

**DERIVING VALUE FROM SERVICE ORIENTED
ARCHITECTURE IN KENYAN BANKS**

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DECLARATION

This research project is my original work and has not been submitted in any other college or university for academic purposes.

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This research project has been submitted for examination with my approval as the university supervisor.

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DEDICATION

This project is dedicated to my family and friends for their sacrifice and support throughout my studies

ACKNOWLEDGEMENT

I thank the Almighty for giving me the strength, good health and determination to complete this project. My sincere gratitude goes to everyone who contributed in one way or another to the completion of this project. To all respondents thank you very much.

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LIST OF ABBREVIATIONS AND ACRONYMS

SOA	Service Oriented Architecture
WSDL	Web Service Description Language
SOAP	Simple Object Access Protocol
UDDI	Universal Description, Discovery and Integration
XML	Extensible Mark-up Language
ESB	Enterprise Service Bus
ANOVA	Analysis of variance
USSD	Unstructured Supplementary Service Data
KSH	Kenya Shillings

ABSTRACT

The banking industry has changed drastically in the recent past due to improved internet adoption, technological evolution, mobile money solutions, financial technology innovations and customers demanding for better access to diverse services and better customer care. Commercial banks are seeking to remain competitive in a market characterized by global competition, increased regulation and a growing preference for mobile money and mobile payment systems. Service oriented architecture provides a platform where banks can achieve these goals and reduce operational costs. Based on these facts, this research focused on finding the current levels of service oriented architecture utilization, the factors that influence the levels of SOA utilization and to establish if there is any relationship between Service Oriented Architecture utilization and business value. To satisfy these objectives, a descriptive cross-sectional survey was used as the research methodology. The data collection method used was the administration of questionnaires to a study population of the 41 commercial banks in Kenya. Primary data was collected through the use of questionnaires and secondary data was collected from the financial statements of the commercial banks. The data was analysed by use of descriptive statistics which included the calculation of mean and percentages. Linear regression analysis was used to find the relationship between SOA utilization and business value. The study found that the current rate of SOA utilization in commercial banks in Kenya is above average. Web technology factors, software integration factors and managerial factors affected SOA utilization at different levels. The cost and complexity of SOA greatly influenced its overall utilization in commercial banks in Kenya. The findings showed that increased SOA utilization positively influenced business value. The study recommends a long term managerial strategy to ensure improved SOA utilization. Through effective management, commercial banks can mitigate the factors affecting SOA utilization which will lead to improved business value.

CHAPTER ONE

INTRODUCTION

1.1 Background

Innovation in secure and convenient financial mobile payments systems has led to more opportunities through which organizations can improve on their operations. This has led to a shift in the Information technology architecture from legacy systems to core applications that are more accessible, scalable, agile, and adaptable in order to compete in a more complex business environment. There is however increasing pressure to leverage existing IT investments scalability and agility in order to ensure faster responses to business needs, customers, partners and industry demands.

There is also increased competition in the banking industry in Kenya especially with the capping of interest rates on loans which has reduced the high profit margins that banks could previously make. Competing in the new banking economy means that banks should be aware of changing business needs, requirements and customer demands. To do this more banks have been investing in service oriented architecture models and principles of integration (ICS, 2014). These solutions are aimed at complementing core banking and integrating new innovations such as payment of utilities, mobile banking and internet banking among other solutions.

The service oriented architectural style is one of the ways through which organizations can derive value from information technology investments. It is based upon the design principle whereby business processes and services can be considered in greater and larger contexts and can be shifted from one form to another (Lian, 2012). SOA has emerged as an architectural style used to reduce the lengthy cycles involved in new system development and integration (Adari, Diwakar & Varma, 2012 p. 452). According to Dimare & Ma (2008)

“an institution would need to deploy and integrate twenty different software applications to enable flexibility and multichannel integration without SOA, with SOA, an enterprise has to build only one application which can be reconfigured twenty different ways to meet the imperatives of changing business and market conditions”. Service oriented architecture is crucial in industries and organizations that provide services and use different information systems across different platforms. SOA is highly implemented in government services, and in insurance, hospitality, health and banking industries. It is used to improve customer services, data analytics and ubiquitous access to services (Chan, Tan, Lau and Yeoh, 2014).

This research concentrated on how commercial banks can derive value from service oriented architecture and the key issues involved. There are different approaches that have been used to investigate SOA. This study focused on a deductive approach using the Design theory, and the Delone and McLean IS success model. Below is a brief description of the concepts in this study.

1.1.1 Service Oriented Architecture

Service oriented architecture (SOA) is an information technology architectural style that works with an application’s elementary parts and easily and quickly rearranges them into new applications. It is essential in creating a dynamic framework for evolving and dynamic e-business. Through its architectural style it is able to redefine operations automatically according to business requirements and enables applications to be combined with those of partners, suppliers and customers (Tsai, Shaw, Fan, Liu, lee and Chen, 2010).

A service is a component that has a distinctive functional meaning from a high level business concept (Lian, 2012). It involves descriptions, messages, interfaces, as a set of

operations logic and data. An example of a service would be applying for a loan by filling out a loan request form. Architecture refers to the structure of a system, its properties, the interacting parts and how the interactions take place.

System architecture and design is based on the underlying system, the user requirements and the business model. The chosen system architecture should be able to support future business requirements. There are different styles of system architecture. Common architectural styles include: Client server, three tier or n –tier, Object-oriented, Component-based, Layered, and service oriented architectural styles.

According to International Business Machine (2017),SOA involves breaking an application into common repeatable services that can be used by consumers and other applications on a network. The difference between SOA and other architectures is its unique ability to enable business decisions to be rapidly transformed into technology. Users can access these functionalities via interfaces or web technology. Web services are technologies used to implement SOA (Bianco,Kotermanski&Merson, 2007, p 4).The ‘services’ that make up an application in SOA are used in interfaces that are accessible over a network through web standards and technologies (Wan, Lei &Chatwin, 2006, p 5).

1.1.2 Service Oriented Architecture utilization

Utilization is defined as the use of a resource or system for productivity (Patton, 1996). The utilization rate measures the percentage of a system that is used effectively and productively. SOA utilization requires not only adequate knowledge of business and information technology but there is also need for a strategic vision on how the architecture is to be used in an organization and a supporting organizational structure in order for any new models to be effective(Rosen, 2005).Although a lot of organizations have deployed SOA, the level of utilization is quite low (Basias, Themostocleous&Morabito, 2012).

SOA can be used to do so much more than it is engaged to do currently. This may be because although SOA is a design principle that is not tied to any technology, it relies on a variety of business and technology techniques to be effective and productive (Mankad, 2010). Some of these factors include the effective utilization of web services, policy and strategy, and the required information technology skills. Effective utilization is only possible if all these factors are taken into account and are used to optimize and maximize SOA for efficiency and productivity.

1.1.3. Business Value

Business value is defined as maximizing stakeholders' wealth and also targets other business aspects such as better service delivery, improved customer services, better collaboration with suppliers and corporate social responsibility (Gavrea, Ilies&Stegerean, 2011). An organization that creates value for its stakeholders in the long term is considered successful. Stakeholders include shareholders, partners, employees, customers and the society the organization operates in.

Business value can be measured using the balance scorecard which retains the financial aspects of an organization but also focuses on future value based on investments in customers, suppliers, employees, management, processes, technology and innovation (Kaplan & Norton, 1998).

The balance scorecard evaluates value from four perspectives: The learning and growth Perspective, The business Process Perspective, The Customer Perspective and the financial perspective (Arverson, 1998). To understand how SOA creates business value, data was analysed from these four different perspectives. Measuring business value from a financial perspective involved evaluating revenues, costs and efficiency ratios;

Customer perspective involved evaluating response times and service delivery; Business process perspective involved evaluating process cycle periods and time to market new products and services periods while as learning and growth was measured and evaluated using data science and analytics, strategy and policy evaluation and on improving the organization's culture and structure.

1.1.4 Service Oriented Architecture and Business Value

Service oriented architecture delivers business value by focusing on customer experiences. It aims at aligning an organization's information technology component with the business component and maximizing technology assets. Today more and more enterprise systems are using SOA because of these features and advantages.

Some of the ways through which SOA has improved in service delivery and customer focus include; creating flexible service based applications which are less expensive since they are created based on the reuse of existing applications (Endrei et al., 2004).

Times to market periods are reduced and there are lower risks in failure. Maintenance costs for new applications are cheaper since the codes are already used, proven and tested. Systems can also be scalable and extensible with the use of SOA (Microsoft, 2004). It is easy to assemble the required services in order to create new required applications which are constantly required in any rapidly changing business environment. Service oriented architecture provides an integrated environment that ensures there is a holistic and real time flow of customer data (Lin et al., 2011, p 10). Seamless customer information is crucial in cross selling and delivering tailor-made products and services. By using data analytics banks can use multi-channel integration to achieve competitive advantage. The value proposition of using SOA translates to an

improved value chain whereby there are better and improved services, agility, lower prices, cheaper costs, asset utilization, improved customer value, faster time to market and improved operations(Gai, 2014).Demonstrating SOA's real value is based on an organization's key performance indicators. These can include cycle time, development time, costs and operational expenses.

1.1.5 Commercial banks in Kenya

There are many definitions of the term 'bank', however in current terms a bank is an institution which accepts deposits, lends money and deals with money creation and circulation. The banking act of Kenya defines banking business as "accepting money in form of cash or cheques and employing the money by lending or investment at the risk of the person employing the money."

There are two types of banks: commercial banks and central banks. Commercial banks provide banking business and services for profits while the central bank regulates commercial banks and other country specific economic activities.

Banks in Kenya are regulated by the Kenyan Constitution (2010), the Central Bank of Kenya Act (2015), The Banking Act (2015), the National Payment system Act (2011) and the Kenyan Deposit Insurance Act (2012).According to the Central Bank of Kenya, there are currently 41 licensed banks in Kenya with two banks under receivership and one under statutory management (Central bank of Kenya, 2017).

Kenya is a world leader in mobile payment systems and commercial banks have played a crucial role in the consistent diversification of products and services. Currently more banks are introducing SOA oriented enterprise systems solutions where consumers can access banking services anytime anywhere. Equity bank recently upgraded its Finacle

system which has enabled it to achieve 100% service oriented architecture (Infosys, 2015). Finacle is a core banking solution that uses service oriented architecture, web technology and supports 24/7 operations, it has diverse modules targeting various differentiated business functions and reusable services (Infosys, 2013). Mshwari, a flagship product between commercial bank of Africa (CBA) and Safaricom operates on a service oriented architecture under the Fiorano software platform (Fiorano, 2013)

1.2 Research Problem

A study by Raines (2009) explains that SOA is essential in the integration of applications and services and in reducing the pressure on information technology budgets. However despite the vast SOA adoption in commercial banks, the utilization levels are remarkably low. According to a study by Basias et al. (2012) on e-banking in Germany and France, utilization levels in the two countries are between 30.6% and 45.2 % respectively mainly due to poor business processes and structures. Research by Gitau & Mburu (2016) on service delivery in Kenya found out that services can be improved significantly by the adoption of SOA. Although there is increased adoption of SOA in Kenya as a means to access a variety of services via web portals in order to change bank operations from previous physical branch transactions to online transactions, there are limited studies on the utilization levels achieved and whether there is any value derived from this utilization.

Although most information systems architects who implement SOA understand the benefits of SOA, it is difficult for them to associate it with business value maximization. In his research, Bardnt (2007) argues that the key to realizing the business value of building SOA is to recognize its ability to leverage existing applications and assets. Business value is based on how SOA can maximize value from existing assets. However

this is only possible if the SOA infrastructure is well configured, streamlined and measured. New programs can only be beneficial if done in a timely manner. A study done by Alqhatani (2015) on the organizational issues that affect business value found that in order to obtain the full benefits of implementing SOA there is need for change in the organizations' culture structure and strategy.

In his paper, Liegl (2007) however argues that the influence of SOA may expand to other areas such as infrastructure, applications, innovation and standards, investment and human resources. A study done by Angelopoulos (2010) also reiterates that factors that may affect business value include SOA levels of maturity and utilization, scope of implementation and specific organization characteristics.

A study by Niknejad, Ghani & Hussin (2013) explains that factors such as lack of web technology knowledge and expertise, budget and cost migration, organization change management and lack of clear business structures and objectives may affect the levels of utilization of SOA.

Although the empirical studies above indicate that there are different issues that organizations can focus on to ensure SOA utilization, there is no clear link between how changes in utilization levels affect business value. There is also no clear link between the issues that organizations and industries face and how they affect SOA utilization. Organizations need to address these issues and factors, in order to maximize utilization and derive business value from SOA. This research sought to fill this gap by answering the below research questions:

What is the level of utilization of service oriented architecture in commercial banks in Kenya?

What are the factors that influence the utilization of Service Oriented Architecture?

Is Business value realized from utilization of Service Oriented Architecture?

1.3 Research Objectives

- I. To determine the level of utilization of Service Oriented Architecture in commercial banks in Kenya.
- II. To assess factors that influence the utilization of Service Oriented Architecture in Kenyan banks.
- III. To establish whether there is business value realized from utilization of Service Oriented Architecture.

1.4. Value of the study

In academia, this research will fill the current research gaps on SOA in Kenya by reviewing the current academic and business practice literature on SOA and business value, present a theoretical framework and assess the validation of SOA. The research will attract further studies on SOA and its contribution to business value by evaluating the link between SOA utilization levels and business value and addressing factors that limit the benefits of SOA.

Banks will also benefit by analysing and identifying critical issues that may be affecting the optimization of SOA. Banks can use this study to critically evaluate their current structures, infrastructure, web technologies and technical know how to better improve the business value of SOA. SOA architects can use this study as a means to re-evaluate processes and procedures in SOA implementation and management.

This research will influence governing policies and frameworks in banks and in the government that can be used to best implement and utilize SOA for business value and efficiency. This study can also be used as a reference on how to optimize business value while using SOA.

CHAPTER TWO

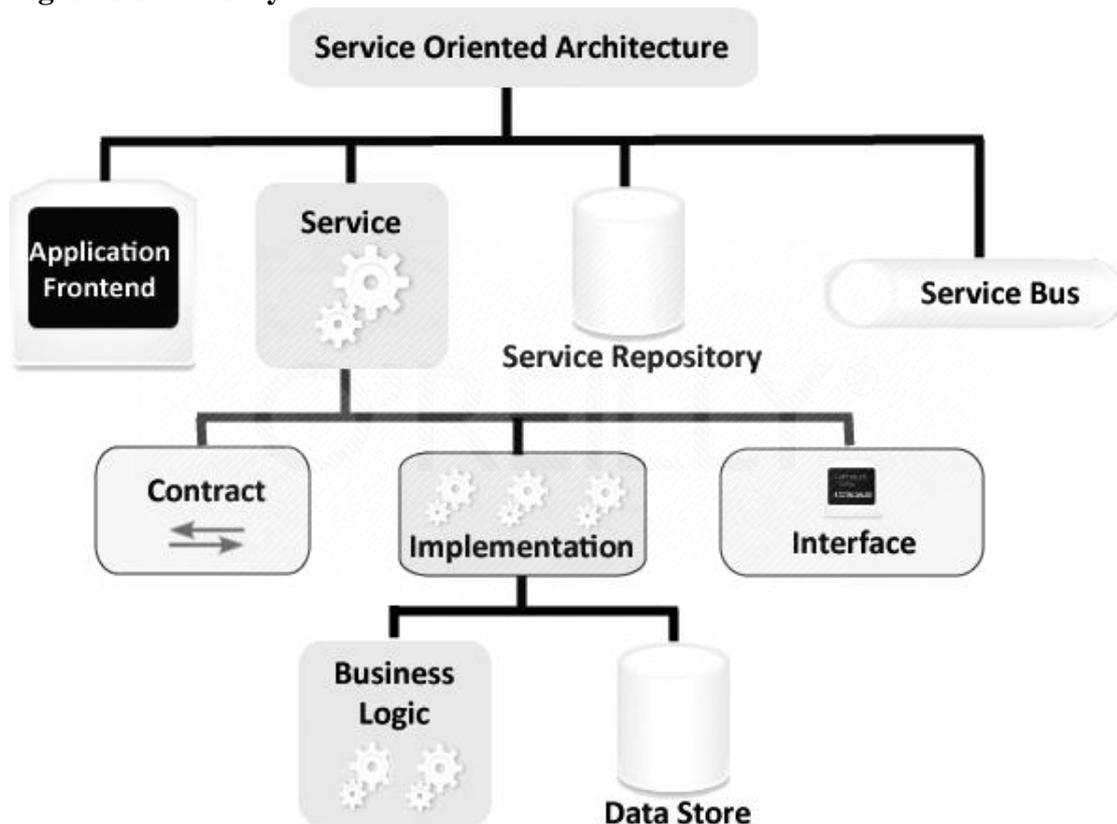
LITERATURE REVIEW

This chapter consists of an overview of SOA and its architectural layout, theories of SOA and business value and the literature review.

2.1 Service Oriented Architecture

Service oriented architecture as an architectural style is used to implement business functions as services which are easily reusable enabling flexibility, efficiency and reduced application costs. Below is a brief description of how SOA contributes to business value.

Figure 2.1: SOA layout



Source: Programming.NET 3.5 by Liberty and Horovitz (2008)

SOA includes an application front end which is not linked to any service. Each service has a contract which details what it should do. One or more interfaces can implement a contract. The service repository stores all the services while as the service bus interacts with the services. Implementation of services is done using web services and technologies. Web services help in the realization of SOA value by ensuring lower integration costs and greater flexibility.

2.2 Theories of SOA and Business Value

The theories below form the background of how SOA can be utilized for business value in organizations leading to performance.

2.2.1. Design Theory

Design theory was first investigated on in 1998 by Adolf Loos and involves design as a science in a variety of disciplines including information systems. The theory explains that successful implementation and development of a product involves the environment which is composed of people, organizations, strategy, competitive environment and technologies. It seeks to help designers and architects create value in innovative products and services in business, industry and the public sector for economic value. Walls, Widmeyer and El Sawy (1992) specify two major components of IT design theories: a product component and a development process component.

Design science is more concerned with innovative products that ensure utility and effectiveness (Hevner, March, Park & Ram 2004). The main purpose of information technology is to ensure efficiency and effectiveness. The measure of success depends on factors such as characteristics of the organization, its work systems, its people and its development and implementation methods (Silver et al., 1995). Simon (1996) argues that

development and implementation is an iterative and continuous process and therefore the theory of design in information systems is in a constant state of scientific revolution (Kuhn, 1996). This similarly applies to deriving value from Service oriented architecture. Any organization that is keen to implement SOA should investigate on how these changes will relate to the organization's strategy and environment and how the organization as a result needs to change in order for SOA to be successful. As the environment changes there is need to constantly re-evaluate SOA and the services involved in order to achieve value over time.

2.2.2. The Delone and Mclean IS Success Model

The Delone and McLean IS success model also known as the IS success model was developed by William .H Delone and Ephraim R. McLean in 1992. The theory seeks to provide a comprehensive understanding of information systems success by identifying six major dimensions, their interdependencies and measures (Delone & McLean, 1992). There has been further research on the model with Delone and McLean improving the first model in 2002 and 2003 (Delone & McLean, 2003). The updated model consists of six interrelated dimensions to information systems success: information, system and service quality; (intention to) use; user satisfaction and net benefits. The model explains that a system can be evaluated in terms of information, system, and service quality. These characteristics affect future use or intention to use and user satisfaction (Urbach & Muller, 2011).

Information quality directly relates to the value of output from the implemented information system. Quality output leads to customer satisfaction. Service quality relates to the levels of support customers receive. Intention to use refers to the utilization levels

which can be measured by frequency of use or the functions in use. Net benefits depend on how the information system is satisfying the needs of the different stakeholders.

While common measures of benefits are market share, profitability, ROI and productivity analysis, some researchers argue that there are intangible benefits that would be hard to measure numerically (McGill, Hobbs & Klobas, 2003). There are also increased call for further research for this model covering the organizational perspective and not just the information technology perspective (Petter et al., 2008). An improved model can then be used in the implementation and assessment of new information technology. The dimensions used in this theory can also be used to find out if organizations are deriving value from SOA and what areas an organization can improve on in order to ensure optimization of value. As suggested there might be need to incorporate the organizational context in order to ensure maximum value.

Both theories were used in the study as they address different aspects of the study and are therefore equally important. While design theory addresses the design science of a successful architecture and its implementation, the DeLone and Mclean success model addresses successful factors that should be considered in ensuring the long term success of SOA.

2.3 Service Oriented Architecture Utilization and Business Value

There are many business and technical benefits of SOA, however according to a study by Langel (2004), the most important reason and benefit for SOA is the capability for an organization to effectively and quickly respond to business change and leverage this for competitive advantage. Rigid information technology systems increase maintenance

costs and reduce flexibility. Opportunities are lost because it is too expensive for organizations to meet new market and customer demands and keep up with competition. By looking at business functions as services which can be inter-connected, an organization will ensure flexibility in introduction of new services and first mover advantage. In his study, Bierberstein (2006) argues that for SOA to derive business value there is need for alignment and close interaction between the information technology function and the business function in order to ensure maximum and effective utilization of SOA. Business functions streamline services which are implemented by SOA therefore knowledge of business is required in deriving value. In the paper by Hirschheim et al. (2010) the authors found that for any organization to have efficient SOA utilization and achieve value in the long term there is need for a strategic implementation that requires clear business motives for the implementation of SOA. They identified six dimensions of SOA evaluation: expectations, management, technology, governance and methodology. Alluri, (2009) explains from his findings that new services and roles that constantly emerge with the growth of SOA must be well managed, as well as constant knowledge and skill improvement for the organization in order for value to be realized. SOA training is important and individual departments and project teams should have enough knowledge and commitment towards SOA in order to ensure constant growth and development in SOA utilization.

In his study, MacVittie (2007) asserts that by critically analysing, reviewing and addressing factors affecting SOA utilization an organization can achieve maximum value. According to Hsing et al. (2012) most organizations tend to underestimate the complexity issue of managing scalable SOA services. Many researchers have argued that there is constant need for monitoring and evaluation especially since all these services use different platforms. Murer (2011) explains that one crucial issue is the need for

strong compatibility between services. Case studies by Adam et al. (2010) on diverse industries prove that there may be need for constant re-engineering of legacy systems to accommodate SOA especially if the Information technology infrastructure was not mature enough to begin with. A study done by Roch (2006) further iterates that SOA constantly requires changes due to complex system dependencies and constant changes in the business environment. He concluded that these issues can only be solved by having a strategy roadmap for SOA.

Previous studies by Lee et al. (2010), Koumaditis et al. (2013) and Beydoun et al. (2013) classified factors affecting SOA utilization into four category areas: Technical, Governance, Strategy or Management. Some factors however fit into more than one category. Maurizio et al. (2008) concurs that technology alone cannot fix business. There is need to form linkages within the different departments to ensure these issues are solved. A report by Gartner (2012) also found that governance is not an option but an imperative. SOA fails in many organizations due to lack of governance mechanisms. Poor governance issues lead to more technical and management problems as the SOA develops and becomes more scalable. This may also lead to ownership disputes because there are no clear stipulations and as more integration occurs there are no clear guidelines of the specific services or software. Vaaradan et al. (2008) also concurs that management, governance, organization and technology are crucial elements in the use of SOA.

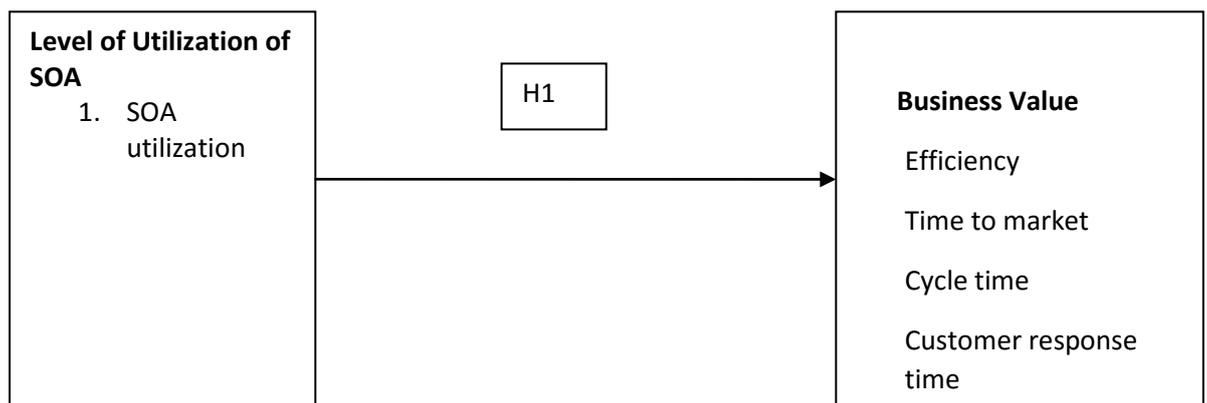
2.4 Summary of the Empirical Studies and Research Gap

It is clear from the empirical studies that SOA is very crucial in achieving business value. There are however factors that limit the business value achieved. These issues and factors are quite similar to the issues affecting utilization rates. Although there are many studies on the potential benefits and value of SOA, there are limited studies on the actual value

realized. The researcher did not find any link between the factors and issues involved how they affect utilization and ultimately how business value is affected. The researcher also found no studies in Kenya relating to the business value realized from SOA and the issues and factors that affect SOA utilization in organizations in Kenya. Issues faced in other countries may be different from the issues experienced in Kenya especially since SOA is a new and evolving paradigm. It is also clear that there can be no benefits without analysing the current issues that organizations face and address them. The study sought to investigate the actual business value derived from SOA based on utilization levels in commercial banks in Kenya.

Figure 2.5 Conceptual framework

Independent variable **Dependent Variable**



This study aimed to find the link between the levels of SOA utilization (independent variable) and business value (dependent variable). Business value was measured based on key performance indicators such as efficiency, reduced cycle time, reduced costs, reduced development time and reduced time to market.

H₁: SOA utilization leads to improved business value for Organizations.

H₀: SOA utilization does not lead to improved business value for organizations.

The study also investigated on other issues and factors that influence SOA utilization in Kenya as separate findings.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter consists of the research strategy used to achieve the objectives of this study. The methodology includes and covers the research design, population and sampling, methods of data collection and data analysis.

3.2 Research Design

The study consisted of a descriptive cross-sectional research design used to investigate how service oriented architecture utilization affects business value.

Data was collected at a specific point in time, therefore the need for a cross-sectional study. Descriptive research uses both quantitative and qualitative data. It is characterized by summarized reports and correlation statistics. According to Krawthwohl (1993) descriptive research organizes data to fit them into explanations and then validate those explanations. The aim of this research was to describe, explain and validate the link between SOA utilization and business value. The description on factors that affect the level of utilization illuminates knowledge that may not have been noticed or encountered.

3.3 Population and Sampling

The study involved a census of all the 41 commercial banks operating in Kenya (Central bank of Kenya, 2017). The census aimed to provide an overview of the adoption and utilization of SOA in commercial banks in Kenya and the link between the utilization rates and business value. Commercial banks in Kenya are diverse and range from medium sized micro-finance institutions to regional and global banking institutions. The census provided adequate data on challenges and issues involved in each of these banks.

3.4. Data Collection

To ensure accuracy and validity, both primary and secondary sources of data were used to collect data. The primary method of data collection involved administering questionnaires. The questionnaires were divided into four sections. The first section included an overview of the organization, the second part involved questions on the availability of SOA, the third section included questions on the utilization levels of SOA, the fourth section involved detailed questions on the link between SOA and business value while the fifth section included other factors that affect the utilization of SOA. The questionnaire was directed to the highest ranking information technology manager in commercial banks who makes information technology strategy and policy decisions and is involved in the monitoring and evaluation of the information technology systems. The secondary sources of data included published data on financial performance reports of each of the commercial banks for a period of three years for adequate data analysis. The financial performance reports were obtained from the Nairobi Stock exchange website

3.5 Data Analysis

To analyse the data, descriptive statistics was used to investigate the levels of utilization of SOA in commercial banks in Kenya. Descriptive statistics which included mean and percentages were used to analyse the factors that influence the utilization levels of SOA. Linear regression was used to investigate the relationship between SOA utilization and business value. Below is the linear regression model used for the analysis:

$$Y = a + bX + e$$

Where Y is Business Value

Alpha is the constant or the value of Y when X =0

Beta is the co-efficient of X; how much Y changes with a unit change in X

X is the utilization level of SOA.

e-is the error in predicting Y

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND EVALUATION

4.1 Introduction

This chapter covers data findings, analysis, interpretations, discussions, and presentation of results. Analysis was done using SPSS, Microsoft Excel and R open source programming language for statistical computing. Data was then presented using tables, bar graphs and pie charts based on frequencies and percentages and analysed using linear regression.

4.2 General Information

This section covers general information on the study on deriving value from SOA in commercial banks in Kenya. A total of 41 questionnaires were issued out to each of the 41 commercial banks listed by the Central bank of Kenya. Of the 41 questionnaires, 27 of them were returned with the desired level of consistency, accuracy and completeness. The questionnaires were also completed without bias and within the required levels of information knowledge and understanding. The returned questionnaires represented a response rate of 65.85% which is well above the recommended response rate of above 50% (Mugenda&Mugenda, 2003). The percentage is a good representation of the intended population and reflects the elements of the whole population (Fincham, 2008).

4.2.1. Number of Bank branches

The findings indicated that there is a huge variation in the number of branches banks have, 15% of the branches had between 0 and 10 branches, 25.92% of the banks had between 11 and 20 branches, 18% of the banks had between 21 and 30 branches while as 22.22% of the banks had over 50 branches. Hannan and Hanweck (2007) explain that there are many potential determinants of the number and size of bank branches. A bank might increase

and maintain a large network of branches in order to maximize on the number of potential deposits, and to position itself strategically in order to compete with other banks. However technology does affect branching and branch size decisions if the consumer traffic reduces based on the fact that a large percentage of products and services can be accessed online without physically visiting a bank. Utilization of SOA means there is integration of services from different providers such as mobile money, ubiquitous access of products and services through web services, improved customer feedback time and better service delivery, however other business factors such as increasing investments and assets and choosing between average and marginal increase in deposits are crucial factors that are also taken into account (Davis et al., 2007).

According to Castri and Gidvani (2013), mobile money account deposits accounted for 1.2% of all commercial banks deposits in Kenya. Mobile money transactions in Kenya have grown to a value of more than Kshs 3 trillion. With increasing levels of mobile money transfers and the future of lending being mobile money, commercial banks are focusing more on improving mobile transactions as compared to branch transactions (World Bank, 2016). However, although banks in Kenya have diversified services and products widely, there is a huge majority of customers that make cash deposits in banks (World Bank, 2015). By strategically locating bank branches, commercial banks can benefit from increased deposits and assets. Kenya has 31 million bank account holders and the deposits in the accounts are valued at Kshs 2.5 trillion (Kenya Deposit Insurance Corporation, 2015). By comparison of the number of bank branches and the current bank account holders in Kenya, it can be concluded that majority of the bank customers can access banking products and services without physically visiting a bank, signifying presence of SOA.

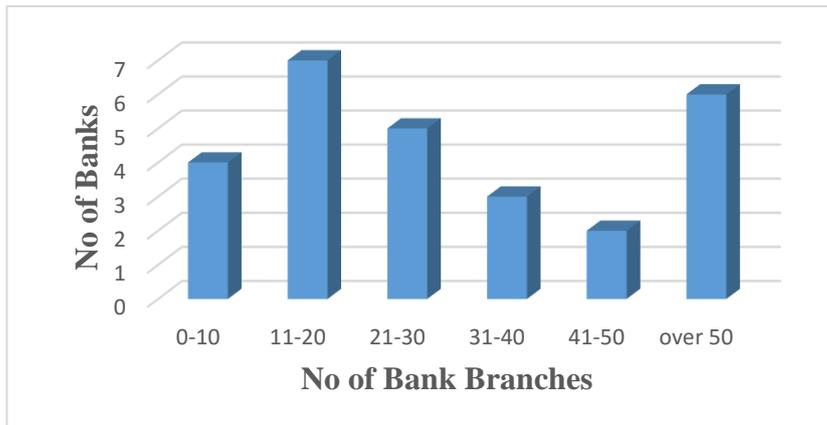


Figure 4.1 No of Bank Branches

4.4.1.3 Geographical Area of Operation

Respondents were required to indicate the areas which their commercial banks operated in. 22.22% of them indicated that their banks were only operational in Kenya, 51.85% indicated the banks operated only in the East Africa region while 25.93% of the banks had global operations. The findings indicated that most of the commercial banks had regional and global operations. It can be concluded that commercial Banks that operate regionally and globally use technology to improve on their large-scale operations and have better access to new and improved technology such as the use of SOA (IBM, 2013). A study done by Ernest and Young (2014) on Banking in Sub Saharan Africa showed that large banks are more efficient because they benefit from their size. The study however noted that international banks are losing customers to regional (mid-tier) banks which use a more targeted customer service approach.

Table 4.1 Geographical Area of Operation

Area of Operation	Frequency	Percentage
Local	6	22.22
Regional	14	51.85
International	7	25.93

4.3 Demographic Data

In this section, the study aimed to determine the level of availability of SOA in commercial banks in Kenya. There were different determining factors which were collectively critical in identifying the level of SOA availability in commercial banks in Kenya. The factors included; system (s) integration, Presence of web technologies, Presence of unified data models and the data ownership policies implemented. Below is an evaluation of each of the critical factors.

4.3.1 Level of System(s) Integration

One of the indicating factors of availability of SOA in commercial banks in Kenya is system(s) integration. Muar(2010) explains that SOA plays a crucial role in integrating core applications and enterprise software. The integration of systems in commercial banks enables different services to interact with each other and for the banks to provide a huge array of services as per the customers' needs. The researcher found out that 22.2% of the respondents had system(s) integration levels below 50%. All banks had an integration level of above 15% and 18.52% of the banks had a level of integration of above 75%. Based on the integration levels on table 4.2 below, there was an average level of SOA availability of above 50%. The findings concur with a report by IBM (2011) which

confirmed that credit bank, Cooperative bank, family bank, National Bank of Kenya and National industrial bank have upgraded their systems in order to improve integration.

Table 4.2 Level of system(s) Integration

Level of Integration in %	No of Banks	Percentage
0-15	0	0
16-30	2	7.4
31-45	4	14.81
46-60	8	29.63
61-75	8	29.63
76-100	5	18.52

4.3.2 Presence of Web Technologies

Service oriented architecture is implemented using web services. The researcher found out that 100% of the respondents used web technologies. All the banks used the three major web services technologies; XML, UDDI and WSDL. The findings based on the presence of web technologies indicated that there was availability of SOA in commercial banks in Kenya. These findings were supported by Bih (2006) who asserts in his study that web technologies are the basis through which SOA is implemented by enabling programming solutions for specific messaging and integration problems. Gisofi (2001) iterates that web technologies ensure interoperability of applications from different vendors and automatic centralized data management and validation. These advantages enable compatibility with service oriented architecture.

Table 4.3 Presence of Web Technologies

Web Protocols/Technologies	Frequency in %
XML	100
UDDI	100
WSDL	100
SOAP	100
Others	0

4.3.3 Data Ownership Policy

The researcher found that 90% of data ownership policies in banks were focused on the business perspective. The business perspective data ownership policy indicates that through clear goals and strategies the business function determines how data is used to ensure successful implementation (Reimer et al., 2009). 10% of the data ownership policy focused on information technology which means that the information technology function worked independently and did not rely on the business function. The findings indicated that through the policy criteria, 10% of commercial banks in Kenya had no SOA availability while 90% of commercial banks had SOA availability.

Table 4.4 Data Ownership Policy

Data Ownership Policy	Banks in %
Information Technology	10%
Business Function	90%

4.3.4 Organization Data Model

The researcher found that 75% of the respondents had a unified data model which means that data was accessible enterprise-wide. This shows that 75% of commercial banks in Kenya have access to platforms that ensure universal data access. This showed availability of SOA in the banks. SOA is based upon the design principle that every function or service is part of a bigger or larger context and incorporates the whole organization in order to operate efficiently (Rohan, 2008).

Table 4.5 Organization Data Model

Organization Data Model	Banks in %
Unified data model	75%
Domain/Function specific data model	10%

4.3.5 Average Availability of SOA in commercial banks

The researcher tabulated the collective determining factors of SOA availability in table 4.4 as shown below. The researcher then calculated the grouped mean percentage for each determinant and divided it by four to calculate the average % availability rate of SOA for each of the 27 banks

Table 4.6 Availability of SOA in Commercial Banks in Kenya

SOA Availability in %	Systems Integration	Web Protocols	Data Model	Data Ownership policy
0-15	0	0	3	7
16-30	2	0	0	0
31-45	4	0	0	0
46-60	8	0	0	0
61-75	8	0	0	0
76-100	5	27	24	20

Table 4.7 Average Availability of SOA

SOA Availability in %	No of Banks
31.5	2
35.25	1
55.375	3
59.125	1
79.25	7
83	8
88	5

The researcher found that the average SOA availability in commercial banks in Kenya was 73.42%.

4.4 Objective findings

The objectives of the study were; to determine the level of utilization of SOA in commercial banks in Kenya, to find out how other factors are related to SOA utilization and to find the relationship between SOA and business value. Below is an analysis of the findings of each of the objectives.

4.4.1 Utilization of Service Oriented Architecture

To determine the level of utilization of SOA, the researcher used the below determining factors; The level of online access of services, Composite services levels, Level of cross channel solutions and the level of functional data dependencies. Below is an evaluation of each of the determining factors.

4.4.1.1. Level of Online Access of Services

Commercial banks need to avail services and business functions online in order to successfully utilize SOA. Lack of online availability of services and business functions means that SOA and web technologies are under-utilized. The researcher found that 67.7% of banks had a below average (50%) level of SOA utilization since only 32.4% of banks had more than 50% of their services/business functions available online. Although all the banks had access to web services, utilization levels were below average.

Table 4.8 online access of Services

% use of Service Access	No of Banks(Frequency)	Average
0-15	6	22.22
16-30	8	29.63
31-45	4	14.81
46-60	5	18.52
61-75	2	7.41
76-100	2	7.41

4.4.1.2. Composite Services

SOA enables an assembly of services and service components that work together to perform a specific task, this become composite services (IBM, 2006). High presence of composite services is a clear indication of utilization of SOA. The researcher found out that 25.92% of the banks utilized more than 30% of their composite services. 7.41% of the banks had between 46-60% of use while as 29.63% had a rate of utilization of above 50%. Utilization of SOA was therefore above 50% in terms of use of composite services.

Table 4.9 Composite Services

% use of composite services	No of Banks(Frequency)	Percentage
0-15	0	0
16-30	0	0
31-45	7	25.92
46-60	2	7.41
61-75	10	37.04
76-100	8	29.63

4.4.1.3 Cross Channel Solutions

Cross channel solutions and services are as a result of systems integration. SOA enables ease of integration of different systems such as mobile applications (IBM, 2013). The findings indicated that 51.85% of the banks had utilization levels of cross channel solutions of above 50%. This showed that SOA utilization levels based on cross channel solutions were above 50%.

Table 4.10 Cross Channel Solutions

% use Cross Channel Solutions	No of Banks(Frequency)	Percentage
0-15	1	3.70
16-30	4	14.81
31-45	8	29.63
46-60	4	14.81
61-75	5	18.52
76-100	5	18.52

4.4.1.4 Functional Data Dependencies

Data integration in SOA means that one function depends on data from another function. The seamless movement of data ensures service reusability. Due to reusability and the increase in composite services, there should be more dependence of data from one function to another (Chong and Kulkarni, 2005). The researcher found that data functional dependencies varied across the respondents as per table 4.9 below. However for all the banks, the level of use was above 15%. This showed that despite having policies in place utilization of SOA based on functional data dependencies was average. Although some banks had higher utilization rates, there were banks whose levels of utilization were below average.

Table 4.11 Functional Data dependencies

% of use of functional Data Dependencies	No of Banks(Frequency)	Percentage
0-15	0	0
16-30	4	14.81
31-45	8	29.63
46-60	5	18.52
61-75	5	18.52
76-100	5	18.52

4.4.1.5 Utilization Rate of Service Oriented Architecture in Kenyan Banks

The researcher tabulated the collective determining factors of SOA availability in table 4.10 as shown below. The researcher then calculated the grouped mean percentage for each determinant and divided it by four to calculate the average % availability rate for each of the 27 banks

Table 4.12 Utilization Rate of Service Oriented Architecture in Kenyan Banks

Rate in %	Data Dependencies	Composite services	Cross channel	Online Data Access
0-15	0	0	1	6
16-30	4	0	4	8
31-45	8	7	8	4
46-60	5	2	4	5
61-75	5	10	5	2
76-100	5	8	5	2

Table 4.13 Average Rate of Utilization of Service Oriented Architecture

Utilization Rate in %	No of Banks
19	1
22.875	3
26.625	1
30.375	1
34.25	1
38	2
41.75	3
45.5	1
49.25	1
53	3
60.5	1
64.25	1
69.25	3
79.25	1
83	2
88	2

The researcher found that the average rate of utilization for commercial banks in Kenya is 51.39%.

4.4.2 Current factors affecting SOA Utilization

There are different factors that affect utilization of SOA. These factors were divided into management factors and technical factors. The technical factors were further sub-divided into web technology factors and software integration factors. Below are the findings of the assessment.

4.4.2.1 Web technology factors affecting Service Oriented Architecture Utilization

Although web technologies are not related to SOA, these technologies are the current way through which SOA is effected and utilized. Poor implementation of web technologies and protocols leads to poor delivery of the benefits of SOA. The respondents indicated that integration and re-engineering costs affected SOA utilization at a level of 68.2%, complexity of re-engineering legacy systems at 54%, Bandwidth and internet at 51.2%, security loopholes and vulnerabilities at 57.8%, web technologies and protocols development at 55.6% and technical skills at a level of 54%.The results of the survey suggested that there is still a lot to be done to mitigate factors affecting availability and utilization of web services.

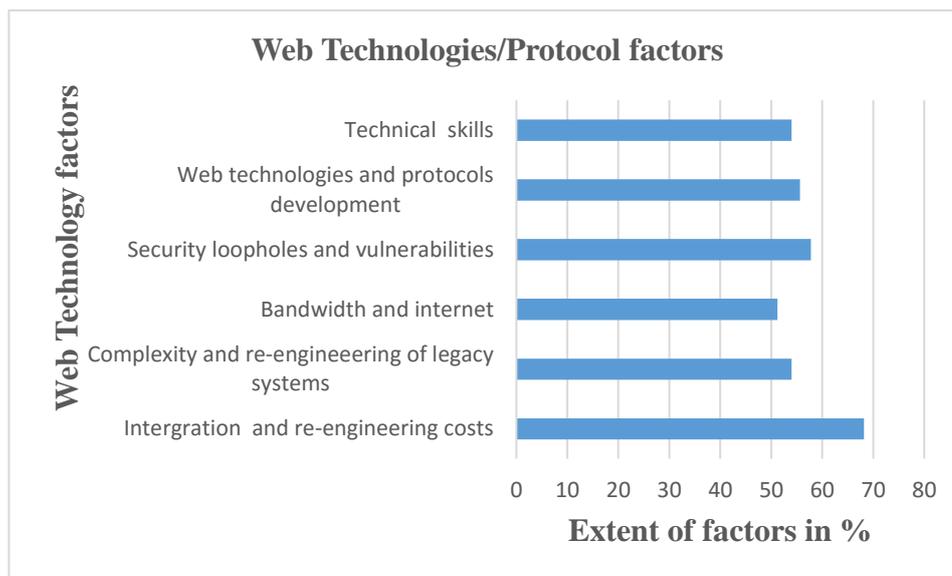


Figure 4.2 Web technology factors affecting utilization of SOA

4.4.2.2 Software Integration factors affecting Service Oriented Architecture

The researcher tabulated the data from the Likert scale in percentage format to investigate how each factor affected the utilization of SOA according to the respondents.

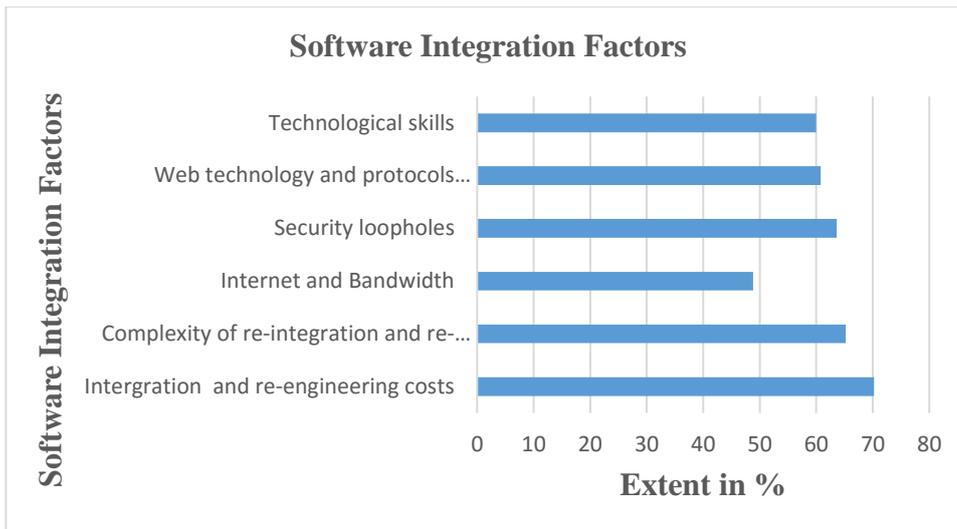


Figure 4.3 Software Integration factors affecting Service Oriented Architecture

Respondents indicated that integration and re-engineering costs affected SOA utilization at a level of 70.2%, complexity of integration and re-engineering at 65.2%, internet and bandwidth at 48.8%, security loopholes and vulnerabilities at a level of 63.6%, web technology and protocols development at 60.8% and technical skills at 60%.

4.4.2.3 Managerial Factors affecting Service Oriented Architecture

The respondents indicated the extent which managerial factors affected SOA utilization. The results were based on a Likert scale with 1 being no extent and 5 being to a very large extent. The researcher then tabulated the average extent based on percentagemean. The researcher found that organization change management affected SOA at a level of 66.6%, maintenance and long term strategy at a level of 74%, Employee attitude and knowledge at a level of 78.6%, Monitoring and evaluation at 63%, Organizational structure and culture at 43%, competitive strategy at 41.4% and policy at 34.8%.

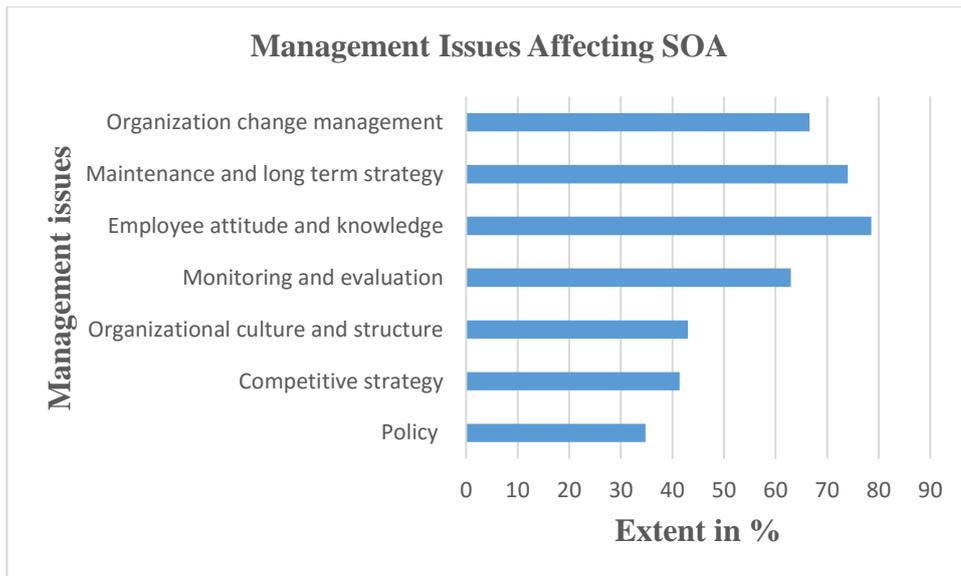


Figure 4.4 Managerial issues affecting Service Oriented Architecture.

4.4.3 Service Oriented Architecture and Business Value

The respondents were required to indicate through a Likert scale the level of business value their banks had, based on customer value, operational and business processes. The most efficient SOA benefit was the ubiquitous access of core banking services at a rate of 89.6%. Bank customers could access banking services anytime anywhere due to the utilization of SOA. The respondents further indicated that time to market services and products was at a rate of 61.4%, customer feedback time at 57.6%, real time flow of data at 63%, service delivery services at 63.8%, process cycle period at 45.8% and new product development at 40%.

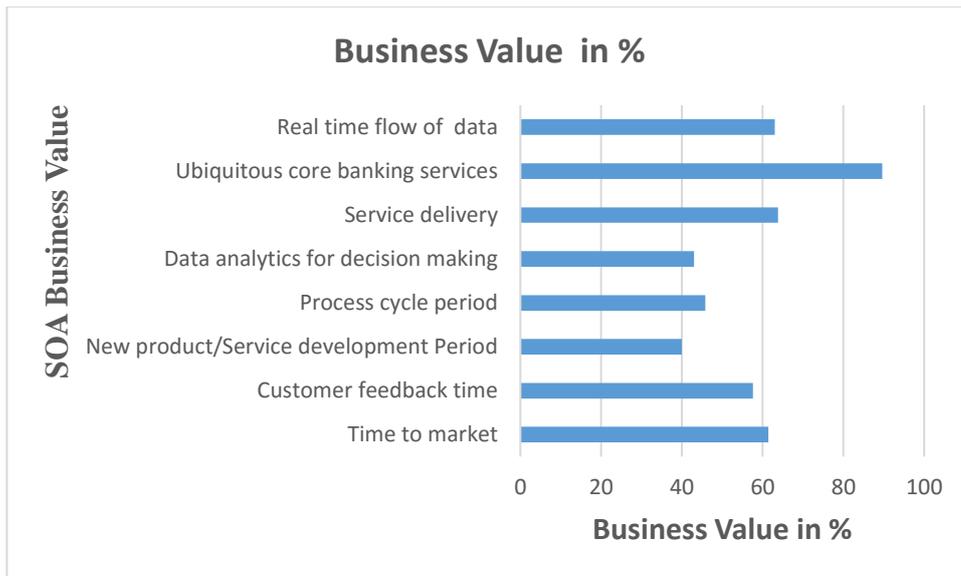


Figure 4.5 Service oriented architecture and Business Value

Table 4.14 Measure of Business Value

Measure of Business Value	Totals	Population	Mean	Percentage
Customer Feedback time	78	27	2.88	57.6
New service development period	54	27	2	40
Process cycle period	62	27	2.30	46
Data analytics	58	27	2.15	43
Service Delivery	86	27	3.19	63.8
Ubiquitous core banking services	121	27	4.48	89.6
Real time flow of data	85	27	3.15	63
Time to market	83	27	3.07	61.4
Totals	627	27	23.22	86

The researcher used the efficiency ratios to find the relationship between SOA and business value. The efficiency ratio is a commonly used financial measure that relates non-interest expenses to total operating income (Hays et al., 2009). The Efficiency ratio is a preferred

financial measure of business value by investors because it includes the element of risk and return (Cantaluppi & Hug, 2000). The researcher's analysis aimed to investigate and compare the efficiency ratios based on the most recent data of the years 2014, 2015 and 2016 and the average utilization levels in percentage of each of the banks.

The researcher computed a linear regression model to investigate the relationship between the average utilization of SOA and commercial bank efficiency rates as a measure of business value.

Table 4.15 Average Utilization versus Efficiency

Observations	R	R square	Adjusted R square	Std. Error of the estimate
27	.416	.159	.119	.41356

Based on the findings of the regression analysis, the adjusted R squared generated indicated that 11.9 % of variability in utilization is explained by the business value realized.

Table 4.16 ANOVA Results for Average Utilization versus Efficiency

Model	Sum of squares	Df	Mean square	F	Sig
Regression	1.170	1	1.173	4.730	0.032
Residual	6.451	25	0.162		
Total	7.621	26			

The ANOVA results show that the regression model had a significance level of 0.032 which is less than 0.05. The regression model predicts the dependent variables significantly well and is a good fit for the data.

Table 4.17 Regression Co-efficient for Average Utilization versus Efficiency of SOA

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	2.001	.842		2.007	.028
Utilization	.341	.216	.322	2.012	.036

The model's regression equation is $\text{Efficiency} = 2.001 + 0.341 (\text{Utilization}) + \text{error}$. This shows that 1 unit change in utilization leads to 0.341 increase in business value. The constant shows that if utilization is held constant at zero, business value would be 2.001. The p-value is 0.028 which is below 0.05 hence rejecting the null hypothesis. Utilization of SOA leads to improved efficiency levels and therefore improved business value for commercial banks.

4.5 Discussion of Findings

To better understand the concept of SOA and its current use in Kenya, the study investigated the current levels of SOA availability. SOA availability is based on existing technologies and policies in an organization's operations (Raines, 2009). These technologies include: level of system(s) integration which refers to how different systems in commercial banks work together, availability of web service protocols/technologies which are used to implement SOA, availability of a unified/enterprise data model that can

be used by loosely coupled independent business services supported by diverse platforms and a business oriented data policy to ensure synchronization and management of data based on an organization's business goals and strategies. The findings showed that the level of SOA availability was 73.42%.

4.5.1 Level of Service Oriented Architecture utilization

The first objective of the study was to investigate the current levels of SOA utilization in commercial banks in Kenya. SOA utilization was based on the level of services available over the internet, data dependency levels, the level of composite services and cross-channel solutions. The findings indicated that the average rate of SOA utilization in commercial banks in Kenya was 51.39%. This shows that the rate of SOA utilization in Kenya is above average. The findings however contradict with Basias et al. (2012) whose study on SOA and e-banking in Germany and France showed that the utilization levels in the two countries were between 30.6% and 45.2 % respectively. The difference could be explained by the time difference between the two studies and the dynamism of the fin-tech and banking industries in Kenya (World Bank, 2016). It can be concluded that the study objective of determining the level of SOA utilization in commercial banks in Kenya was met.

4.5.2 Factors affecting Service Oriented Architecture utilization

The second objective was to assess the factors that affect the utilization of SOA in commercial banks in Kenya. The factors were divided into web technology factors, software integration factors and management factors. Among the web technology factors, the researcher found that integration and re-engineering costs affected SOA utilization at a level of 68.2%, security loopholes and vulnerabilities at a level of 57.8%, web technologies and protocols development at 55.6%, technical skills at 54%, complexity of

re-engineering legacy systems at 54% and bandwidth and internet at 51.2%. Web technologies do not have the capability of providing the semantic meaning of data based on inference, therefore poor structure definitions could lead to failure in achieving true integration and inter-operability for SOA, thus the need for re-engineering of legacy systems. Oluwatoyin (2017) concurs that web technologies are open standards and do not have security of their own. Security flaws such as lack of encryption, lack of logging features and vulnerability to denial of service attacks need to be addressed. Fixing these issues lead to high implementation costs, more so because most commercial banks have to contract the services of specialized software companies. Gartner (2004) also argues that with web technologies, in-house technical skills are required to re-solve down time issues as soon as possible.

Internet access challenges still affect a lot of users in Kenya especially because web technologies use the internet, although mobile money has shown positive growth especially in the rural areas, Communications Authority of Kenya (2017), access to online technology and smart phones is still limited as compared to USSD transactions such as Mpesa. Integration of the different mobile and online options however is intended to solve these issues.

Among the software integration factors, the researcher found that integration and re-engineering costs affected SOA utilization at a level of 70.2%, complexity of integration and re-engineering at 65.2%, security loopholes and vulnerabilities at a level of 63.6%, web technology and skills development at 60.8%, technological skills at 60% and internet and bandwidth at 48.8%. Roch (2006) concurred with the findings on the complexity and cost of integrating and re-engineering software and argued that SOA constantly requires changes due to complex system dependencies and constant changes in the business environment. This is especially hard for legacy systems, the cost of constantly re-

engineering legacy systems is as high as the cost of adopting a new SOA based core banking system. Constant changes may lead to slow flexibility to industry changes and exposure to security loopholes, a new core banking system however means re-training staff who lack the required skills to work with a new SOA based system. The findings on the level of internet and bandwidth concurred with the report by the Communications Authority of Kenya (2017) which found that the current internet penetration level in Kenya is 64.8%. The inter-operability between different software could be one of the reasons why SOA utilization is least affected by internet since users can switch between USSD technology and the internet based on access. The researcher concluded that some of the software integration factors are highly inter-related and failure to solve issues emanating from one factor may lead to a total collapse of banking operations.

The significant management factors that affected the utilization of SOA were employee attitude and knowledge at a level of 78.6%, maintenance and long term strategy at a level of 74%, organization change management at a level of 66.6%, Monitoring and evaluation at 63%, Organizational structure and culture at 43%, competitive strategy at 41.4% and policy at 34.8%. The findings were supported by Lee et al. (2010) who emphasized on the need for a decentralized organization structure and culture that focused on the organization's strategy to ensure SOA is optimally utilized. Working towards organizational goals as a team and ensuring that all employees are included in strategy formulation and execution would significantly improve SOA utilization and business value maximization. Graham (2006) concurred with the findings and recommended using tacit knowledge to pass on technical skills to employees. It is clear from the findings that ensuring that SOA is utilized for business value is a long term strategy and both employees and the management need to invest in SOA in the long term. It can be

concluded that that the study objective of assessing the management factors that affect the utilization of SOA were met.

4.5.3 Relationship between Service Oriented Architecture and business value

The third objective was to establish whether there was business value realized from utilization of SOA. The study focused on key operational areas that can be significantly improved by utilization of SOA and found that; ubiquitous core banking services had an efficiency rate of 89.6%, service delivery at 63.8%, real time flow of data at 63%, time to market at 61.4%, customer feedback time at 57.6%, process cycle period at 45.8% and new product development at 40%. These findings are at par with IBM (2004) whose study indicated that SOA enables compound growth of business benefits with one benefit improvement improving on another. To find out if SOA contributes to overall organizational business value, the researcher used a linear regression model to find out if utilization levels led to improved efficiency ratios. The model was as follows: $\text{Efficiency} = 2.001 + 0.341 (\text{Utilization}) + \text{error}$. The findings of the regression model showed that; 1 unit change in utilization leads to 0.491 increase in business value. The findings supported the hypothesis that SOA utilization leads to improved business value for organizations. In his study Bardnt (2007), supported the findings by iterating the fact that SOA realizes business value by leveraging existing applications and assets. Channabasaviah et al. (2003) concurs that with SOA information technology infrastructure is utilized as a commodity through which new applications and services are built, reducing infrastructure and operational costs thereby improving efficiency. It can be concluded that the study objective of establishing whether there is business value realized from SOA utilization was met.

CHAPTER FIVE

SUMMARY CONCLUSIONS AND RECOMMENDATION

5.1 Introduction

This chapter contains the summary of findings, conclusion, recommendations and suggestions for further research.

5.2 Summary of findings

The main objectives of the study were; to determine the level of utilization of SOA in commercial banks in Kenya, to find out how other factors affect SOA utilization and to find the relationship between SOA and business value. The study found that the rate of SOA availability in Kenyan commercial banks is 73.42% while the rate of SOA utilization is 51.39%. Mahmood and Muhammad (2008) explain that SOA has been used in construction of mobile services, software development and the mapping of integrated and collaborative services. Based on this utilization, commercial banks were able to improve on business processes, operations and customer service, improving the overall business value by maximizing on the available technology platforms. SOA utilization improved business value by reducing expenses and costs while maximizing revenues. However, the study found that with SOA's ease of use comes a new set of management and technical challenge. There were web technology factors, software integration factors and managerial factors that affected the utilization levels of SOA that need to be addressed to maximize business value.

5.3 Conclusions

From the findings, it would be safe to conclude that there has been an increased level of SOA adoption in Kenya. The conclusion is supported by the fact that the current level of SOA availability is 73.42%.

As per the first objective, the study revealed that the current level of SOA utilization is 51.39%, this means that SOA has provided an efficient, reusable and platform independent environment for the current banking environment. Secondly, the study found that the web technology factors, software integration factors and management factors that affect SOA utilization need to be mitigated in order to achieve 100% utilization and consequently, business value. These conclusions are supported by the descriptive and inferential statistics as indicated.

Finally, on the third objective, commercial banks in Kenya have improved business value as a result of SOA utilization. While business value has been realized in terms of real time flow of data, ubiquitous banking services, improved service delivery, use of data analytics for decision making, reduced process cycle periods, reduced service development periods, reduced customer feedback time and reduced time to market, the overall levels of efficiency for the banks have improved. These findings have been supported by the average efficiency ratios of the commercial banks. Efficiency ratios measure how well banks are using their overhead expenses in generating revenue. Other factors being constant, a decreasing efficiency ratio is positive while an increasing efficiency ratio is undesirable as it shows low revenues despite high costs. Commercial banks that utilize SOA have low efficiency ratios; these shows that SOA seeks to reduce expenses by reducing the costs of new products and services. It would be safe to conclude that SOA utilization leads to business value.

5.4 Recommendations of the study

The banking industry is one of the most dynamic industries in Kenya especially due to the rapid growth of the fin-tech industries both locally and globally. With the constant technology advancements, technology is no longer a competitive advantage. This is supported by the many arguments based on the information technology productivity-paradox (Lichtenburg, 1993). However people management, working in decentralized teams and having a long term strategy incorporating SOA will lead to competitive advantage. It's through effective management that commercial banks in Kenya will ensure that SOA utilization is maximized and business value realized by ensuring that the underlying factors are addressed. More and more banks in Kenya such as Equity bank are sending their employees for further studies to ensure they have the necessary technical and managerial skills to deal with the dynamism of the industry (World Bank, 2016). Banks should no longer look at SOA as a tool for competitive advantage but as a means through which the organizations strategy and goals are realized. The research recommends constant training for project teams and individual departments in order to deal with the complexity of SOA. By having the required skills commercial banks will be able to comfortably manage scalability of SOA and control SOA utilization factors that may affect business value.

The success of SOA in the recent past has improved adoption in other sectors such as government services, improving the overall adoption of SOA in diverse industries in Kenya. However the government should ensure that the employees have the necessary technical and managerial skills as SOA adoption and utilization continues to grow. There is also need for the revision of the current curriculum in academia to reflect the changes in management of technology, long term strategy, people management and emphasis on team dynamics.

5.5 Limitations of the Study

The researcher encountered a number of challenges related to the research. With SOA being a new and evolving paradigm, there are limited studies in this area. It was a challenge to find and compare research findings with studies done by other researchers.

Respondents may have given rough estimates while responding to the questionnaire instead of using well informed and accurate data due to reasons such as privacy and busy schedules at their places of work.

Questions on Business value based on customer feedback and access to services could have been biased. The researcher could have obtained more accurate responses from bank customers.

5.6 Suggestions for further Studies

The current study has exposed challenges on costs, complexity of SOA, lack of technical skills and the need for better SOA managerial skills. The study suggests further studies on management and long term strategy of SOA. The study also recommends other studies to be carried out in other industries as the researcher only focused on commercial banks.

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APPENDIX ONE: QUESTIONNAIRE

This is a questionnaire on the value derived from service oriented architecture in Kenyan Banks. Data obtained from this research is only for the achievement of the study objectives. Therefore, your cooperation in answering the questionnaire will be highly appreciated.

PART 1: GENERAL INFORMATION

1. Name of the company(optional)-----
2. Information technology position/role in your company-----
3. How many branches does the bank have-----
4. Is your bank local, regional or international(Tick one)
Local _____ Regional _____ International _____

PART II: LEVEL OF DEPLOYMENT

5. What is the current level of system(s) integration?

<input type="checkbox"/> 0-15%	<input type="checkbox"/> 46%- 60%
<input type="checkbox"/> 16-30%	<input type="checkbox"/> 61%-75%
<input type="checkbox"/> 31%-45%	<input type="checkbox"/> 76%-100%
6. Which web service protocols/technologies does the organization use (tick all that apply)

<input type="checkbox"/> XML (Extensible Mark-up Language
<input type="checkbox"/> UDDI (Universal Description, Discovery and Integration
<input type="checkbox"/> WSDL (Web service description Language)
<input type="checkbox"/> SOAP (Simple object access Protocol)
<input type="checkbox"/> Others (Specify)

7. Which data model is currently in use in the organization?

- Unified/Enterprise data model
- Domain/function Specific data model

8. What is the organization's policy on data ownership?

- Business Perspective
- Information technology (IT)

PART III: LEVEL OF UTILIZATION

9. What percentage of services can be accessed over the internet?

- 0-15%
- 16-30%
- 31-45%
- 46%- 60%
- 61%-75%
- 76%-100%

10. What percentage of services can be reused in other composite services?

- 0-15%
- 16%-30%
- 31%-45%
- 46%- 60%
- 61%-75%
- 76%-100%

11. What percentage of services uses cross-channel solutions?

- 0-15%
- 16%-30%
- 31%-45%
- 46%- 60%
- 61%-75%
- 76%-100%

12. What is the current level of data dependencies? (Is data from one function or service highly dependent on data from other functions or services?)

- 0-15%
- 16%-30%
- 31%-45%
- 46%- 60%
- 61%-75%
- 76%-100%

PART IV: BUSINESS VALUE

13. Rate the organization on the below areas:

1=Very Poor, 2=Poor, 3=Average, 4=Good, 5=Very Good

	1	2	3	4	5
Time to market new products and services	<input type="checkbox"/>				
Customer feedback time	<input type="checkbox"/>				
New product/service development period	<input type="checkbox"/>				
Process cycle periods	<input type="checkbox"/>				
Data analytics for improved decision making	<input type="checkbox"/>				
Service delivery	<input type="checkbox"/>				
Ubiquitous core banking services	<input type="checkbox"/>				
Real time flow of data and information (for customers,employees and partners)	<input type="checkbox"/>				

PART V : OTHER FACTORS

14. To what extent have the below issues contributed to the level of use of web services?

1=No extent, 2=Small extent, 3=Average, 4=Large extent, 5=Very large extent

	1	2	3	4	5
Required technical skills	<input type="checkbox"/>				
Web technologies and protocols development	<input type="checkbox"/>				
Security loopholes and vulnerabilities	<input type="checkbox"/>				
Bandwith and Internet	<input type="checkbox"/>				
Complexity in Re-engineering legacy systems	<input type="checkbox"/>				
Integration and re-engineering costs	<input type="checkbox"/>				

15. To what extent have the below issues contributed to the level of use of software integration?

1=No extent, 2=Small extent, 3=Average, 4=Large extent, 5=Very large extent

	1	2	3	4	5
Required technical skills	<input type="checkbox"/>				
Web technologies and protocols development	<input type="checkbox"/>				
Security loopholes and vulnerabilities	<input type="checkbox"/>				
Bandwith and Internet	<input type="checkbox"/>				
Complexity in Re-engineering legacy systems	<input type="checkbox"/>				
Integration and re-engineering costs	<input type="checkbox"/>				

16. Which of the below management issues has the organization faced in system integration and use of web services, and to what extent?

1=No extent, 2=Small extent, 3=Average, 4=Large extent, 5=Very large extent

	1	2	3	4	5
Policy issues	<input type="checkbox"/>				
Competitive strategy issues	<input type="checkbox"/>				
Organization culture and structure	<input type="checkbox"/>				
Management, monitoring and evaluation	<input type="checkbox"/>				
Employee knowledge levels and attitudes	<input type="checkbox"/>				
Maintenance and long term strategy	<input type="checkbox"/>				
Organization change management	<input type="checkbox"/>				
Maintenance and long term plan and strategy	<input type="checkbox"/>				

APPENDIX TWO: LIST OF LICENSED COMMERCIAL BANKS

1. African Banking Corporation Limited
2. Bank of Kenya Limited
3. Bank of Baroda(K) Limited
4. Bank of India
5. Barclays Bank of Kenya Limited
6. Charterhouse Bank Limited
7. Chase Bank Limited
8. Citibank N.A Kenya Limited
9. Commercial Bank of Africa Limited
10. Consolidated Bank of Kenya Limited
11. Cooperative Bank of Kenya Limited
12. Credit Bank Limited
13. Development Bank of Kenya Limited
14. Diamond Trust Bank Kenya Limited
15. Eco bank Kenya Limited
16. Spire Bank Limited
17. Equity Bank Kenya Limited
18. Family Bank Limited
19. Fidelity Commercial Bank Limited
20. First Community Bank Limited
21. Guaranty Trust Bank Limited
22. Guardian Bank Limited
23. Gulf African Bank Limited
24. Habib Bank A.G Zurich

25. Habib Bank Limited
26. Imperial Bank Limited
27. I &M Bank Limited
28. Jamii Bora Bank Limited
29. KCB Bank Kenya Limited
30. Middle East Bank (K) Limited
31. National Bank of Kenya Limited
32. NIC Bank Limited
33. M-Oriental Bank Limited
34. Paramount Bank Limited
35. Prime Bank Limited
36. Sidian Bank Limited
37. Stanbic Bank Kenya Limited
38. Standard Chartered Bank Kenya Limited
39. Trans-National Bank Limited
40. UBA Kenya Bank Limited
41. Victoria Commercial Bank Limited

Source: Central Bank of Kenya (2017)

APPENDIX THREE: SECONDARY DATA SHEET

Banks	Years		
	2014	2015	2016
African Banking corporation (ABC bank)	0.48	0.49	0.48
Bank of Baroda(K)	0.48	0.42	0.39
Bank of India	0.48	0.5	0.48
Barclays bank of Kenya	0.48	0.46	0.45
Chase Bank limited	0.48	0.44	0.47
Citibank	0.35	0.48	0.52
Commercial bank of Africa Limited	0.35	0.27	0.3
Consolidated bank of Kenya	0.42	0.38	0.39
Cooperative bank of Kenya	0.55	0.56	0.57
Credit bank	0.5	0.42	0.42
Diamond trust bank	0.45	0.46	0.44
Eco bank Kenya	0.43	0.42	0.44
Equity bank	0.41	0.39	0.39
Family bank	0.43	0.42	0.41
Guardian bank	0.44	0.42	0.42
Guranty trust bank	0.44	0.44	0.44
I & M bank	0.48	0.5	0.47
Imperial bank	0.46	0.44	0.45
Jamii bora bank	0.43	0.44	0.41
KCB bank	0.51	0.5	0.5
National Bank of Kenya	0.44	0.41	0.4
NIC bank	0.49	0.49	0.47
Paramount bank	0.5	0.47	0.47
Prime bank	0.47	0.49	0.48
Sidian bank	0.48	0.45	0.44
Stanbic bank	0.38	0.35	0.34
standard chartered bank	0.36	0.36	0.33