 2005). A recent study from Luthria and Rabhi (2009) suggests that SOA might also contribute to an organisation competitive advantage by providing flexible interaction and communication between the IT services. The authors argued that IT architecture is in this case a strategic enabler, where SOA provides a platform for increasing the flexibility of IT architecture.

Other authors study SOA from an enterprise context, also referred as to enterprise SOA. Woods and Mattern (2006) define enterprise SOA as the full SOA adoption, this is SOA adopted for the entire enterprise architecture. Enterprise SOA enables interoperability between services layer, reduce cost of integration, create loosely coupled application, while supporting enterprise rationalization of IT systems (McGovern et al., 2006). Enterprise SOA involves a higher level of SOA diffusion, often describe in SOA stack levels. Table 2.3 describe five SOA stacks levels.

Table 2-4 Enterprise SOA Stacks (Woods and Mattern, 2006)

Layer	Description	Example
User Interface	The role of user interface layer is to manage lists of task that intended to reuse configurable components or services.	<ul style="list-style-type: none"> • Web based client • Desktop client • Mobile client
Process Orchestration	Since the process orchestration will happen at many different levels, composite applications will use this layer as the coordinator and integrator for set of process steps that exist in enterprise services. Meanwhile for the individual services might use process orchestration layer to create composite services.	<ul style="list-style-type: none"> • UDDI • Enterprise Services Bus
Enterprise Services	This layer is the place for services that are being exposed by enterprise applications or by external service providers in term of supporting business process. Enterprise services created not just for functionality purpose, but for greater participation for reusable processes.	<ul style="list-style-type: none"> • Web services
Business Object	Business objects constructed from collection of data and functionalities. The functionality of business objects will be exposed by enterprise services layer	<ul style="list-style-type: none"> • Legacy applications
Persistence	Persistence layer acts as the database where all the information and description from entire layers in stack are stored.	<ul style="list-style-type: none"> • Data sources

As it was mentioned in chapter 2.1.1, SOA is an emerging architectural style, which its adoption often leads to redefining enterprise IT architecture (Erl, 2005). This can explain by the introduction of new technologies, design principles and concepts that not only affect the IT architecture but also on organisational specific factors (Erl, 2005; Joachim et al, 2009).

2.5 SOA Impact Frameworks

This following section presents some frameworks depicting the benefits and impacts of IT Architecture on organization. Some of frameworks directly present the impact of SOA that can be regarded as an IT Architecture enabler to organization (Patrick, 2005; Beiberstain et al., 2005; Yoon and Carter, 2007), while other frameworks depicts the impact of IT Architecture to the organization and SOA benefits (Erl, 2005; Fink and Newman, 2007).

2.5.1 Erl (2005) Framework

Erl (2005) has identified the impact of SOA adoption in organization in these following aspects:

- System integration: since the nature of SOA that provides solution which built upon interoperable services, it will affect IT architecture to use services orientation principals when dealing with the system integration issues. The adoption of SOA technology within IT architecture will facilitates seamless cross application integration, since SOA technology will facilitate standardization for services; IT services governance, communication and orchestration between IT services.

- Component reusability: SOA makes the services are inherent for reuse. It will give impact for the design of IT components in application level requirements. SOA required IT components to support reusability principle.
- Architectural solution: within SOA, service can be independent or ready to be composed and orchestrated with another services. This leads to the higher degree of automation for the solution provided by IT architecture, since most of the services, composition, and orchestration have been handled by SOA technology within the IT architecture.
- Legacy investment: the use of technology standard in SOA such as web services and enterprise services bus, improves the IT architecture ability for facilitating flexible communication between IT components or legacy systems. Wrapping the legacy system into services with SOA technology makes the legacy system easy to interoperate with other services. As a result it will minimize the possibility of replacement and leverage the investment in legacy systems.
- Communication infrastructure: SOA provides standards in communication for services through its technology (e.g. web services and enterprise services bus). Thus SOA enables interoperability between IT components inside IT architecture as well as interfacing with external services that reside outside the IT architecture. This leads organization to focus their investments on providing reliable technology that responsible for communication.
- Alternatives solution: adopting SOA will create higher degree of vendor independency for IT architecture technology. As a result this will lead organization to be more flexible in choosing “the best of bread” technology for their IT architecture.
- Organizational agility: SOA empowers IT architecture for facilitating flexible communication and orchestration between services. This kind of IT architecture makes organization more flexible in arranging their business context (e.g. business task, business entity, or business process) as composable services and as a result will increasing organization’s agility in coping with the changes in business.

The following figure depicts the above mentioned aspects.

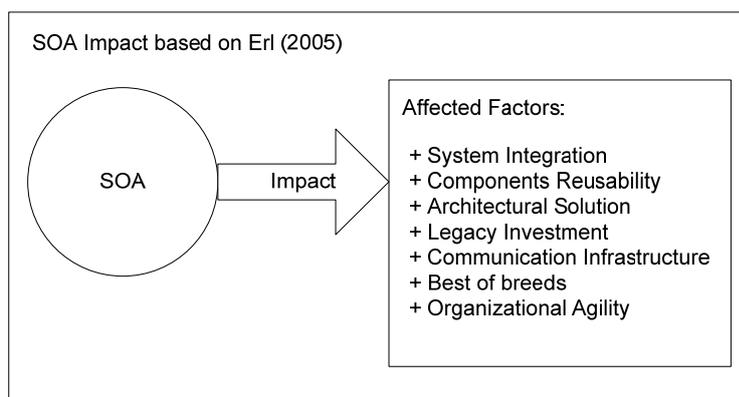


Figure 2.2 SOA Impact in Organization based on Erl (2005)

2.5.2 Patrick (2005) Framework

Patrick's (2005) study examines the impact of SOA on enterprise information architecture. By exposing data sources as services throughout organization, SOA will have an impact the following aspects:

- Data services: SOA emphasises on hiding the implementation and access mechanism between services. This also applies for the organization's data sources that have been wrapped into service orientation style. It will make less customization effort for application developer, since they now can focus on making services request and handling the responses instead of making specific code for each data sources.
- Unified information views: only exposing data sources as services within IT architecture is not enough to have unified information views. It will require organization's knowledge to select which information sources are needed to construct a unified view in particular context.
- Data transformation: exposing data sources as services also create another impact in organization especially in transforming message format between services. Services bus as one of SOA technology has empower IT architecture in addressing message transformation issue.
- Integration with enterprise security: as data source being exposed as services throughout organization, it also affects the security aspect in organization. Since most of the information are confidential, organization need to define services governance. Within this services governance, organization will create authentication and authorization rules for particular data source services.

The following figure illustrates the above mentioned aspects.

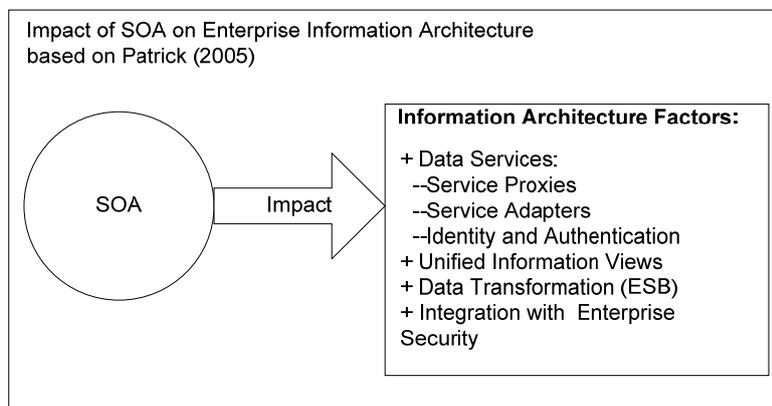


Figure 2.3 SOA impact in Enterprise Information Architecture based on Patrick (2005)

2.5.3 Beiberstain et al (2005) Framework

Within their study, Beiberstain et al. (2005) have positioned SOA as a facilitator for aligning IT components within organization's IT architecture. As an alignment facilitator, SOA enables IT architecture to provide communication infrastructure and facilitates flexible end to end connectivity between IT components throughout organization. Figure 2.3 summarized

Beiberstain et al. (2005) study results. The following items are major aspects that are affected by SOA adoption:

- Enterprise systems: the adoption of SOA through entire enterprise system is such a complex and difficult process, since it will involve silos of IT system that spread throughout organization and will create unified view of IT architecture as well as standardization of technology and method. As a consequence, to get successful enterprise wide SOA adoption it will require enterprise initiatives and directives that come from top management.
- Organizational structures: SOA adoption has affected the structure within organization. Organization needs to optimize their workforce by streamlining cross-unit process to exploit all benefits from new IT architecture. Instead of having classic organization structure (e.g. functional organization, divisional organization, and matrix organization), to release the full benefits of SOA organization must have flexibility in creating cross-business unit operations and flexible team-based services.
- Individuals: SOA adoption will create cultural transformation and behavioural changes at individual level. It will change how the individuals will carry out their work as well as the relation between individuals.

This following figure depicts the descriptions above.

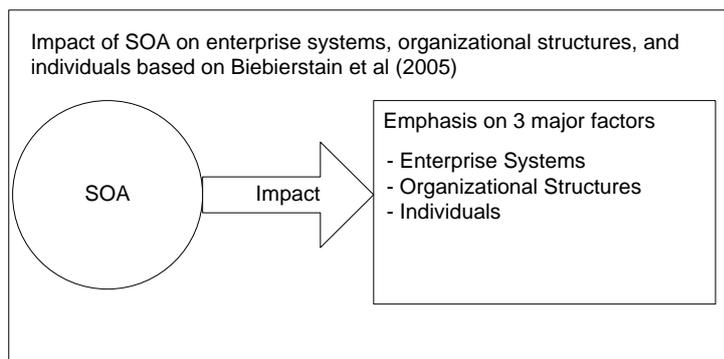


Figure 2.4 SOA impact in Enterprise System, Organization Structures, and Individuals based on Beiberstain et al. (2005)

2.5.4 Yoon and Carter (2007) Framework

Yoon and Carter (2007) multiple case study, identified the antecedent and benefits of SOA adoption. Their study focuses in the impact of SOA adoption from a business value perspective. This perspective is divided in the following categories:

- Business agility: SOA adoption has affected system integration, alignment between IT and business, response to market changes and customer demands, data flow, and the way organization deliver services to the customer. They are all together classified as business agility factor for organization

- Cost: SOA adoption also has influence on organizational cost that can be detailed in these following factors: application development time and cost, reusability of applications, and operational cost.

The following figure depicts the above mentioned aspects.

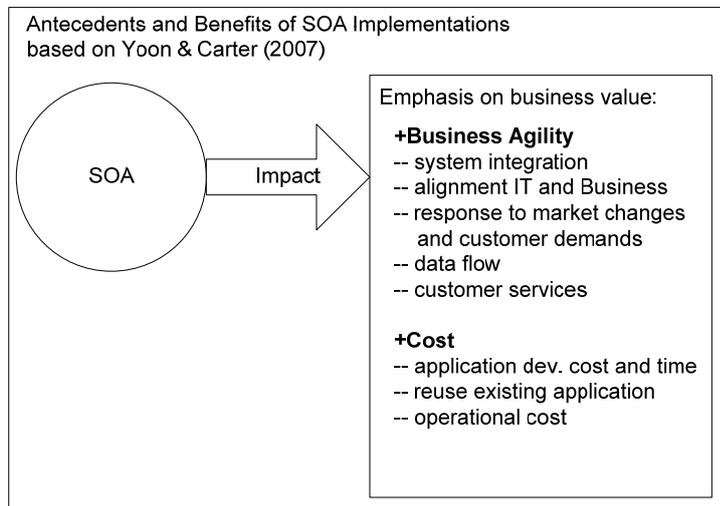


Figure 2.5 SOA Impact in Organization based on Yoon and Carter (2007)

2.5.5 Fink and Neumann (2007) Framework

Fink and Neumann (2007) study the impact of IT architecture on organizational agility. According to the authors organizational agility is associated with the ability of an organization to maintain competitive advantage. Flexibility affects an organisation competitive advantage, since an organisation is able recognize sudden changes in the market and respond in timely and cost effective manner (Baskerville et al., 2005; Seo & LaPaz, 2008; Cummins, 2009).

In this study relation between flexibility of IT architecture and the capability for realizing organizational agility constructs are further develop. This study suggests that there is a positive relation between the IT architecture flexibility and the realization of information agility (e.g. increasing the time response for information request), strategic agility (e.g. cutting time to market for new product/services development) and system agility (foster development time for information systems customization). An IT-architecture is considered to be flexible if it facilitates communications, orchestration and integration of IT services (or components).

The framework identifies three major factors that construct organizational agility:

- Information Agility: ability to accommodate the changes in information resources flows within organization.
- Strategic Agility: ability to response effectively for the changes in business by taking advantage of IT services.
- System Agility: ability to orchestrate the changes within information system in timely manner.

The following figure illustrates the descriptions above.

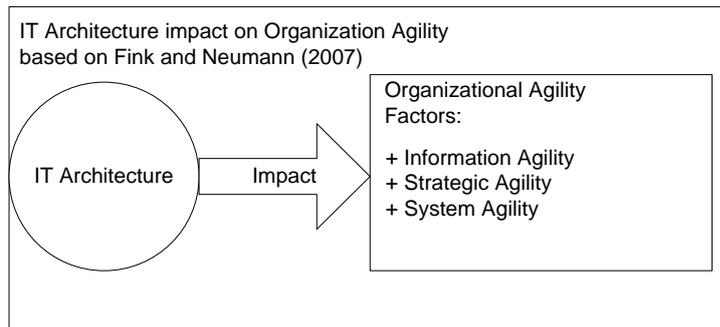


Figure 2.6 IT Architecture Impact on Organizational Agility based on Fink and Neumann (1994)

2.6 Results of Literature Review

In this chapter the relevant literature review has been presented in order to answer our research question: what is the impact of SOA adoption? As it has been discussed about the broad definitions of SOA in chapter 2.1, for the purpose of this study, SOA is defined as an IT architectural style that results from applying and follow service orientation paradigm, which uses a set of technologies to adopt SOA.

In chapter 2.2, the term of SOA adoption has been briefly discussed. In order to develop our understanding about SOA and IT architecture, we have presented discussion of IT architecture in chapter 2.3 and the relationship between SOA and IT architecture in 2.4. Since one of the purposes of this study is to identify the impact of SOA adoption in organisations, it is important to delimit the focus of this study in order to comply with these study resources limitations. Consequently, this research will focus on the impact of SOA from a business value perspective. In order to get some insights of SOA adoption, five frameworks about SOA benefits and SOA impacts has been presented in chapter 2.5.

From the five frameworks, we believe that Yoon & Carter (2007) is the most suitable framework for this study. It presents a broad outline of the possible impact of SOA adoption from a business value perspective. From the literature review conducted in this research it seems to be that there are no other frameworks that study SOA form a business value perspective. Moreover, Yoon & Carter's framework will provide a straightforward structure as basis for the empirical study. Finally, since the target group of this study, presented in chapter 1.4, are business practitioners and decision makers, it is important that this study presents the impact of SOA adoption in a concise and easy to understand format. Business practitioners and decision maker has often emphasizes the importance of IT investment in terms of business value: what will the organisation gain from investing and implementing a new technology?

In order to better understand the impact of SOA adoption, we will also provide a broad picture of the environment surrounding SOA adoption in an organisation. For this reason, the research

framework of this study will contain two main parts: the context of SOA adoption as well as the impact of SOA adoption, according to Yoon & Carter (2007) study. Figure 2.7 presents the overall framework of this study.

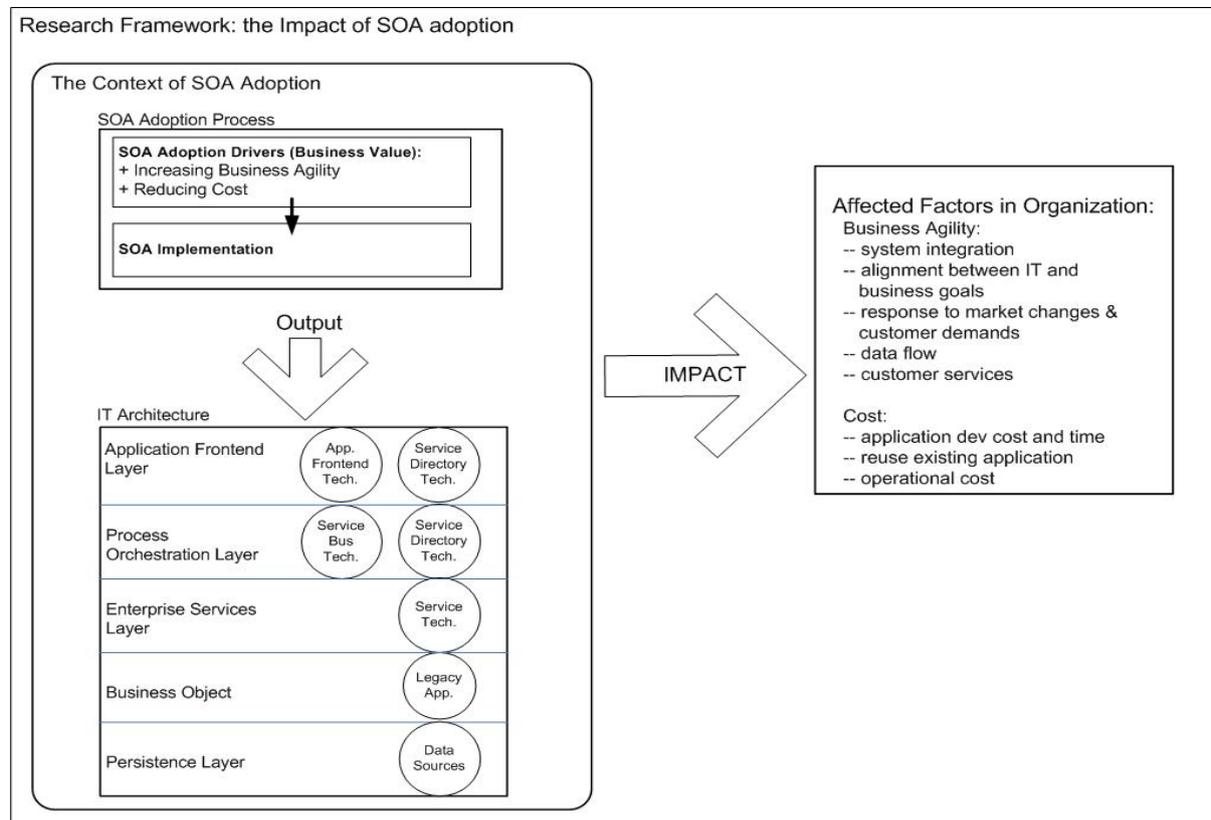


Figure 2.7 Research Framework

As we can see from the picture above, the research framework is divided into two main components:

- The context of SOA adoption
- The factors affected by SOA adoption

The first component (left box) describes the context of SOA adoption. In this study the terms *SOA adoption* will be related to the drivers for adopting SOA, the process of implementing different SOA technologies and finally the operationalization of the new Enterprise IT Architecture. AS we can see from figure 2.7, SOA adoption context constructed from two main parts: SOA adoption process and IT architecture as an output of the process.

Within SOA adoption process, we use Yoon & Carter (2007) business values for the drivers of SOA adoption. The business values drivers incorporated two aspect of business: increasing business agility and reducing cost. SOA implementation as the second part of SOA adoption process incorporates activities surround the physical implementation of SOA, including development of implementation plan or strategy, conceptual design, physical process of implementation, and operationalization of the new enterprise IT architecture.

As the second part of SOA adoption context, IT architecture has been defined as an output of SOA adoption process. For the purpose of the study, we constructed the abstraction layer of the enterprise IT architecture using Woods and Mattern (2006) SOA stacks described in table 2.3 and Krafzig et al. (2005) SOA technological elements described in table 2.2.

The second component (right box) of the research framework contains the factors that affected by SOA adoption. For examining the impact of SOA adoption, this research will focus on two aspects of business value by Yoon and Carter (2007) namely business agility and cost. Business agility aspect constructed from five factors (system integration, IT and business alignment, response to market changes and customer demands, data flows, and customer services. Cost aspect incorporates three factors such as application development time, application reusability, and operational cost.

3 Method

3.1 Research Strategy

The research design of this study consists of several methods. These methods include literature review, collection of SOA adoption project documentation, in-depth interview and finally a combined analysis in order to discover the impact of SOA adoption.

As it was mentioned in sub-chapter 1.2, SOA is a relative new concept that has different meanings and is often misunderstood. For this reason, this study has an exploratory character, which according to Marshall & Rossman (2006) is a study that “seeks to investigate a phenomenon that is little understood”. Moreover, the research question: what is the impact of SOA adoption?, has an exploratory nature because first we are trying to *discover* the impact that SOA adoption may have in an organisation, and thereafter will be described.

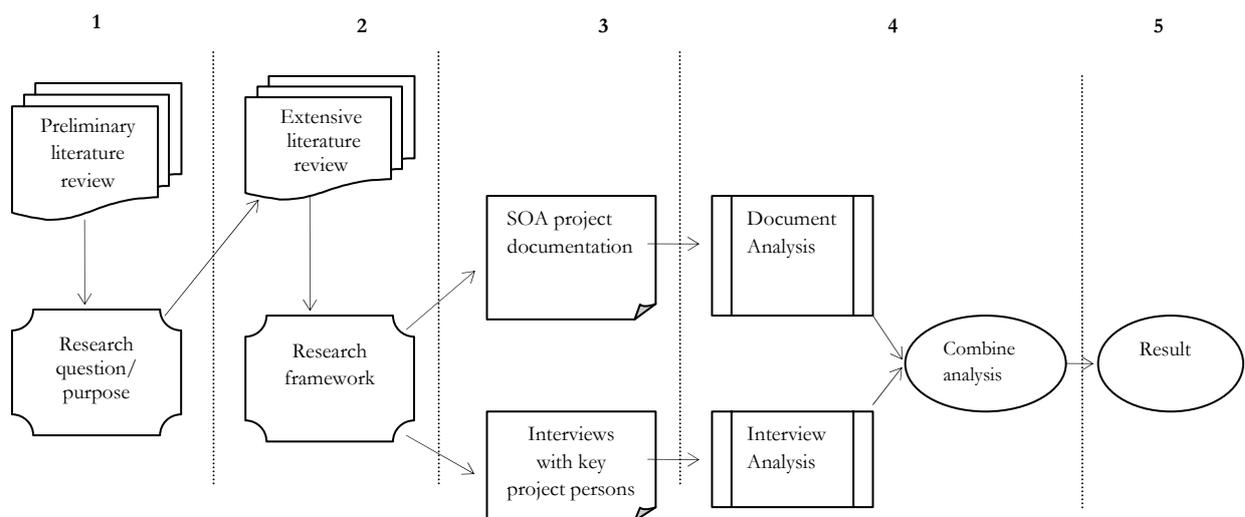


Figure 3.1 Research Strategy

The approach used in this research has some resemblance with a case study approach as proposed by Yin (2009). A case study is a research method that investigates a contemporary phenomenon within its real-life context, where the boundaries between the context and the phenomenon are not clearly defined. It is been argued that this approach might gain some benefits from previously develop theoretical propositions and that it normally employs multiple source of evidence.

As it was also described in 1.2, SOA is a relative new concept and there is a lack of studies focusing on SOA adoption. Consequently, this study focuses on a contemporary phenomenon: the adoption of Service Oriented Architecture. In this study, the boundaries between the

organisation and the adoption of SOA play an important role. Therefore, it is essential to understand SOA from the case organisation in order to avoid the common misunderstandings mentioned above. Our intention is not to define the “boundaries between the phenomenon of study and the context”, as one of the recommendations when conducting case study by Yin (2003). We aim to study the relationship between SOA and the IT-architecture in a specific context; this is within the context of the case organisation discussed in chapter 1.3. Another similarity between this research and the case study approach is that we build this research upon some theoretical propositions, summarized in chapter 2.6. Finally, as Yin (2009) recommends, the empirical study in this research employs different sources of evidence: project documentation and interviews.

Despite these similarities, we will not apply a case study because it is not in line with the scope of this study. A case study involves a deeper study, whereas our study merely uncovers some of the effects of SOA adoption from a business value perspective. Furthermore, a case study involves extensive data collection and a larger amount of resources, which is not the case in this study. Nonetheless, given the likeness between this study approach and case study, we have followed the some of Yin’s general guidelines for conducting a case study.

The combination of different data collection methods has been encouraged not only by Yin (2003) within case study research but also by other authors across other research approaches. (Creswell, 2007; Seale, 1999). This study uses two data collection methods not only provide two different points of reference for a research study but also as a way to increase study reliability. In order to achieve this, we rely on two different approaches: project documentation and in-depth interview, which provide us with two different points of reference. These are illustrated in phase 3 on figure 3.1.

The first source of data is project documentation. As it was mentioned in the sub-chapter 1.3, one of the goals of this study is to clarify the context of SOA adoption. In order to study SOA adoption, we need to situate SOA adoption within a context, the case company. For this reason, a contextual analysis was conducted using SOA adoption project documentation. The contextual analysis in this paper comprises the study of the context (setting) surrounding the preparation of SOA adoption. The second source of data collection is provided by interviews with different SOA experts in the case organisation. The interviews conducted in this study had a semi structured character, which allows the interviewee to convey their perspectives and to further develop ideas. The main reason behind the decision of using interviews as an empirical collection method is because our interest in studying the interviewees’ views and perception of SOA and how it has affected their organisations.

The overall analysis strategy in this study is based on theoretical propositions, summarized in chapter 2.6. These propositions have also helped us to focus attention on certain data and have played an important roll in the design of this research. By relying in previous studies, we hoped to increase the reliability of this study while at the same time encouraging the new discovery of the impacts of SOA adoption.

One of the challenges in conducting research is to produce high-quality analysis. Yin (2003) implies that the researcher is required to “*attend to all the evidence*”. Multiple sources of evidence can be viewed as convergence of evidence or non convergence of evidence. This research

includes non-convergence evidence addresses, where we treat source of evidence separately – *substudies*. The purpose of the document analysis is to clarify the context of SOA adoption-one part of the analysis, while the analysis of the interview aims at explore the effects of SOA adoption – another part of the analysis. Thereafter, the analysis is done by comparing the conclusion from the different analysis against this research literature review and framework. Figure 3.2 shows a graphical representation of non convergence of evidence in this study.

documents analysis	> findings	> conclusions	> aims to elucidate the context of SOA adoption
interviews	> finding	> conclusions	> aims to find the effects of SOA adoption

Figure 3.2 Study non convergence of evidence Adapted from Yin (2003), page 100.

In this sub-chapter we have presented the research design of this study. An overview of the phases (figure 3.1) of the research design has been discussed, as well as the motivations behind the selection of approaches used through this study. In order to increase the transparency and quality of this research, a thoroughly description of each of the approaches utilized during the different phases of this study are presented further down.

3.2 Research Process

3.2.1 Defining the Research Question

The first step of this study was to define research focus by formulating research problem are and research question. The focus of this study was initially delimited to: Service Oriented Architecture (SOA) as an approach to deal with IT-architecture.

A preliminary literature review was conducted at the beginning of this research. The main purpose of this preliminary literature review was to get a general view of the main areas of study: SOA and IT architecture. At this stage we were able to clarify some of the theoretical issues associated with the area of study and identify a number of research problems. This literature review was conducted using google scholars, which produce a mixed result of academic papers, vendors review, private research market organisations and textbooks. Despite the variety of sources obtain through google scholars, we primary focus on academic works, articles .The outcome of this literature review result in a collection of personal summaries.

From each research problem, a certain number of research questions were formulated. In order to identify the final research question in this study, it was important to ensure its testability, or in other words: are they empirically testable? It was essential that the research question could be observed and answer within the limitations of our study. The limitations of this study are not

only mainly resource limitations due to time constrain as well as budget but also access to existing academic resources. During this process a number of iterations were done in order to determine the research question that was most suitable for this study.

The research question in this study is: what is the impact of SOA adoption?. After the research question was formulated, the purpose and limitations of this study were delineated. These were formulated based on the type of our research question, a *what*-question, which according to Yin (2003) might be consider as an explorative question. The main purpose of this study, presented in 1.3, is to discover the impact of SOA adoption. Hence, we were interesting in studying an organisations experience in adopting SOA.

3.2.2 Literature Review

Once the research problem and research question were formulated, a more extensive literature review was conducted. The starting point of this literature review was our personal summaries collected during the tentative literature review, describe in 3.2. The purpose for this second literature review was to get a deeper understanding of the concept of SOA and to look at some of the existing research that we consider significant to our work within the focus of this study. Since the focus of this study is IT-architecture and SOA we concentrate our literature search around these main concepts. This search was done using some of the majors's academic internet sources. These sources were concentrated to science direct, IIEEE, Sage and Palgrave; in which relevant keyword or phrases such as 'IT-architecture and SOA', 'adoption of SOA' and 'effects of SOA'. By concentrating in a limited number of search words, efforts were concentrated towards related academic works that into some degree were related to this study research question: *what is the impact of SOA adoption?*

There were several available sources to develop a literature review (Yin, 2003). These sources include: journal articles, corporate reports, newspapers, the internet, magazines and conference proceeding and books. In order to increase the reliability of this study, the literature review is based three main sources:

1. Journal articles – these sources offer concise format information. Journal articles normally offer a higher academic level than other online articles, due to their peer review process.
2. Books - despite the fact that books are in many cases intended for teaching purposes, this study made heavily use of “*SOA concepts, technology and design*” by Tomas Erl. He is considering the most prominent SOA books author. Furthermore, the majority of SOA related journal articles and conference proceedings refer to previous work published by Erl. Books were also use during the development of this chapter.
3. Conferences proceedings, as we mentioned in section 1.1, SOA is a rather new concept which results in a limited number of journal articles. As a complement to journal articles we have used different conference proceedings, which gave us access to the latest research in SOA.

Other sources as magazines, blogs and internet sources where also used, but only during the first preliminary literature review, described in 3.1. These were however not further developed not

presented in this study, due to their low credibility which would have affected the quality of this study.

3.2.3 Selection of Case Company

In order to identify a case company, the following criteria were identified:

- The organization should have explicitly made a policy in adopting or working towards a SOA framework.
- The organization should have adopted SOA in at least one business unit.
- The informants of the organization should have first hand information on the adoption of SOA, preferably project members of the adoption process.

These criteria were formulated in order to fulfil the purpose of this study by identifying an organization that has been experiencing the impact of SOA adoption.

In this research, we have identified a large South East Asia bank that has adopted SOA within their IT architecture and complies with above mentioned criteria.

3.2.4 Empirical Study

As we mentioned before, this study will follow Yin's guidelines for conducting a case study. He states that there are six different source of evidence for a research study: documentation, archival records, interviews, direct observation, participant-observation, and physical artefacts. The sources of evidence in this study are: documentation and interviews, which were shortly introduced in 3.1.

Documentation

The documentations reviewed in this study are:

- The SOA architectural workshop, this document contains almost 62 pages describing the bank's condition after the decision of adopting SOA. It also includes drivers and motivations for adoption of SOA, business goals, SOA strategy, the description of the legacy architecture as well as the expected new SOA architecture.
- The design workshop document (136 pages), which is a continuation of the above mention workshop, discusses technical solutions and the realization of the previous reference model.

One of the main advantages of using documents is that they are ready to use sources. It does not need translation or transcription (Yin, 2003). These documents provided a broad view of the SOA adoption project that help us understand why and how SOA would be adopted at the Bank.

Interviews

Interviews are considered to be the most important source of evidence in a case study (Ying, 2009). Using interviews as a data collection method give us the possibility to focus directly into the research question by designing the interview guide in some specific SOA impact factors described in figure 2.6. The factors described in figure 2.6 were developed in this study based on Yoon & Carter (2008) study framework. The interview guide contains the following factors and dimensions:

1. Business agility
 - System integration
 - IT alignment
 - Business response
 - Market changes
 - Data flow
 - Customer services
2. Cost
 - Application development cost and time
 - Reuse existing application
 - Operational cost

The complete interview guide is presented in Appendix B.

In order to increase the quality of the interviews, a pilot interview was conducted with an IT infrastructure specialist. During the pilot interview the interviewee was briefed on the purpose of the study and was asked to evaluate the interview fit, comprehensibility and relevance. Following the pilot interview, we modified the formulation of some factors in the interview guide.

Kvale (1996) stresses the importance of advance preparation and interviewer competence in order to conduct a good interview. Hence, in this study we will follow Kvale's methodological stages to conduct interview investigation:

1. The *thematizing* phase was done through the research framework presented in figure 2.7. As it was mentioned before, the interview guide is based on Yoon and Carter study on the business value of SOA.
2. During the *design* phase, the overall planning and preparation to conduct the interviews were done. In order to ensure the quality of the interviews, we conducted a pilot interview, which resulted in the modification of the original interview guide.
3. The interviews were *conducted* by telephone interview and one by email. At the beginning of each interview we briefed the interviewees and explained them the purpose of the study and they were asked their consent to record the interview. At the end of the interview, during the debriefing, the interviewees were asked whether they had further comments on the interview questions.
4. After the interviews were conducted, we transcribed them. During this phase, certain noise, extra comments were deleted, as well as the first part of the interview, where we made an introduction.

The last three methodological stages for conducting interview: analysing, verifying and reporting will be further described in the next sub-chapters.

3.2.5 *Analysis of Empirical Data*

As an overall analytical strategy, this study will rely on theoretical propositions (Yin, 2009). According to this strategy, the analysis of the empirical study evidence is shaped by the theoretical propositions derived from the literature review, which are also reflected the research question and the design of the study. By relying on theoretical propositions, we were able to link the collected empirical data to those propositions. Yin (2003) suggests that this can be done in several ways. In this study, the literature review is used as a *lens* to analyses the empirical data. Moreover, we also intended to have an open and critical perspective, therefore in all of the interviews we had an open question that allow the interviewees to ‘add’ information and suggests further dimensions to the impact of SOA adoption, presented in the research framework in chapter 2.6. In synthesis, the literature review is not only view a filter –lens- to analysis collected data but also as a starting point to discover new dimensions, new impacts of SOA adoption.

The project documents are analysed using logical models. Logical models were used because they are useful tools to do evaluation (Maxwell, 2005). By using logical models we aim to understand and present the organisation’s decision to adopt SOA, their strategies as well as their expectations. These elements would then be used to give a deeper perspective and to establish the context in which SOA was adopted.

Thereafter, the interviews were analysed using two methodological approaches for analysis of meaning: meaning condensation and meaning interpretation. The answers provided by the interviewees were first condensed, trying to find the most important information expressed by the interviewees. Once this information was identified, we choose some briefer statements to represent the main ideas of each answer, which are presented in throughout sub-chapter 4.3. These briefer statements were then use in the meaning interpretation analysis. In this stage, we aim at finding a deeper meaning of the interview by taking into consideration the findings, the theoretical framework and the literature review.

Once the project documentation and interviews were separately analyzed, a combine analysis was done. The purpose of this analysis was to situate the context of SOA drivers and SOA adoption strategies in line with the SOA impact describe during the interview. The analysis here was not only done in relationship the research framework, while having a critical perspective. We try to determine the effects of SOA adoption by not only looking at the framework but also by considering alternative factors, given during the interview. The result of the combine analysis is presented in chapter 5.3.

3.3 Generalization

Generalization based qualitative studies has been discussed by several authors (Seale, 1999; Maxwell, 2005). In quantitative research, generalization is often done since many studies are conducted using a sample of the total population. This research is a qualitative research and this poses some difficulties when trying to generalize our findings.

Seale (1999) argues that generalization cannot be done in qualitative studies from a sample population unless there is a clear relation between the sample and the total population. Moreover, the case organisation in this study has not been randomly selected, on the contrary it was arbitrary selected due to its characteristics and the potential benefits of the providing rich information in order to study the effects of SOA. These two problems will be address in the following lines.

Finance institutions (e.g. banks) are subject to national regulations as well as international regulations. While national regulations vary between different countries, banks that have international operations follow principles recommended by the Joint Forum on Financial Conglomerates. This group brings together three financial regulatory representatives from the Basel Committee on Banking Supervision (BCBS), the International Organization of Securities Commissions (IOSCO) and the International Association of Insurance Supervisors (IAIS). Although banks are not obliged to follow these recommendations, a great majority of banks do follow these recommendations in order to increase the transparency of their operations. As it is the case with the bank in this research.

It is important to clarify that we are not implying that all the banks have the same policies and same business process around the world. We merely imply that there are several banks that might fit into the description of the bank in this study, since they follow similar regulations. If this is the case, the findings in this study might also be applicable to these banks.

Hence, this research will aim to conduct a specific type of generalization, *internal generalization* (Maxwell, 2005). It is important to remark that this study does not pretend to describe the characteristics of a specific population. On the contrary, this study makes efforts to present a detailed description of the context where SOA was adopted. It is our hope that this will not only increase the generalization of this study but also its' replicability and transferability.

3.4 Quality Aspects

The quality aspects of the research are essential for the overall result of the study. This is because the research report can not be claimed as a representation of the real world condition that researcher observed (Seale, 1999). That is why it is important to ensure the quality of this study. This following table resumes the quality aspects of qualitative research that guide this study.

Table 3-1 Quality aspect of the research

Quality factor	Technique use in this study
Reliability (consistency, internal and external validity)	Writing separate translations of the interview Use of multiple sources Striving to keep the chain of evidence
Internal validity (credibility)	Rich data Member validation
External validity (transferability and applicability)	Detail and rich description
Bias	Open discussion, concept maps

3.4.1 Reliability

Throughout this study, we have strived to maintain the chain of evidence. At the beginning of each chapter we have describe the objectives of each chapter as well as the information presented. At the end of the chapter information was summarized and related to the research question and the purpose of this study. By maintaining the chain of evidence, we hope to increase the reliability of this study.

Yin (2003) stresses the important to increase the reliability in a case study by using multiple sources of evidence. As it was mentioned in section 3.1 the use of multiple sources of evidence is to provide different references points. This has also contribute to provided a more accurate and unbiased picture of the overall context of SOA adoption in the bank.

3.4.2 Internal Validity

The concept of validity in this study is related to the inferences –conclusions- that are made based on the interviews and documentary evidences. Maxwell (2005) points out that validity should not be considered as a way to verify a conclusion; instead it should be regarded as a way to test the validity of the conclusions of a study. Hence, validity considerations in this study will focus on how the conclusions of this research were inferred and whether or not they were correct inferred.

In this study we have try to contribute to internal validity by applying the following techniques: member validation and rich data (Maxwell, 2005). Member validation has been done by asking feedback on the analysis and conclusion of this study. The persons interviewed in this study

received a draft of chapter 5 (Empirical Analysis) and chapter 6 (Conclusions) and were asked to comment on it. Rich data is another technique used in this study. It consists of the project workshop documents that provide a detailed account of the SOA project. These documents contain 200 pages which helped us get a overall picture of the SOA Adoption project in the case company.

3.4.3 *External Validity*

Seale (1999) refers to external validity as the extension to which propositions “are likely to hold true in other settings”. The concept of external validity is often associated with a research aspects related to generalizability of finding (Yin, 2003; Seale, 1999). In order to increase external validity we provide a detail description of this study, therefore this chapter contains a detailed description of each step conducting this research (Creswell, 2003). The description includes the rational behind each decision made during this study as well as how this study was conducted.

In this research, efforts have been made to emphasis the context of the study; this is the adoption of SOA in a large South East Asia bank. Once the context of the study was well delimited, we had a better ground where these study findings could be generalized. This is one of the main considerations done in this research, since SOA can be define in different ways and therefore lead to the wrong selection of a case organisation.

The empirical findings are presented in chapter 4 in order to give the reader an overview of the empirical data, without analysing it, while chapter 5 presents the analyse. The main purpose of dividing the empirical findings from the analysis part is that because anonymity reasons we cannot attach the project documentation to this study.

3.4.4 *Bias*

The main sources of biases in this study are our pre-conceived ideas and specially our previous knowledge on SOA. While one of us had very little knowledge in IT-architecture and SOA, the other one have had previous experience developing software that complies with web Services. Maxwell (2005) point out that experiential data, personal experience and previous technical knowledge is likely to bias a research study. However, he suggests that critical subjective could be used to reduce personal biases in this study, we have done this by increasing our awareness. In other words, we have increase of awareness by “raising [our primary experience] to consciousness” (Maxwell, 2005).

In practice, one technique that we use in order to increase awareness of our own biases is the use of concept maps. The process consists of two steps: first we openly discuss our ideas and ‘what we believe’ about a certain issue of this study; secondly we construct concepts maps of our previous assumptions and the findings from the literature review. This helps us to keep a fresh an open mind to different points of views and to achieve a common understanding of SOA.

During data collection, we contacted IT-consultants that had some experience working with SOA projects. We discussed our project and ask them for alternative explanation and what was their point of view about our study. In total, we contacted three IT-consultants that provide feedback about adoption of SOA.

3.5 Ethics

Researchers should be sensitive to ethics considerations, through all the phases of the research process (Creswell, 2003). Some ethical issues that have been taken into consideration in this study involves: information about the nature of this study and confidentiality.

The large South East Asia bank was contact in advance, and they were informed of the progress of this study, the purpose, and the research questions. It was clearly specify during the first contact that the participation in this study was voluntarily and that they were entitle to withdraw from the study if they wished.

During the data collection phase, ethic issues were related to confidentially and anonymity of the informants. In order to protect the anonymity of the informants, the names of the informant and the large South East Asia bank will not be disclosed during this research. The informants were anonimized and are referred as informant A, informant B and informant C. The case study in this research, the large South East Asia bank, is considered an average organisation providing banking services, hence presenting a composite picture of an organisation rather than an individual picture (Seale, 1999).

Therefore, even though the large South East Asia bank is described in chapter 4.1, the description would not led to discover the name of the bank, because the description could fit any other organisation offering banking services. Detailed information is presented only to specify the context where SOA was adopted in the organisation, i.e. technical issues (IT-architecture) that are more related to SOA and its intrinsic characteristics; these are presented in chapter 4.2.

During the interviews, the participants were reminded of the kind and purpose of this study. Moreover, we ask the consent of each of the participants in order to tape the interview. Previously, the CIO had given his consent of recording the interviews, but we felt that the consent should also be taken from each of the interviewees.

A final ethical issue that was addressed in this study is the dissemination of qualitative reports (Creswell, 2003), because this research will be available on the internet. During the first data collection phase, detailed project documentation has been studied and analyze. This documentation does not contain sensible information, like customer's information, budget reports or year accounting results. Nevertheless, these documents would not be attached in the appendix nor further transmitted to third parties.

3.6 Critiques of Research Approach

As it was mentioned in chapter 1.2 SOA is a relatively new concept that often has different definitions, leading to confusion. This paradigm introduces some difficulties in this study: how can we assure that our interpretation of SOA agrees to the case organisation definition of SOA, especially in terms of how SOA is conceptualize, purpose and type of technology. Our approach, combining multiple source of evidence from project documentation and interviews allow us get a deeper understanding of SOA adoption in the case organisation.

In order to achieve our goals and to have clear guidelines on how to conduct this study we used Yin's guidelines for conducting a case study. As such, some of the critics to this study derive from this decision. Yin (2003) suggests that a case study is a methodology that includes a deep study of a phenomenon. We were able to get a hold to two project documents from the case organisation. The project itself contents several documents that we were not able to analyse, thus we might not have the full picture of the context of SOA adoption. Furthermore, documents are written for a specific audience, meaning that some factors or negative aspects have not been included in it. We have tried to minimize this by asking all the interviewees about their own experience on working in the SOA project.

SOA is still a quite new concept and as such it imposes restrictions in the amount of academic sources available for this study. The same principle applies to the empirical study, where there were problems finding participating organisations that had formally started a SOA implementation. Consequently, the nature of this study, and constraints in terms of time and budget had been contributing factors that has affect our choice of the case organisation.

Interviews are one of the main qualitative approaches use in case study. Despite its advantages this collection method has several drawbacks (Yin, 2009), which are important to acknowledge before conducting an interview:

- The informant might be biased to answer in a certain way or to answer a question that the interviewer wants to hear. We intend to form the questions in a way that they might not carry a negative or positive message to the respondent, which have a neutral meaning. Thus, limiting the informant's inclination to defend himself or the organisation he represents and also to avoid possible reflexivity answer (answering what we want to hear).
- The answer might be inaccurate, due to the respondent poor recall. In order to prevent poor answers, we will ask the respondent about the possibility to get in contact with other persons in the organization that might be more suitable to answer a particular question. This was beneficial in this study, the CIO help us get in contact to other persons in the organisation that could answer some questions of the interview that he was unsure of.

In order to increase the generalizability of the results in this study we have made explicit all our decisions, we have also motive them and related them to this study purpose and goals. In order to increase the transparency of the study, a detailed description of how this study was conducted

is presented in this chapter. This does not guaranty the generalizability in this study, but it gives tools to further review this study and hopefully to replicate it.

4 Presenting Empirical Data

In this chapter, we present empirical data from project documents as well as interviews with the Bank's representatives. First, we provide general information about the case organisation, the large South East Asia Bank. The second part presents our findings of SOA adoption from the Bank's project documents. Finally, we present the findings from the interviews.

4.1 Brief about the Case Company

The Bank is a well established bank in the South East Asia region and can be considered as a large bank since it has more than 800 local branch offices and some international office branches, having more than 9 million customers and accounts, and handles more than 3 million transactions per day. The large South East Asia Bank has two core businesses: consumer banking and corporate banking. Within consumer banking business, the Bank provides various services in the form of deposit products (e.g. saving, checking as well as time-deposit account, personal asset management, and various bill payment services) and loan products (e.g. consumptive, car and housing, investment as well as working capital, and credit card). The Bank also provides a wide range of services in corporate banking sector such as corporate cash management, pension funds, import-export loan, working capital loan, and syndication credit. The large South East Asia Bank has distinctive value in providing services of excellence as well as value added to their customer, responsible in fostering community development, and delivering investment value to the shareholders.

As a part of their corporate strategy, the Bank has made an effort for continuously adapting to the latest banking technology. The Bank believes that technology is a key success factor for delivering sustainable improvement and competitive advantage within their business. This proved by the Bank's efforts in leverage their investment to acquire new core banking system technology in 2005 moving towards from their distributed application into centralized core-banking system, and followed by the adoption of SOA in 2007 as a strategy to empower their IT Architecture.

In accordance with the increasing maturity of their core banking system, the next significant step in leveraging IT investment is building the reliable foundation for the Bank's IT architecture. The emergence trends and potential benefits of SOA have had attracted the Bank's CIO to have initiative on SOA. The CIO believes that the appropriate SOA adoption can give the flexibility for their IT architecture, in which flexible IT architecture is a significant factor for supporting the Bank's core business. As a result, SOA adoption project started in 2007.

4.2 Empirical Data from Project Documentation

As it was mentioned in chapter 3.2.4 (Empirical Study), project document is one of source of evidence in this study. We have already examined two types of documents: SOA architectural workshop report and SOA design workshop report. The former document contains information about business and IT drivers that led the Bank to adopt SOA, general strategy for SOA adoption project, and proposed architectural reference for enterprise SOA. As the continuation from the first workshop, the second document specifies the detailed design from the previous conceptual model and physical component model as well as specific technological components that tied into it. In this section we only present the findings from the former documents, since the second document contains more technical details and also tends to refer to some specific technology and vendor in which beyond the scope of our study.

4.2.1 *The Drivers of SOA Adoption*

In line with one of corporate distinctive values of being a leader in services and performance, IT department has started SOA adoption initiative in 2007. The main motivations for SOA adoption are to reduce the cost of providing additional services to the Bank's customers and also increasing business agility by shortening the time to market in providing business services.

The IT department realized that SOA adoption was a considerable challenge for them. They believe that the successful SOA adoption will help them for shifting orientation from being technology-driven towards being a business-driven activity with a focus on real business value. As a first step towards SOA adoption journey, they have made formulation in business goals and IT goals. These goals intended as a statement of purposes, key objectives, as well as milestones for measuring the accomplishment of SOA adoption project. Table 4.1 and 4.2 present the Bank's business goals and IT goals.

Table 4-1 The Bank's Business Goals for SOA adoption

Goals	Key Performance Indicator	Description
Increase Revenue	Transaction Fees	Creating new services/products will provide more revenue stream. Thus the increasing number of revenue streams will contribute in raising the total revenue for the Bank.
Reduce cost per transaction	<ul style="list-style-type: none"> • Cost per transaction • Increased proportion of non-teller transactions 	The transactions handled by the Bank's clerks are the most expensive. Increasing the proportion of non-clerical transactions will reduce the total cost per transaction.
Retain Customer	<ul style="list-style-type: none"> • Number of active customers • Younger segment customer number • Customer attrition 	Maintain the total number of active accounts. To attract new customers, the Bank can increase the number of services available to customers. The Bank can also offer services to attract a specific area of the market, such as the younger segment.
Add new business partner	<ul style="list-style-type: none"> • List of available business partners 	The Bank has a specific goal to increase the number of their business partner such as available providers that are for their SOA adoption pilot project (SMS Banking)
Keep pace with the finance industry	<ul style="list-style-type: none"> • Numbers of services provided 	Increasing the number of services available throughout the Bank's delivery channels as point of transaction (e.g. increasing number of available financial services that can be used in SMS banking as one of the Bank's delivery channel)
Quality	<ul style="list-style-type: none"> • Quality Index Standard 	Increase the score for the Bank Quality index standard.

Table 4-2 The Bank's IT Goals for SOA adoption

Goals	Key Performance Indicator	Description
Effective use of centralized IT architecture	Formal Financial Control	The Bank has moved to a centralized architecture. It is important that this centralized architecture be used effectively.
Support IT innovation/new business models and rapid introduction of new business capability	<ul style="list-style-type: none"> • Fulfilled requests for new systems • Time required to introduce new business capability 	The Bank aimed to increase their productivity to release new product or services. The ability to provide shorter time to market for innovative products and services also expected within one year.
Retain Customer	<ul style="list-style-type: none"> • Number of active customers • Younger segment customer number • Customer attrition 	Maintain the total number of active accounts. To attract new customers, the Bank can increase the number of services available to customers. The Bank can also offer services to attract a specific area of the market, such as the younger segment.
Rapid application Development	<ul style="list-style-type: none"> • Application development duration 	Decreasing the development time of new applications will constitute rapid application development.
Keep project on Schedule	<ul style="list-style-type: none"> • Project Duration 	Focus on meeting or delivering ahead of stated schedules.

4.2.2 SOA Adoption Strategy

As the Bank has formulated their business and IT goals in the SOA architectural workshop report, this document also contained information about SOA adoption strategy. To ensure continuous return from their SOA investment, the Bank needs to make an incremental adoption phase of SOA. This is can be done with project-by-project basis and initiated with one pilot project. Furthermore the Bank has formulated their strategy into these following milestones:

1. Understanding SOA

IT department realises the importance of building solid understanding about SOA concepts before take a further step in SOA adoption journey. As a result, before officially started the SOA adoption project they have had conducted SOA workshop. The workshop participants consisted of groups from business people, enterprise architect, system analyst, as well as SOA vendor and consultant. This workshop divided in two phases: the first workshop was SOA Architecture workshop, and then followed by SOA design workshop. SOA architectural workshop intended to develop a common understanding about SOA concept and create conceptual architecture solution for the first pilot project of SOA adoption (SOA reference architecture). The Bank has selected SMS banking application as the pilot project for SOA adoption. The conceptual architecture solution as an outcome of SOA architectural workshop then will be used as a

starting point for SOA design workshop. This workshop presented the elaboration of conceptual architectural solution into detailed pilot project design and the technical implementation (physical architecture decision for selection of technology).

2. Pilot Project and Develop SOA Reference Architecture

As the Bank has selected SMS banking application for SOA adoption pilot project, they have had presented in the conceptual IT architecture solution before started the pilot project implementation. Conceptual IT architecture consists of SMS banking requirements specification, business modelling and also services identification. This conceptual IT architecture had been designed to be extensible and flexible in order to accommodate additional access channels and other applications in the future. Therefore the conceptual IT architecture also regarded as SOA reference architecture. The possible use of enterprise services bus has been introduced as a SOA technology and pattern to facilitate flexible and extensive communication through standards based interfaces, loose coupling, and location transparency. The components of SOA reference architecture will further discuss in chapter 4.2.3 (SOA Reference Architecture).

3. Established SOA Governance

The third milestone after enrolled SOA adoption pilot project and prepared SOA reference architecture is establishing SOA governance capability. SOA governance can be regarded as an extension of IT governance that has an emphasis on the service life cycle and composite applications within SOA infrastructure. Within the document, the Bank described two fundamental aspects of SOA governance. The first is about the process required to decide who will have the role to take certain decision within the Bank. The second aspect is about the creation of policy and mechanism that required to measure and control the way decisions implemented in the Bank.

The importance of establishing SOA governance is that the Bank can optimize the benefits of SOA such as increasing process flexibility and responsiveness, reduced IT maintenance costs, and mitigating business risk. The latter benefit (mitigating business risk) can be done by establishing decision rights, guidelines for the appropriate services, managing assets and monitoring effectiveness. Furthermore, the Bank defined the expected output from SOA governance such as best practices, standards, processes, strategic-architectural decision, reference architecture, organization structure, and funding models.

4. Integrate existing systems into SOA

Following the successful implementation of the SOA adoption pilot project and SOA Governance capability, IT department will continuously migrating their legacy applications into SOA on a project-by-project basis until the whole system adopted into SOA

4.2.3 *SOA Reference Architecture*

SOA reference architecture is a fundamental result from the SOA architectural workshop, since it will create the foundation for the Bank's IT architecture. SOA reference architecture will be

used as a reference throughout the entire SOA adoption journey. The figure 4.1 will depict the Bank's SOA reference architecture (based on the Bank's SOA runtime pattern (SOA Architectural Workshop, 2007, pp. 37)).

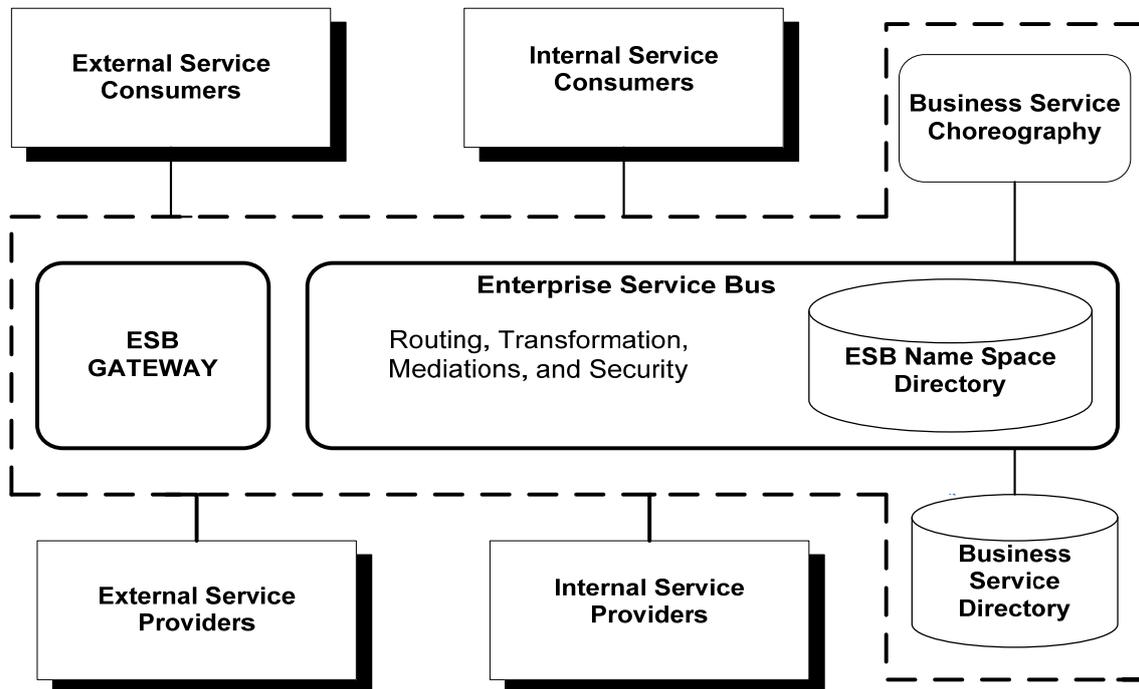


Figure 4.1 SOA Reference Architecture (SOA Architecture Workshop Report, 2007, pp. 37)

From the picture above we can see that there are six elements within SOA reference architecture:

- Service Provider is a system which implements business logic and exposes them as a service. Instead of a single system, Service Provider might be in a form of complex distributed-system, which interact and communicate each other within SOA infrastructure.
- Service Consumer is a system which consumes a service provided by the Service Provider.
- ESB Gateway refers to term for a SOA component which provides connectivity services to the system outside the enterprise.
- Business Process Choreography is system that has responsibility for executing and orchestrating composite services.
- Business Service Directory is a system that has responsibility to manage the information about the description of a service and where is the location.
- Enterprise service Bus (ESB) is a system that has a responsibility for providing communication, location transparency and loosely-coupling between services. ESB acts as an intermediary hub between a service consumer and the service providers.

4.3 Empirical Data from the Interviews

The interviews conducted with three different roles in the Bank IT department: top management, SOA co-project manager, and SOA implementation team member. From the top management, we focus on more organizational understanding and decision related to SOA adoption. With SOA co-project manager, we focus on SOA adoption journey and more holistic view of SOA impact. Co-project manager is the person who responsible for SOA project and involved since the beginning of SOA adoption project. This makes co-project manager has rich information and views within different aspect of SOA adoption. We made the last interview with one of SOA implementation team member. In this following discussion, we present a brief resume of our findings in the interview.

These following quotes from the IT department's top management will elicit the common understanding of SOA within the Bank:

Question One:

How IT Department would describe SOA?

"We define SOA as a solution framework for improving IT support to businesses.

Why? Because with SOA framework, we can address key challenges in supporting businesses namely time delivery and reliability. The increasing level of SOA maturity and the re-usability character of SOA will give better efficiency in the development of IT products and services. We can also increase the reliability of our services to business, because within or SOA we have been using best practices and well proven components as well as industry standards technology."

Question Two:

Why did your company decided to implement SOA?

"We decided to implement SOA because we believe that SOA can help us to provide flexibility and agility in our IT assets. We believe that the flexibility and agility in our IT assets is necessary to give better support for business units. As we understand the ever changing nature of the business environment required our organization to be more flexible and agile in coping with those changes. Other consideration is that our Bank continuously expands the business by establishing cooperation with business partner from various industries. This requires our system to be flexible and scalable, so it will be easy to communicate with our partners system. For example: educational institution, oil and gas company and other partners."

From the SOA co-project manager, we have an in-depth interview about two themes, SOA adoption journey and also the realized impact of SOA adoption. According to the co-project manager the SOA adoption journey within the Bank divided in three phases:

1. System Integration

This is the most important phase of SOA adoption journey for the Bank, since the foundation of SOA is constructed in this phase. As an integration strategy, incrementally integration or project-by-project basis with initiation SMS banking as first pilot project was preferred. From this strategy, they can realize the proof of concept whilst increasing the understanding of SOA. As a result, they have better knowledge in prioritizing which legacy system needed to be integrated into SOA. It is not necessary to integrate the entire legacy systems into SOA. They need to be more selective on deciding which systems that have high value to be integrated in SOA. They also incorporate “multi electronic-channel strategy” in deciding which legacy systems need to be integrated in SOA. Multi electronic-channel strategy is about build one services that can be reused and accessed from various electronic channels (SMS Banking, ATM, and Clerical application).

2. Exploiting SOA benefits

Taking advantages from centralized systems that already integrated within SOA were the next phase. It can be done since the re-usability principles of service. A service that has published in SOA can be accessed from various electronic-channels. SOA also provides flexibility for orchestrating and composing services. All together make it is possible to deliver faster solution in responding to the business needs.

3. Creating SOA governance

Having SOA infrastructure in place, the next phase was to create SOA governance. Within this phase, they focus on creating pattern or standardization in defining services, registering and services version, and implement or published the services. As they have built their learning curve from the SOA adoption journey, they believe that the more mature SOA governance in the organization, the easier to see the impact of SOA adoption.

Meanwhile for the realized impact as a second theme for the interview, we found that according to the co-project manager SOA adoption has been affecting almost the entire factors in our research framework. He also identified some additional factor that has not been covered within our framework. We would analyze each factor and also the new finding with more details in Chapter 5.

As we have conducted an interview with SOA implementer, he gave more technical viewpoints in examined the impact of SOA adoption. For example, he emphasised the impact of SOA adoption from system integration perspective and also from the re-usability aspect of applications. He also added from his practical experience he found that the emergence trend of SOA enabled system within the industry is beneficiary. It facilitates easier communication with the third parties system.

5 Empirical Analysis

In this chapter, we present the analysis based on the empirical findings, presented in chapter 4. In the first part, an analysis of SOA adoption is presented from organization project documents. These documents contain information about drivers for SOA adoption, general strategy for SOA adoption, and SOA reference architecture. The purpose of this analysis is to clarify the context of SOA adoption in the Bank. In the second part, the analysis of the impact of SOA adoption is presented based on the findings from the interviews. As part of this analysis, new discovered factors are also discussed. Finally, a combined analysis is presented.

5.1 SOA Adoption Context

5.1.1 SOA Adoption Process

In order to develop a common understanding about the context of SOA adoption, firstly logical model is used to analyze our empirical data. The following logical model illustrates the process of SOA adoption in the Bank (figure 5.1).

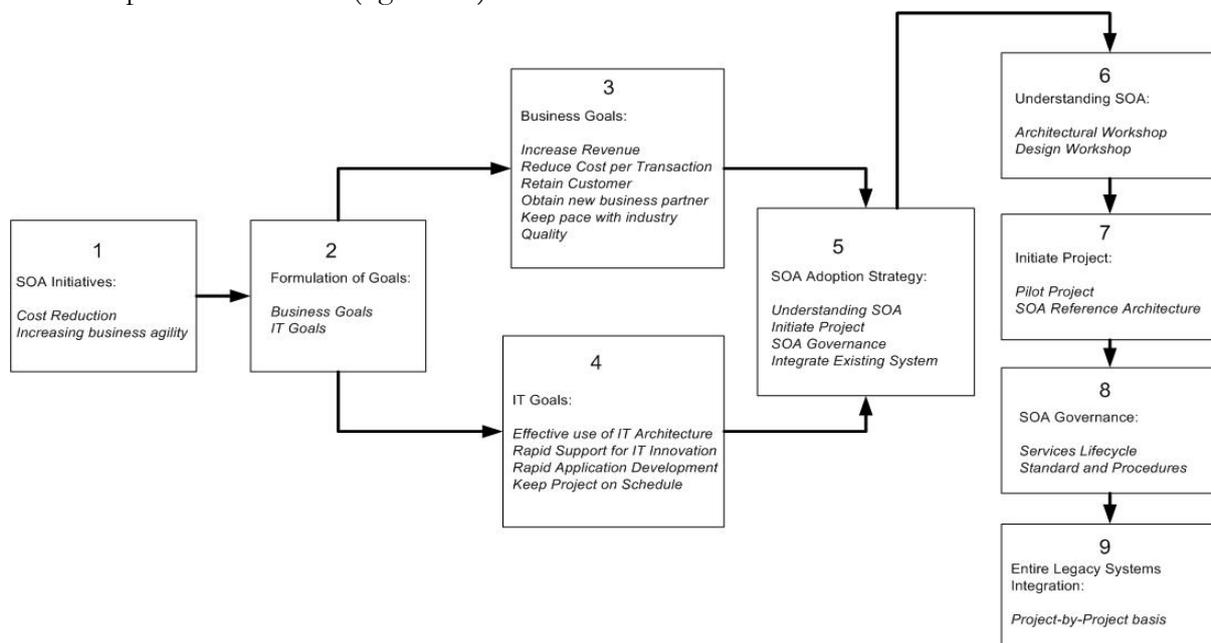


Figure 5.1 SOA Adoption Process

The SOA adoption events initially started in 2007, from the initiatives of the IT department. The main motivations for SOA adoption were to reduce the cost as well as improving business agility. The later means that the Bank wants to increase their business capability. This is done by

shorten the time it takes to release new products and services and also ensure extensive cooperation with business partners.

Next the Bank formulated the goals of SOA adoption. As it can be seen, the Bank has classified their goals in two different fields (business goals and IT goals). Within their business goals, the Bank has targeted to increase revenue, reduce cost per-transaction, retain whilst increase customer, extend business network by adding new business partner, increase the competitive advantage to keep pace with financial industry, and increase their quality of services. The IT goals are related to the Bank wishes to increase the effectiveness of their IT architecture, support products and services innovation by increasing their flexibility in adapting new business models and rapidly delivers the new business services, shortened time for application development, and keeps the project always on schedule. The next step after defining the goals is the development of SOA adoption strategy. There are four phases in SOA adoption strategy: understanding SOA, project initiation, creating SOA Governance and integrating existing system into SOA.

5.1.2 IT Architecture Fitness

From the previous discussion in chapter 4.2 (Findings from Documents), one of central findings in SOA architectural workshop report is the SOA reference architecture. With this reference architecture, it is possible to compare the SOA context between this research framework and the object of empirical study. In this study, SOA is defined an IT architectural style. Therefore to clarify the context of SOA adoption, a comparison between IT architecture research framework and the Bank's SOA reference architecture will be conducted.

IT Architecture Fitness:
Comparison SOA Research Framework and The Bank's SOA Reference
Architecture

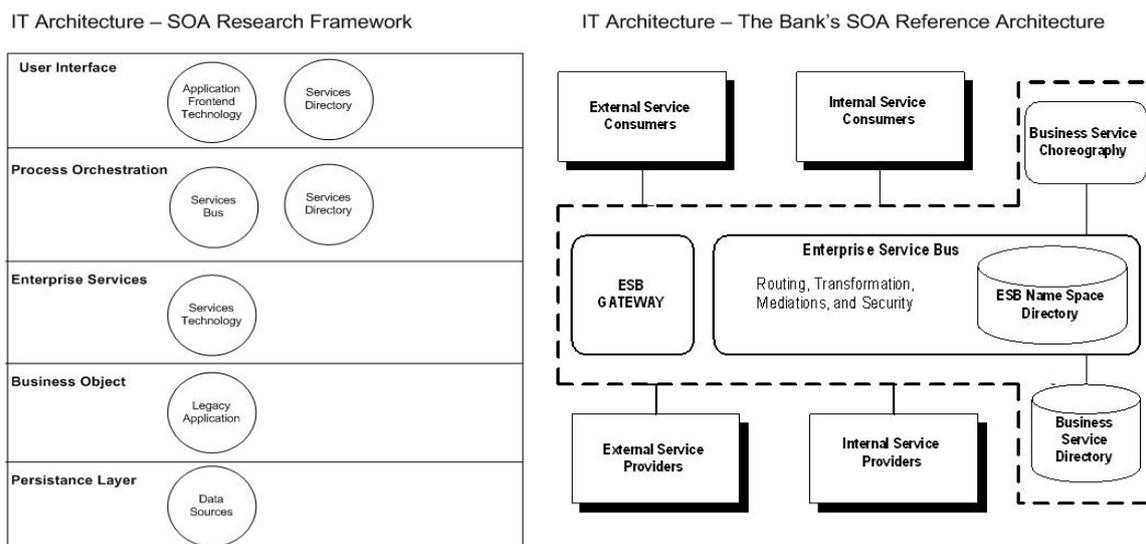


Figure 5.2 IT Architecture Fitness

Picture 5.2 depicts architectural components in the SOA research framework and the Bank's SOA reference architecture. In order to analyse the similarity between these IT architectures, a comparison is made for each architectural-component's role. Table 5.1 will presents the IT architectural fitness between research framework in our study and the Bank's reference architecture.

Table 5-1 IT Architecture Fitness

SOA Research Framework		The Bank's SOA Reference Architecture	Fitness	Description
User Interface Layer	<ul style="list-style-type: none"> Application Frontend 	<ul style="list-style-type: none"> Services Consumer Services Provider 	<input checked="" type="checkbox"/> Yes	A service provider or consumer provides or consumes service by interfacing and interacting between each other. This has similarity with application front-end role for its can be used to orchestrate interaction between services within SOA. Therefore application front-end can be either service provider or consumer or both.
	<ul style="list-style-type: none"> Services Directory 	<ul style="list-style-type: none"> Business Services Directory 	<input checked="" type="checkbox"/> Yes	The business services directory has the similarity with services directory since they have the same role for hosting the information about services.
Process Orchestration Layer	<ul style="list-style-type: none"> Services Bus 	<ul style="list-style-type: none"> Enterprise Service Bus Business Service Choreography ESB Gateway 	<input checked="" type="checkbox"/> Yes	The role of services bus within process orchestration layer to provide communication standards between services represented with enterprise service bus, business services choreography, and ESB gateway.
	<ul style="list-style-type: none"> Services Directory 	<ul style="list-style-type: none"> Business Service Directory 	<input checked="" type="checkbox"/> Yes	Service directory share the same role with business services directory.
	<ul style="list-style-type: none"> Services Technology 	<ul style="list-style-type: none"> Services Consumer Services Provider 	<input checked="" type="checkbox"/> Yes	Services technology and service provider or consumer has the same form as a service that exposed by enterprise applications or external service providers.
Business Object Layer	<ul style="list-style-type: none"> Services Technology (encapsulating legacy applications) 	<ul style="list-style-type: none"> Services Consumer Services Consumer 	<input checked="" type="checkbox"/> Yes	Within business object layer services technology share the same role with services provider or consumer in the way that all of them encapsulate the functionalities as well as data within application.
Persistence Layer	<ul style="list-style-type: none"> Data Sources 	<ul style="list-style-type: none"> ESB Name Space Directory 	<input checked="" type="checkbox"/> Yes	ESB name space directory share the same role as persistence layer since all of information and description from entire components are stored here.

5.2 The Impact of SOA Adoption

The Bank argues that they have succeeded in the pilot project phase of SOA adoption project by integrating SMS Banking application into SOA infrastructure. Moreover, they have started the initial phase of SOA governance whilst incrementally integrating the rest of the legacy applications in the Bank into SOA. In relation with the impact of SOA adoption, the Bank also argues that the more mature their SOA governance is; the easier it will be to see the impact of SOA adoption. Within this following discussion, an analysis of the impact of SOA adoption within the Bank will be presented using the research framework (*business agility* and *cost*).

5.2.1 Business Agility

Factor 1 – System Integration

Before the Bank implements SOA, they had many siloed applications scattered throughout the organization. As the Bank started SOA adoption project, the siloed applications were integrated into this new IT architecture.

As it was mentioned in chapter 4.2.2, the second strategy of SOA adoption is to provide the foundation for SOA infrastructure by implementing SOA Reference Architecture through SMS Banking pilot project. The Bank stated that system integration was the first priority in the pilot project. Based on their experience in the system integration process of SMS Banking pilot project, the Bank has highlighted some facts about the impact of SOA adoption.

The first impact was in the initial development effort for migrating legacy application into SOA infrastructure. The Bank argues that the shifting pattern in developing applications from previous siloed application into services-oriented style required additional effort from the Bank's IT developer. They were required to think holistically in designing application as a service. This is because within the former siloed application, the developer does not need to pay attention about interfacing with other applications. Meanwhile, regarding to the service-oriented principals, the IT developer had to standardized their application or service in order to be able to discover and communicate with other services. IT developers were required to elaborate their previous business process into fine-grained and autonomous service in order to ensure loosely coupling services, which required extra work. Nevertheless the Bank argues that after they have managed to publish the services within SOA, they started to see the benefits.

The Bank states that once a service is published in the SOA infrastructure, the rest of the system integration process will be easier. As the standardization, independent and atomic nature of a service, make it flexible to be integrated with other services. The re-usability principle of service also makes system integration performed faster. As a service is published, other systems or electronic-channels in the Bank, that are connected with SOA can discover and use the service at the same time without any extra re-development effort.

Another impact of SOA adoption is from inter-organizational system integration. SOA provides better standards technology for the Bank's such as web services and enterprise service bus. All of

these technologies facilitate the establishment of a better inter-system communication and integration with business partners.

Table 5.2 summarizes the realized impact of SOA adoption from System Integration factor as well as SOA characteristic that underlying the impact.

Table 5-2 SOA Adoption Impact on System Integration

Realized Aspect	SOA Characteristic	Description
Initial Development Effort	Service-orientation computing	SOA adoption requires shifting in development pattern (siloe application to service-orientation computing).
Application Integration System integration with third parties	<ul style="list-style-type: none"> • Autonomous • Service Discovery • Open Standard • Intrinsic interoperability • Inherent re-usability • layers of abstraction • loose coupling 	The underlying characteristics of SOA that fostering the positive impact of SOA adoption from System Integration perspective. SOA adoption streamlined application integration process and facilitates better inter-system integration with third parties.

Factor 2 – Alignment IT and Business Goals

The IT department in the Bank has two roles: functional and supporting business unit. This suggests that IT department has close relation with the all the business units, since all the core systems or banking applications that support business units operational are developed and maintained under the responsibility of IT department.

As it has been mentioned in chapter 4.2.2, one of the SOA adoption strategies was to incrementally migrating existing system into SOA. In other words, all the systems that run and support business operational will be integrated into the new architecture. Therefore, SOA will affect the alignment between IT and business. As it was stated by the IT Department manager, SOA is regarded as a solution framework that bridges the interest of IT and business.

The Bank states that they have undergone through different phases, during the SOA adoption process. The first phase was system integration; followed by the second phase where they were able to identify the benefits of SOA, and finally the SOA governance creation, which they are currently facing now. An important fact during the second phase is the banks improvement to support business. This has been achieved by shortened the time to market of new developed services or application. For example, the Bank has developed core-services by wrapping the core-banking application with web services in the SMS Banking project. Subsequently when the Bank intended to implement Cash Management System as the next project, they realized that it was easier to integrate and align all the business functionalities. The re-usability and flexibility characteristic of the services make it easier for the Bank to orchestrate the core-services, making new composite services such as Cash Management System.

Within SOA, core-services represent the abstraction layers of the Bank's business functionalities. The Bank argues that the flexible, autonomous, and inter-operable nature of service, has

facilitated them to create flexible alignment between IT and business interest by delivering new composite application based on the core-services.

Changes in the Bank's business process are often initiated from the different business units. The changes will be addressed by IT department by making service composition or decomposition accordingly. IT department argues that standard interface within SOA makes them easier and faster to integrate and align business functionalities as they can create new composite application based on the core-services.

Table 5.3 summarizes the realized aspects that have affected by SOA adoption on Alignment IT and Business factor as well as SOA characteristic that underlying the impact.

Table 5-3 SOA Adoption Impact on Alignment IT and Business Goals

Realized Aspect	SOA Characteristic	Description
Business requirements delivery	<ul style="list-style-type: none"> • Autonomous • Service Discovery • Open Standard • Intrinsic interoperability • Inherent re-usability • layers of abstraction • loose coupling • federation 	SOA improves speed for delivering business solution as a service and facilitates flexible relation between IT and business.
Business functionalities alignment and integration		

Factor 3 – Response to Market Changes or Customer Demand

The Bank states that responding to the market condition is the ability to comply with the increasing number of industry using open standard. As it was mentioned in section 4.2.1, that increasing business partner and rapid changing finance industry are some of the Bank's business goals. Besides focusing on core-banking services, the Bank also seeks and explores new business breakthrough. For example, cooperation with business partners outside the Bank's competencies is a way to explore new business and be alert to new business breakthroughs. As a result, new business opportunities have been established with new business partners; for example, project for payment integration that varied from many organizations and industries such as oil and gas company and educational institution.

As a consequence for the increasing number of relations with business partners, the bank is required to have a flexible inter-operability with external systems. The Bank argues that SOA made their IT architecture flexible, since SOA provides them with open standard technology such as web services, enterprise services bus and messaging format (e.g. XML and SOAP). Therefore, it is easier and faster for the Bank to create integration scheme with business partner.

In relation with the impact of SOA adoption in customer demand factor, the Bank realizes that customers nowadays are more demanding. Customers want sophisticated banking products that are easy to access. Therefore, it is necessary for the Bank to provide products that can be accessed anytime and anywhere. The re-usability character of a service helps the Bank to answer that challenge. A service can be reused by the system if it is included in the SOA architecture.

This further allows the Bank to establish multichannel implementation strategy. Multi channel implementation strategy means that once service has published it can be accessed from the entire Bank's delivery-channel that connected to SOA.

Table 5.4 summarizes the realized aspects that have been affected by SOA adoption on Alignment IT and Business factor as well as SOA characteristic that underlying the impact.

Table 5-4 SOA Adoption Impact on Response to Market Changes or Customer Demands

Realized Aspect	SOA Characteristic	Description
Expanding business partner	<ul style="list-style-type: none"> • Autonomous • Service Discovery • Open Standard • loose coupling • Intrinsic interoperability • Inherent re-usability • layers of abstraction • quality of service 	SOA provides the Bank with flexible IT architecture that facilitates easier inter-system integration with their business partner, facilitates implementation of multi-channel strategy, and comply with industry standards. SOA also ensure the QOS such as security, reliability, and performance.
Multi-channel strategy		
Compliance with industry standard		

Factor 4 – Data Flow

Enterprise services bus facilitates the flexible communication between services in SOA. The Bank argues that enterprise service bus provides a single point of control for the entire service providers that connected into it. Therefore, SOA provides easier controls and monitors for all services activities including their data flows. SOA also provides the means to have an integrated view of data. Integrated view of data is important for the Bank because it reduces information redundancy that flows throughout the department in the Bank. The decrease of information redundancy in the organization gives many advantages such as facilitates the Bank with reliable information.

Table 5.5 summarizes realized aspects that have been affected by SOA adoption on Data Flow factor as well as SOA characteristic that underlying the impact.

Table 5-5 SOA Adoption Impact on Data Flow

Realized Aspect	SOA Characteristic	Description
Single view of Data	<ul style="list-style-type: none"> • Service Discovery • Intrinsic interoperability • layers of abstraction • quality of service 	With ESB, SOA provides QOS by ensuring reliability and integrity of service and the data that flows within it. The comprehensive abstraction layers of services, provides the Bank with the single view of information.
Reliability of data		

Factor 5 – Customer Services

The Bank considers the impact of SOA adoption from customer services dimension as an indirect rather than the direct impact. From their experience, the Bank argues that SOA accelerates time to market for new products or services as well increasing services reliability. The

faster time to market of new products and services the more satisfied customer since they provided with various alternatives of high quality products and services.

SOA also facilitates the Banks' integrated view of data and monitoring services activities through its enterprise service bus. This also applies to customer transactions monitoring, where the Bank can discover a customer from transactions that originated from various delivery-channel. The Bank states that enterprise service bus facilitates them in having single view of customer information. This information includes customer behaviour and financial transaction pattern in using the Bank delivery-channel (e.g. ATM, phone-banking, SMS banking, internet-banking, etc.). The customer information is very important, since it is used to get to know their customer better. The Bank can identify their customer preferences as well as customer behaviour. The Bank argues that customer information facilitates them in providing the strategy to create value added for the customer.

Table 5.6 summarizes the realized aspects that have been affected by SOA adoption on Customer Service factor as well as SOA characteristic that underlying the impact.

Table 5-6 SOA Adoption Impact on Customer Service

Realized Aspect	SOA Characteristic	Description
Single view of Customer	<ul style="list-style-type: none"> • Service Discovery • Intrinsic interoperability • layers of abstraction • quality of service 	SOA facilitates the Bank to have better information about customer and provides ability to create value added for the customer.
Creation of Value Added		

5.2.2 Cost

Factor 1 – Application Development Time and Cost

The impact of SOA adoption in application development time and cost factor are:

- The Bank's application developer is now able to find and access existing services within the new IT architecture, without additional effort to create connector (application interface) to access the service.
- The Bank application developer can reuse the service for developing new composite application.
- Since services are atomic, independent and standardized, it is easier to create new composite applications. The developer saves times, since applications are not longer required to be developed from scratch. On the contrary, the developer focuses more on the composition and decomposition of service instead of re re-coding and re-develops the application.

All of these factors support the notion that SOA adoption has affected the development time by shortening time to market for new application and therefore reducing the Bank's budget for application development cost.

Table 5.7 summarizes the realized aspects that have been affected by SOA adoption on Application Development Time and Cost factor as well as SOA characteristic that underlying the impact.

Table 5-7 SOA Adoption Impact on Application Development Time and Cost

Realized Aspect	SOA Characteristic	Description
Interface program	<ul style="list-style-type: none"> • Autonomous • Service Discovery • Open Standard • Intrinsic interoperability • Inherent re-usability • layers of abstraction • loose coupling • federation • agility 	SOA facilitates shorter application development time thus reducing application development expenditure.
Application Reusability		
Composite Application		

Factor 2 – Re-usability of Existing Applications

As it has been discussed in the impact of SOA adoption in application development time and cost, an important factor was the services re-usability, which is one of the main characteristics of SOA. The Bank further clarifies that the impact in re-usability of existing applications was reflected in the increasing number of solutions that they have provided for supporting business requirements. Whenever a new request for developing new business product arrives, it was possible for the IT department to reuse services and make new composite service. The continuous usage of the service in the Bank will therefore increase the degree of service re-usability.

Table 5.8 summarizes the realized aspects that have been affected by SOA adoption related to Re-usability of application. .

Table 5-8 SOA Adoption Impact on Re-usability of Applications

Realized Aspect	SOA Characteristic	Description
Business solution deliverables.	<ul style="list-style-type: none"> • Autonomous • Service Discovery • Open Standard • Intrinsic interoperability • Inherent re-usability • layers of abstraction • loose coupling • federation 	SOA increases the degree of application re-usability in the Bank. Application re-usability makes the development time faster, therefore increases the number of solution delivered for business unit.

Factor 3 – Operational Cost

The Bank argues that SOA adoption has had an impact in cost reductions. Before SOA adoption, the Bank has siloed applications scattered in many different platforms. According to them, it required many efforts, resources, and higher costs to maintenance those siloed applications. Moreover, various uses of technological platform and the scattered place in which application resides make it more difficult to maintain the silo applications. After SOA adoption, the legacy applications were incrementally wrapped into service and migrated to SOA.

Through the new architecture single enterprise service bus, SOA facilitates communication between all services. The single use of enterprise service bus increased the degree of control for services. As a result, support and maintenance of the different applications is now easier.

In other words, the adoption of SOA will potentially affect the Bank's maintenance process by incrementally decreases their effort and cost in monitoring and maintenance applications from various platforms.

Despite these benefits, it is important to remark that the initial investment for adopting SOA involves big initial investments, since it requires more efforts in the initial system integration process and also acquisition of new technology infrastructure. Another major investment is the overall system backup, since the bank and its partners are required to provide different applications that are running constantly. The Bank states that they have to provide contingency plan for system scalability, fail over, and load balance to ensure the overall performance and availability of their system.

Table 5.9 summarizes the realized aspects that have been affected by SOA adoption on Operational Cost.

Table 5-9 SOA Adoption Impact on Operational Cost

Realized Aspect	SOA Characteristic	Description
Initial Investment	<ul style="list-style-type: none"> • building block 	SOA requires considerable initial investment for architectural technology platforms as building block for the Bank IT architecture.
Cost for maintenance application platforms	<ul style="list-style-type: none"> • Open Standard • Intrinsic interoperability • Inherent re-usability • Federation • Vendor diversity • Building block • Quality of Service 	SOA potentially decreases the Bank's effort and cost in monitoring and maintenance applications from various platforms
Scenario for System Backup	<ul style="list-style-type: none"> • Quality of Services • Building Block 	The Bank requires SOA as a backbone of their IT architecture run constantly. Another investment for providing system backup is required to ensure system availability.

5.2.3 Other Factors

Besides all of the factors, which reflect this research framework, the Bank identified other impacts of the SOA adoption. The first is related to *'human resource productivity'*. The Bank also argues that since SOA adoption, the productivity of IT developer has increased. The service re-usability within SOA infrastructure saves a lot of time for IT developers.

IT developers use their working time effectively, creating new innovative solutions reusing the existent services, rather than expending time in re-coding the same program for interfacing with other systems. As the productivity for IT developer has increased, it will affect the overall IT expenditure. This is done by decreasing the working time needed for each project development. In other words SOA adoption contributes in decreasing operational-costs.

The Bank states that they are currently in the phase of implementing SOA governance. IT department now can easily monitor which services or applications have a poor performance in order to optimize them. Moreover, the Bank has more well-organized application structure than before. All of these have resulted in the increasing of application reliability. In many core-banking applications, reliability plays an important role since the Bank needs to ensure that their applications up and running constantly. The failure to provide reliable application will results in various kinds of cost such as troubleshooting costs as well as re-tunning application cost. Therefore with the increasing of application reliability, the will unexpected operational-cost mention before would decrease.

Finally, the Bank suggests that the SOA adoption has affected organization restructuring. This, since SOA governance requires IT department to re-organize their way of working and in many cases their roles. Organizational restructure is a tedious process because it requires further analysis from the Human Resource Department, such as workload analysis and working groups,

this need to be approved by the Bank's Board of Director. For addressing this issue, the Bank takes parallel steps. IT department states that they have established SOA task force team, whilst proposed the organization restructuring for SOA compliance. Since the organizational restructuring is a subject that beyond our study, we will not further analyse this factor in our study.

Table 5-10 Discovered SOA Adoption Impact

Realized Aspect	SOA Characteristic	Description
Human Resource productivity	<ul style="list-style-type: none"> • Autonomous • Service Discovery • Open Standard • Intrinsic interoperability • Inherent re-usability • layers of abstraction • loose coupling • federation • agility 	The underlying characteristics of SOA that facilitates shorter application development, increasing degree of application re-usability, therefore will give contribution in increasing human-resource productivity.
Application Reliability	<ul style="list-style-type: none"> • Quality of Service 	SOA increases the reliability of application or service.

5.2.4 Summary of the Impact of SOA adoption

Chapter 5.2.1 presents the analysis of SOA adoption impact in business agility, while chapter 5.2.3 presents the analysis of SOA adoption impact on costs. Table 5.11 summarizes the overall impact of SOA adoption.

Table 5-11 Summary of The Impact of SOA Adoption

Business Agility		
Factor	Positive Impact	Negative Impact
System Integration	<ul style="list-style-type: none"> • foster application integration • facilitates system integration with third parties 	<ul style="list-style-type: none"> • requires considerable effort in changing application development style and pattern
Alignment between IT and business goals	<ul style="list-style-type: none"> • increases delivery of business solution • facilitates alignment and integration between business functionalities 	-
Responding Market Changes and Customer Demand	<ul style="list-style-type: none"> • expanding business partner • fostering multi-channel strategy • compliance with industry standard 	-
Data Flow	<ul style="list-style-type: none"> • facilitates single view of data • increases data reliability 	-
Customer Services	<ul style="list-style-type: none"> • facilitates single view of customer • value added creation 	-
Cost		
Factor	Positive Impact	Negative Impact
Application development time/cost	<ul style="list-style-type: none"> • avoid redundancy development of interface program • increasing application reusability degree • facilitates the development composite application 	-
Application Reusability	<ul style="list-style-type: none"> • supports multi-channel strategy 	-
Operational Cost	<ul style="list-style-type: none"> • decreases effort and cost in monitoring various application platforms 	<ul style="list-style-type: none"> • requires considerable initial investment for IT Architecture technology • requires creation of system backup scenario
Resources Productivity	<ul style="list-style-type: none"> • facilitates shorter application development time • decreasing application development cost 	-
Application Reliability	<ul style="list-style-type: none"> • increases reliability of application or service 	-

5.3 Combined Analysis

The aim of combined analysis is to give a comprehensive picture about the SOA adoption context and its impact a large South East Asia bank. From the analysis of the SOA adoption project documentation, presented in chapter 5.1, we have identified some salient facts. These include:

1. The drivers for SOA adoption for the Bank are to reduce cost and increase business agility that further formulated with business goals and IT goals.
2. The Bank decided to create milestones as their SOA adoption strategy (e.g. Understanding SOA, Create SOA Architectural Reference with some pilot project, Create SOA Governance, and Migrating existing legacy system into SOA). The SOA adoption strategy is important to ensure the success of SOA project, where they continually evaluate the outcome of each milestone.
3. The Bank has had developed SMS Banking as their pilot project to realize SOA reference architecture. This was an important step for the Bank, since this would build the foundation for SOA infrastructure for future projects.
4. Creating SOA Governance was an important step for the Bank. In order to benefit from the SOA infrastructure, SOA governance is required to prioritize which project is more important to be migrated into SOA and has more potential to enhance business values. Another role of SOA governance is to control and monitor the life cycle of service and composite application within the Bank.
5. In order to ensure the continuously return of the Bank's investment in SOA, the migration of existing legacy system will be done incrementally (project-by-project basis).

Based on these facts, we further develop our analysis by examining the similarity with the context of SOA adoption in our research framework. As a result, we have identified two similarities between the context of SOA adoption in the bank and within our research framework, these are: cost reduction and increase business agility. This increases the applicability of our research framework by identifying the similarities between the drivers for SOA adoption and the impact of SOA adoption. Furthermore, chapter 5.1.2 described Bank SOA reference architecture, which also has similarities with this study SOA adoption framework.

Similarities: the Bank's SOA initiatives and
Affected Factors from SOA Adoption

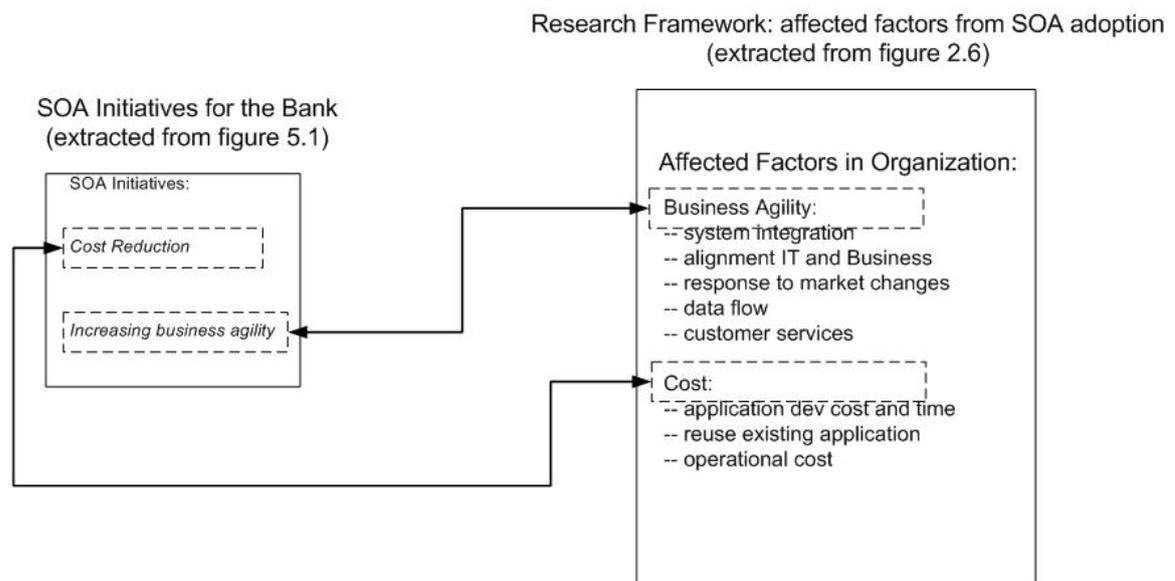


Figure 5.3 The Similarities between the Bank's SOA initiatives and Research Framework

As it was mentioned before, the context of SOA adoption in the Bank has similarities with our research framework, now we will focus on the overall view of the impact of the SOA adoption in the Bank. Table 5.11 summarizes the impact of SOA adoption within the Bank. Generally from the business agility and cost factors, SOA adoption has result in positive impacts for the bank, except for the initial implementation phase that required extra development effort and considerable investment. However, the Bank argues that they do not perceive the extra effort in initial development and the considerable investment for SOA infrastructure as a negative impact that account to system integration and operational cost factor.

SOA releases the potential of the Bank's IT architecture by providing standards for communication between services, allowing service for being reusable, facilitating services composition or orchestration and giving full control of services with SOA governance. More specifically, the Bank has experienced the positive impact of SOA adoption in their system integration processes, strengthen the alignment between IT and business units, increasing ability to respond to market changes and customer demand, increasing reliability of information flows, and release the potential to create value added services for customer. All of these together suggest that there is a general positive impact, which impact the Bank's business agility.

The Bank also confirmed that the SOA adoption has result in a positive impact by increasing the degree of application reusability that published into SOA as a service. The Bank has been able to develop multi channel strategy. This strategy allows every delivery channel that connected to SOA to re-use the service. This feature of service reusability also affected the development time of application. Application developer can re-use services as well as make composite service by orchestrating services within SOA. This makes the application development time shorter than before. From the operational cost factor, the Bank also argues that SOA adoption has given positive impact by potentially decrease the maintenance cost of applications since with the help of enterprise service bus that facilitates them to have a centralized control for the entire services

or application within SOA. The Bank also identified that SOA adoption has affected the human resource aspect by increasing their productivity and also increasing the application reliability. Hence, SOA adoption has had a positive impact in the developing application costs.

Besides from all the positive impact mentioned above, we identified that SOA adoption also has some drawback. The first can be seen from the SOA adoption pilot project, as the first system integration process was considered as difficult process. The former development style for IT department was a silo application that lacked well establish standards for inter-application or inter-system communication (e.g. web services and standardize messaging format), and tightly couple logic and process. With the adoption of SOA, the bank needed to think in a more holistic way. They had to implement new ways to decompose business process in application into fine-grained service and make it loosely-coupled, and also they need to make it more open-standard with using standardize messaging format and wrapping application with standard technology such as web services. The changing style of application-development was considered a difficult process that required big efforts.

The initial SOA adoption project required a considerable amount of investment, since the IT architecture needed to be re-structure. The lack of a well develop SOA adoption might also have negative implications for the SOA adoption.

Finally, the use of enterprise service bus as main communication platform for SOA infrastructure is twofold. On the one hand, it gives centralized view and control for entire service or application activities throughout enterprise and facilitate better inter or intra service communication, but on the other hand because all the service activities happened on the single enterprise service bus, the Bank must ensure the reliability of the enterprise service bus. The Bank is required to provide high service-level standard for their customer by ensuring that their system up and running constantly. Therefore extra effort and investment are required to make scenario for scalability, fail-over, and backup system for SOA. Table 5.3 will resume the overall impact of SOA adoption for the Bank.

Table 5-12 The Impact of SOA adoption for the Bank

Positive Impact	
Business Agility	Cost
<ul style="list-style-type: none"> • System Integration • Alignment between IT and Business Goals • Response to Market Changes and Customer Demands • Data Flows • Customer Service 	<ul style="list-style-type: none"> • Application Development Time and Cost • Application Re-usability • Operational Cost
Negative Impact	
<ul style="list-style-type: none"> • Required extra effort for changing Application development style or pattern • Considerable Amount of Investment (High Risk) • Required extra investment and effort to create scenario for ensure system availability 	

6 Conclusion

In this final chapter, we present our overall findings to conclude our study. A discussion about the process surrounding SOA adoption (the drivers and strategy), context of SOA adoption, and the impact of SOA adoption will be conducted. Presentation of our critiques about the result of the study will be carried out as study limitation. Finally, the possibilities of further studies also discussed.

6.1 The Impact of SOA Adoption in the Case Company

As it was mentioned in chapter 1.3, one of the purposes of this study is to clarify the context of SOA adoption in organization. Based the empirical study conducted in a large south East Asia bank, the adoption of SOA has improved the IT support for business unit. The empirical research suggests that the SOA adoption process include the following underlying aspects: the drivers for SOA adoption, SOA adoption strategy, and SOA reference architecture.

The Drivers for SOA Adoption

The main motivation for the case company in adoption SOA were to reduce the cost and increasing business agility by shortening the time it takes to deliver new business capability. These initiatives then further elaborated through formulation on business goals and IT goals.

SOA Adoption Strategy

There are four important milestones from SOA adoption strategy that underlying the entire process of SOA adoption:

- Understanding SOA – workshops have been conducted to form a common understanding of SOA in the case company.
- Initiate Project – a pilot project was conducted as a proof of concept and to establish IT architecture based on SOA reference architecture.
- SOA governance – establish SOA governance is important for creation of policy and mechanism that required to measure and control the way decisions is being made regarding to the new IT architecture.
- Migrating entire legacy system – having SOA infrastructure in place and SOA governance established, the next strategy is migrating entire legacy system through project-by-project basis. One of the SOA governance purpose is to define which system is important to be integrated in new IT architecture.

SOA Reference Architecture

SOA reference architecture depicts the SOA foundation for the overall architectural model. This architectural model, or IT architecture, was used as a reference through the entire SOA adoption process.

The main purpose of this study was to discover the impact of SOA adoption in organization from with regard to business value. From the results of our empirical study (chapter 5.2) we conclude that from a business value perspective, SOA adoption has positive impacts in the large South East Asia bank. The positive impacts of SOA adoption are:

- *Business Agility*
 1. Increasing flexibility for *System Integration*
 2. Increasing degree of *Alignment between IT and Business Goals*
 3. Quicken response for the *Market Changes and Customer Demands*
 4. Increasing quality of *Data Flow*
 5. Improve *Customer Services*
- *Cost*
 1. Decreasing *Application Development Time and Cost*
 2. Increasing degree of *Application/Service Reusability*
 3. Potentially reducing *Operational Cost*
 4. Increasing *Human-Resource Productivity* (new finding)
 5. Increasing *Application Reliability* (new finding)

Furthermore, our findings suggest that there are other impacts of SOA adoption, outside this study research framework. These are human-resource productivity and application reliability. The original research framework has been reviewed, incorporating the above mentioned impacts. This following figure will illustrate the reviewed research framework.

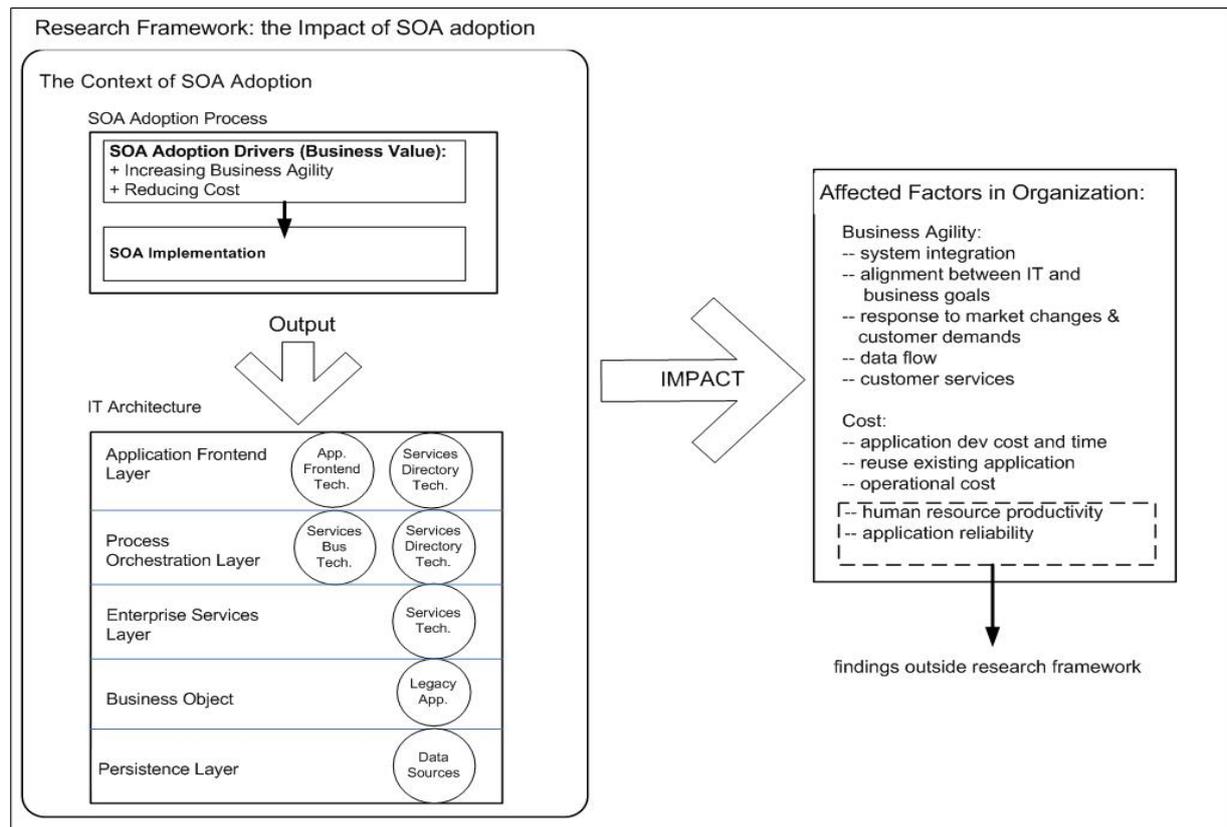


Figure 6.1 Refinement Research Framework

Besides the above mentioned positive impacts, the empirical study indicates that SOA adoption also has certain drawbacks. SOA adoption requires extra efforts by the IT developer to change application development methodology, from process-oriented to service-oriented paradigm. SOA adoption also requires considerable investment in the IT architecture and requires additional investment for the implementation of new technologies as well as to assure the SOA infrastructure backup that can ensure the system availability.

6.2 Study Limitation

This study research framework is based on the study done by Yoon & Carter (2007). To the best of our knowledge there are not further studies that validate their research framework. However, in a study done by Joachim et al. (2008), where they focus on the drives and inhibitor of SOA business value, Yoon & Carter (2007) is further develop. As our findings suggest, there might be other factors that are not included in the original research framework.

The selection of the company might also be a limitation in this study. Due to the limited access of empirical data, it was not possible to do a random selection. This aspect affects the transferability and generalizability of this study.

6.3 Further Studies

Since our study is qualitative study that has explanatory character, it would be possible to make a continuation of this study by conducting an explanatory research. Qualitative study with explanatory character might be suitable to further explain the pattern related to the impact of SOA adoption such as why and how SOA adoption can give impact to the organization.

Further multi-case study also can be conducted as the extension of this study, in order to make broader generalization of the impact of SOA adoption from business value perspective. A multi-case study in different organization with different core business will elicit complete view of the impact of SOA adoption. Greater possibilities to find other factors that affected by SOA adoption will construct better framework to examine the impact of SOA adoption from business value perspective.

Finally, from our empirical study we have discovered a new factor (organizational restructuring) that beyond the scope of the study. Therefore further studies with broader perspective can be conducted.

Appendices

Appendix A: List of Abbreviations

ATM	Automated Teller Machine
BPEL	Business Process Execution Language
EDC	Electronic Data Capture
ERP	Enterprise Resource Planning
ESB	Enterprise Service Bus
IEEE	Institute of Electrical and Electronic Engineers
IT	Information Technology
SMS	Short Message Services
SOA	Service Oriented Architecture
SOAP	Simple Object Access Protocol
SOC	Service Oriented Computing
UDDI	Universal Description, Discovery and Integration
WSDL	Web Service Description Language
XML	eXtensible Markup Language

Appendix B: Interview Guides

Introductory Questions

1. Company name:
2. Working position:
3. Duration of employment at the company:
4. Do you want your answers to be treated confidentially?
 - a. Yes
 - b. No

SOA Adoption Questions

1. What is your understanding about SOA?
2. Has your company already implemented SOA?
3. When did your company starting SOA implementation?
4. What is your role in SOA adoption?
5. Can you provide a short description about process of SOA implementation in your company?
6. Why did your company decide to implement SOA?
7. Does your company aware about services orientation paradigm?
8. If it yes, can you give short description how service orientation paradigm has been interpreted within your company?
9. Which of these following technologies that your company used for realizing SOA?
 - Application frontend technology (desktop based client, web based client, & mobile client)
 - Web services technology (XML, WSDL, SOAP)
 - Services directory technology (UDDI)
 - Services bus technology (e.g. enterprise service bus, proprietary messaging & queuing system)
 - Other technology, please mention...

The Impact of SOA Adoption Questions

1. Overall Impact
2. Impact on Business Agility
 - System Integration
 - IT and Business Alignment
 - Response to Market Changes and Customer Demands
 - Data Flows
 - Customer Services
3. Impact on Cost
 - Application Development Time and Cost
 - Application Reusability
 - Operational Cost
4. Other factors that affected by SOA Adoption

Appendix C: Interview with the Bank's Deputy General Manager**Profile: Mr. A****Organization Role: Deputy General Manager****SOA Role: Organization Executives (Defines Goals and KPI)****Employment Time: 10 years****Interview****Organizational Understanding of SOA:**

Q: How would your organization describe SOA?

A: We define SOA as a solution framework for improving IT support to businesses.

Why? Because with SOA framework, we can address key challenges in supporting businesses namely time delivery and reliability. The increasing level of SOA maturity and the re-usability character of SOA will give better efficiency in the development of IT products and services. We can also increase the reliability of our services to business, because within or SOA we have been using best practices and well proven components as well as industry standards technology.

Organizational Decision in SOA Adoption:

Q: Why did your company decided to implement SOA?

A: We decided to implement SOA because we believe that SOA can help us to provide flexibility and agility in our IT assets. We believe that the flexibility and agility in our IT assets is necessary to give better support for business units. As we understand the ever changing nature of the business environment required our organization to be more flexible and agile in coping with those changes. Other consideration is that our Bank continuously expands the business by establishing cooperation with business partner from various industries. This requires our system to be flexible and scalable, so it will be easy to communicate with our partners system. For example: integrating payment system with educational institution, oil and gas company and other partners.

Appendix D: Interview with the Bank's SOA co-project Manager**Profile: Mr. B****Organization Role: Head of Head Office Application Development****SOA Role: co-Project Manager in SOA implementation****Employment Year: 7 years****Interview****SOA Adoption Process:**

Q: Can you give short description about SOA Journey in your organization

A: I give you a brief history; our former core banking system was distributed architecture, along with the implementation of new centralized core banking system has demanded the former siloed applications to be integrated. So that our first phase: Integration. The second step was took benefits from the integrated and centralized applications, for example, faster time to market in responding business needs.

Q: So we would affirm that the first phase of SOA adoption is Applications Integration?

A: Yes indeed. Because it is impossible to implement SOA concept without undergo this phase. This is my personal opinion.

Q: Within the first phase, was it the entire legacy systems are being integrated into SOA at once?

A: Incrementally, we are very selective in determining which application or system that has high value added for being integrated into SOA. For example, related to the multi electronic channel strategy - build one services that available for all channels, we are focusing in enabling our front-end to SOA (e.g. SMS banking, e-banking, mobile banking). We considered that it is useless to integrate application that has specific purpose into SOA. The important requirements for application to be integrated to SOA: repetitive task and re-usable.

Q: OK. So is there any other phase after the second phase?

A: Within SOA there are service consumer, service provider, and also enterprise service bus where those services are being orchestrated. After everything in place, it is important to have governance.

Q: Is that means that within the third phase of SOA adoption your organization emphasises on SOA governance?

A: exactly but we considered it as an in early stage of SOA governance, we have been focused on how to define services, register services (versioning), and implement service within their life cycle precisely and for long term purpose. We believe that the more mature SOA governance, it will be easier to see the impact SOA including direct and indirect impact.

Impact on System Integration:

Q: Ok, after the SOA journey now your organization has been realized the impact of SOA adoption?

A: Yes ofcourse, one of them was restructuring organization for SOA compliance, but the biggest influence was in the IT development area. It is difficult in the beginning, since we were required to think holistically than previously confined to the siloed applications. The developer also required to standardize the application now. However, now we have been starting to gain the benefits, for example if we have new published service (e.g. fund transfer) it's very easy for the entire application channel to access and use this service. Standardization can also be applied. Another advantages we can make a composite service from independent and atomic services. Initially designing application within SOA took longer time than the technical implementation. But once it available and published it would save some time if there is a new application that required the same services. We can say that there are two processes for service establishment: top down (wrapping the legacy system) and bottom up (using new web services enabled application)

Q: So, is that mean SOA adoption affected system integration?

A: Yes indeed, even we can be more easily to integrate our system with the business parties with the using of web services technology. But keep in mind that SOA is not equal with web services, it just an underlying technology.

S: Does it mean that SOA adoption has positive effect on system integration instead of negative?

A: Exactly. It is true that in the beginning the SOA investment was quite something, but you can not consider it as negative impact...

S: Okay, what about the organization restructuring, I notice that you stated that before explain particular impact on IT development...

A: Well, yea one of the impacts was organization restructuring for SOA compliance. That was big challenge because it is not easy to restructure the entire IT organization within the Bank. Organization structure should be analysed by HR Department and approved by Board of Director based on certain criteria, e.g. workload analysis and job group. What we have done to cope with this issue is to assign task force team to do the SOA related projects; meanwhile we propose the new organization structure and develop working flow based on SOA governance model.

Q: Is that means the organization restructuring is not done yet?

A: Yes, we are still proposing this, meanwhile we rely on our SOA taskforce team.

Impact on IT and Business Alignment and Impact on Application Reusability:

Q: For the next question what do you thing the SOA adoption impact on IT and business alignment.

A: IT and business alignment is clearly yes, because prerequisite to create business

oriented SOA, we must be clear in translating business needs into the SOA architecture.

Q: Can you give real example of that?

A: Well it would be easier to give an example from technical perspective, initially we prepared core services (These services will be used to wrap core banking functionalities). This core services then published, making it accessible and usable for entire electronic channel. Within our first SOA adoption pilot project we implement SMS banking to use those core services. Then subsequently we implement Cash Management System as new business services for user. We found that it was very easy to integrate and to align all functionalities since we can easily orchestrate and re-use the core services that already published.

Q: I see.

A: Direct impact: it is very easy and quick to make connectivity or integration with the use of standard interface.

Q: Okay, so you think that it is still give the positive impact?

A: Exactly.

Impact on Responding Market Condition

Q: Okay, for the next question is the impact on responding to market condition.

A: We perceive responding the market condition as the increasing number industries that comply with the open standard, SOA makes our Bank can answer those challenge with provides ability to create an integration scheme with third business partner easily and faster. It makes us flexible in addressing the uncertainty in the market condition.

Moreover we also required for the new applications from vendor or third parties are needed to be standardized before interfacing with our architecture for example with web services enabled.

S: I see.

Impact on Responding Customer Demand

Q: What about the impact on responding to the customer demand?

A: the increasing demand of sophisticated and accessible product from anywhere can be addressed with SOA. Because SOA enables multi-channel implementation strategy.

Q: What do you mean by multi channel implementation strategy?

A: It means once you published the services, it can be accessible for the entire electronic channel front end (SMS banking, teller, internet banking, and mobile banking)

Q: I see. So far it seems that you have state all the positive impact, can you see the opposite impact?

A: None as I can see that, but instead of see from positive impact, we rather see that as giving value to the organization.

S: Ok, can I continue with the next question?

A: Sure.

Impact on Customer Services

Q: Can you give explanation about the impact of SOA adoption within customer services?

A: What do u mean with customer services?

Q: As an example creating value added services for customer, but not only limited to that

A: Well that might be indirect impact, since the logical consequences from using ESB will give ease for the entire access of services provider. As a result it will be easy to monitor all activities. Many ways we can use to utilize these features for giving value added to user. As one of example single view of customer transactions that conducted from various electronic channels become more easily. With previous approach before SOA, this also can be done, but the effort from customer data integration will be very big.

Impact on Application Development Time and Cost

Q: OK. What about application development time and cost, do you think SOA has impact on those?

A: I think we have bit discuss about application development previously. One of them has something in relation with reusability, it makes the application can be built not from the scratch. Especially with SOA application can talk each other with open or standard message.

Q: Are you saying that SOA could save time and cost for application development?

A: Yes.

Impact on Operational Cost

Q: What about the impact in operational and maintenance cost?

A: Well if it is about cost reduction, maybe we don't fell that now, but I believe if everything has been standardized and accessible from various channels, it should reduce the cost. I might say that relating to the cost; it would be inline with maturity level.

Q: Are you saying that it's getting bigger for both operational and maintenance cost?

A: We still don't have numbers on that, but it's said expensive for SOA adoption because initially we have scattered and siloed applications, which made the integration effort big.

Q: I see, so the most expensive cost was in integration effort?

A: Yes, but I believe after everything is integrated in place, it will reduce the maintenance cost. Imagine how many resources were needed before to maintain

scattered applications compared to the single maintenance effort in ESB. But it raised another challenge; since with SOA we have everything came through the ESB, as a consequence we need reliable platform with high availability.

Q: What do you mean with high availability?

A: I mean we have to guarantee that system will run all the time, we have to provide scenario for the system fail over, load balance, and all that scalability issues.

Another Impact

Q: Ok. So this is our last question. Does your organization experience another dimension that has been impacted besides what we've been discuss?

A: Hmmm, let me think. Well maybe it's from human resources aspect.

S: Can you explain that?

A: Well I think somehow the adoption increasing human resource productivity.

Q: Can you give an example?

A: Well so far after the adoption, programmer doesn't need to give other efforts in creating various connectors to interface with another system, since all services have been published and ready to use. Another thing from the governance, we can have more organized structure for the applications with SOA. I would like to add that what we've been feel now that the possibility time to market for new products is increasing, because the development of applications and services are faster now. And the reliability of applications also increasing because we can optimize the control and governance for the whole applications.

Appendix E: Interview with the Bank's SOA Implementer**Profile: Mr. C****Organization Role: Manager of Channel and Development****SOA Role: SOA Implementer****Employment Year: 7 years****Interview****SOA Impact:**

Q: Can you explain the impact of SOA adoption...

A: Well it gave a lot influences especially in the development areas.

Legacy applications that usually programmed with conventional ways were required to change in order for SOA open standard compliance. Initially it takes a lot of efforts, but eventually we see the benefits. Moreover, when increasing requirements came from business people. The most significant effects from the re-usability characters of service within SOA.

Q: In the beginning you said about open standard, can you give more explanation on that?

A: Yes, SOA based on open standard technology, for example: ESB, Web Services, and reliable messaging.

Q: You also stated that initially it took a lot of effort, what does it means?

A: I mean in the context of elaborating business process, from tightly coupled before SOA to loosely couple after SOA. There are a lot of effort and process required for that.

Especially decompose 'big' business process into independent piece of services.

Q: Can you give an example?

A: I give you example on Housing Loan Application. From this business services, we elaborated the business process into small pieces of independent service for example: account opening, loan scoring, account inquiry, account transfer, and some other independent service. Those small pieces of services then composed and orchestrated with the use of BPEL into a business process. Those small unit of services can also be used from another business processes. If the small unit of services are considered complete, every business requirements came it is like to play some orchestra, you can compose and decompose services as you want to build a business process. Furthermore, i see the impact from technical point of view as a positive impact. System will be easier to integrate, because the open standard characteristic. Moreover SOA now becomes trend in industry. A lot of vendor provides applications that SOA ready. I give you another explanation; there are two approaches for SOA implementation. Rewrite or rebuild application and reuse legacy applications.

The former required more effort from developer point of view. But if it finished will

give result a fine IT architecture. The second approach seems simpler, since it just wrapping legacy applications with web services. But it will raise a problem if there a lot of legacy applications that not web services compliance. But it always depends on ready the enterprise for their IT backbone. If the enterprise is considered ready, they can fit to the first approach.

References

- Baskerville, R., Cavallari, M., Hjort-Madsen, K., Pries-Heje, J., Sorrentino, M., and Virili, F (2005). Extensible Architectures: The Strategic Value of Service-Oriented Architecture in Banking. *13th European Conference on Information Systems, Regensburg, Germany*.
- Beimborn, D., Joachim, N. (2008). Enterprise Applications and Services in the Finance Industry. *4th International Workshop, FinanceCom, Paris*. Revised Papers. Springer, Berlin
- Beimborn, D., Hirschheim, R., Schlosser, F., Schwarz, A., and Weitzel, T. (2008a) Comparing the Operational Integration of a Core Information System in Insourcing and Outsourcing Firms, in *Proceedings of the 14th Americas Conference on Information Systems*, August 14-17, Toronto, ON, Canada.
- Beimborn, D., Joachim, N., and Weitzel, T. (2008b) Drivers and Inhibitors of SOA Business Value – Conceptualizing a Research Model, in *Proceedings of the 14th Americas Conference on Information Systems*, August 14-17, Toronto, ON, Canada.
- Bieberstein, Norbert, Bose, Sanjay, Fiammante, Marc, Jones, Keith, and Shah, Rawn (2005). *Service Oriented Architecture (SOA) Compass: Business Value, Planning, and Enterprise Roadmap*. IBM Press.
- Byrd, T. A., Turner, D. E, (2001). An exploratory examination of the relationship between flexible IT infrastructure and competitive advantage. *Information & Management*, 39:41-52.
- Creswell, J. W. (2003). *Research Design: Qualitative, Quantitative, and Mixed Method* 2nd ed., Thousand Oaks, CA: Sage.
- Creswell, J. (2007). *Qualitative Inquiry & Research Design: Choosing Among Five Approaches*, Thousand Oaks, CA: Sage.
- Cummins, Fred (2009). *Building the agile enterprise with SOA, BPM and MBM*. Elsevier.
- Davenport, T.H., Linder, J. (1994). Information management infrastructure: the new competitive weapon. *Proceedings of the 27th Annual Hawaii International Conference on Systems Sciences*, Vol. 27, IEEE, pp. 885–899.
- Erl, T. (2005). *Service Oriented Architecture: Concepts, Technology, and Design*. Prentice Hall.
- Esteves, J. & Bohorquez, V. (2007). The Communications of the Association for Information Systems, *Communication of the Association for Information Systems*, 19(18).
- Fink, L. & Neumann S. (2007). Gaining Agility through IT Personnel Capabilities: The Mediating Role of IT Infrastructure Capabilities. *Journal of The Association for Information System*, 8(8), 440-462.
- Foley, J. and Stein, T. (1997). Oracle Aims at Application Midmarket. *Information Week*, July 7, p. 30.
- Flinkenstein, C. (2006). *Enterprise Architecture for integration*. Artech House.
- Haines, M.N., and Haseman, W.D. (2009) Service-Oriented Architecture Adoption Patterns, in *Proceedings of the 42nd Hawaii International Conference on System Sciences*, January 5-8, Waikoloa, Big Island, HI, USA, IEEE Computer Society.
- Hammersley, M. & Gomm, R. (1997). Bias in Social Research, *Sociological Research Online*, 2(1).
- Israel, M. & Hay, I. (2006). *Research Ethics for Social Scientists*, Sage, London.

- Joachim, N., Beimborn, D., Hoberg, P., & Schlosser, F. (2009). Examining the Organizational Decision to Adopt Service-Oriented Architecture (SOA) - Development of a Research Model. DIGIT 2009 Proceedings. Paper 4. Available at: <http://aisel.aisnet.org/digit2009/4> [Accessed 10 May 2010].
- Kalling, T. (2003). ERP-systems and the Strategic Management Processes that Lead to Competitive Advantage. *Information resources Management Journal*, 16(4), 46-67.
- Kochan, A. Thomas & Useem, Michael(1992). *Transforming Organizations*. Oxford University Press.
- Krafzig, D., Banke, K., & Slama, D.(2005). *Enterprise SOA: Service Oriented Architecture Best Practices*. Pearson Education.
- Kumar, S., Dakshinamoorthy, V., and Krishnan, M.S. (2007a). Does SOA Improve the Supply Chain? An Empirical Analysis of the Impact of SOA Adoption on Electronic Supply Chain Performance, in *Proceedings of the 40th Hawaii International Conference on System Sciences*, January 3-6, Waikoloa, Big Island, HI, USA, IEEE Computer Society, pp. 1530-1605.
- Kumar, S., Dakshinamoorthy, V., and Krishnan, M.S. (2007b) SOA and Information Sharing in Supply Chain: "How" Information is Shared Matters!, in *Proceedings of the 28th International Conference on Information System*, December 9-12, Montreal, QC, Canada.
- Kvale, S. & Brinkmann, S. (2009). *Interviews: Learning the Craft of Qualitative Research Interviewing* 2nd ed., Sage, Thousand Oaks, CA.
- Luthria, Haresh and Rabhi, Fethi (2009). Using Service Oriented Computing for Competitive Advantage. *AMCIS 2009 Proceedings*. Paper 140. Available at: <http://aisel.aisnet.org/amcis2009/140> [Accessed 10 May 2010]
- Marshall, C. and Rossman, G.B. (2006). *Designing Qualitative Research* 4th ed., Thousand Oaks, CA: Sage.
- Maxwell, J. A. (2005). *Qualitative research design: An interactive approach* 2nd ed., Thousand Oaks, CA: Sage.
- McGovern, J., Sims, O., Jain, A., & Little, M. (2006). *Enterprise Service Oriented Architectures: Concepts, Challenges, Recommendations*. Springer Netherlands.
- Melville, N., Kraemer, K., & Gurbaxani, V.(2004). Information Technology and Organizational Performance: An Integrative Model of IT Business Value. *MIS Quarterly*, Vol. 28, No. 2 (Jun., 2004), pp. 283-322.
- Miles, M. B., & Huberman, A.M. (1994). *Qualitative Data Analysis: A Sourcebook of New Methods* 2nd ed., Thousands Oaks, CA: Sage.
- Oates, Briony J. (2006). *Researching Information Systems and Computing*. Sage, London.
- Oh, L.-B., Leong, Y.-X., Teo, H.-H., and Ravichandran, T. (2007) Service-oriented Architecture and Organizational Integration: An Empirical Study of IT-Enabled Sustained Competitive Advantage, in *Proceedings of the 28th International Conference on Information Systems*, December 9-12, Montreal, QC, Canada
- Oxford Dictionary (2010). Definition for "Impact". [Online] Available at: http://www.askoxford.com/concise_oed/impact?view=uk/ [Accessed 10 May 2010].
- Papazoglou, M.P., and Van den Heuvel, W. (2006) Service-oriented design and development methodology, *International Journal of Web Engineering and Technology*, 2, 4, pp 412-442.

- Patrick, P. 2005. Impact of SOA on enterprise information architectures. *In Proceedings of the 2005 ACM SIGMOD international Conference on Management of Data*.
- Ren, M. & Lyytinen, K. (2008). Building Enterprise Architecture Agility and Sustenance with SOA, *The Communications of the Association for Information Systems*. Vol. 22, Article 4.
- Ross, Jeanne W. (2003). Creating a Strategic IT Architecture Competency: Learning in Stages. *MIT Sloan Working Paper* No. 4314-03.
- Sambamurthy, V, Bharadwaj, A., Grover, V. (2003). Shaping Agility Through Digital Options: Reconceptualizing the Role of Information Technology in Contemporary Firms. *MIS Quarterly* Vol. 27, No 2, pp. 237-263, June, 2003.
- Schelp, J., and Aier, S. (2009) SOA and EA – Sustainable Contributions for Increasing Corporate Agility, in *Proceedings of the 42nd Hawaii International Conference on System Sciences*, January 5-8, Waikoloa, Big Island, HI, USA, IEEE Computer Society.
- Seale, C. (1999). *The quality of qualitative research*, Sage, London.
- Seo, D. and La Paz, A. I. (2008). Exploring the dark side of IS in achieving organizational agility. *Commun. ACM* 51, 11 (Nov. 2008)
- SOA Manifesto. 2010. SOA Manifesto. [Online] Available at: <http://www.soa-manifesto.org/> [Accessed 10 May 2010].
- Somers, T. & Nelson, K. (2003). The Impact of Strategy and Integration Mechanism on Enterprise System Value: Empirical Evidence from Manufacturing Firms. *European Journal of Operational Research* 146:315-338.
- Weill, P., M. Subramani, & M. Broadbent (2002). Building IT Infrastructure for Strategic Agility. *MIT Sloan Management Review*, (44)1, pp. 57-65.
- Whittermore, R., Chase, S. K., & Mandel, C. L. (2001). Validity in Qualitative Research. *Qualitative Health Research*, 11, 522-537.
- Wong-Bushby, I., Egan, R., & Isaacson, C. (2006). A Case Study in SOA and Re-architecture at Company ABC. In *Proceedings of the 39th Annual Hawaii international Conference on System Sciences - Volume 08* (January 04 - 07). . [Online] Available at: [http:// http://dx.doi.org/10.1109/HICSS.2006.4](http://dx.doi.org/10.1109/HICSS.2006.4) [Accessed 25 May 2010].
- Woods, D., Mattern, T., (2006). *Enterprise SOA Designing IT for Business Innovation*. Sebastopol: O'reilly Media Inc.
- Yin, R. (2003). *Case Study Research: Design and Methods (3rd ed.)*, Sage, London.
- Yin, R. (2009): *Case Study Research: Design and Methods*, 4th ed. Sage, London.
- Yoon, Tom & Carter, Pamela (2007). Investigating the Antecedents and Benefits of SOA Implementation: A Multi-Case Study Approach. AMCIS 2007 Proceedings. Paper 195.