

# A literature Review of the Factors Affecting Service Oriented Architecture Adoption in E-Banking

Abdulmajeed Alqhatani

College of Computer Science and Information Systems, Najran University, Saudi Arabia

*Abstract— The evolution of Information Technology (IT) has enabled banks to improve their services by establishing new communication channels with customers through e-banking. In this regard, integration is important for the success of e-banking. However, banks are facing different problems in integrating their systems. Service-Oriented Architecture (SOA) as an emerging technology has the potential to address these problems. A number of studies indicated that the adoption of SOA in e-banking is slow for several reasons. This paper seeks to provide a literature review about the factors affecting SOA adoption in e-banking. In addition, a methodological framework from the previous literature will be presented and discussed. Case studies about SOA adoption in e-banking will also be included for further understanding of the issue from a practical perspective.*

**Keywords—Adoption, E-banking, Influential factors, Service-Oriented Architecture.**

## I. INTRODUCTION

With the rapid globalization and the excessive market competition, it has become very difficult to survive without taking a step toward improving business services. Therefore, many banking sectors have realized the role of e-banking for their business success and have considered information technology as an integral part of their strategic objectives. Today, Information Technology or as usually abbreviated 'IT' is perceived as the backbone that enables communication with people as well as institutions associated with the banking business. It is also considered as a reliable way to respond to the dynamic changes in the market environment. In addition, it can be an effective way to reduce costs, and at the same time to increase the quality of services. In this context, banks seek to collaborate and improve their services through integration. However, this integration can cause different problems between banks as they have different systems and different IT infrastructures. Integration is one of the most challenging factors for e-banking success [2]. Despite this fact, the significant benefits of integration have enforced banks to increase the efforts to find a reliable way to address these problems [2], [17], [20]. With this regard, Service Oriented Architecture (SOA) has emerged as a promising technology to address integration problems. SOA revolves around the notion that a service can be reused by many computers connected over a network, thus improving efficiency and reducing operation costs. It can provide banks with the robust and flexible IT infrastructure to meet their goals. It also acts

as a platform to achieve compatibility requirements between different systems. Nevertheless, many banks have not obtained the benefits of integration, and they are reluctant to adopt SOA in e-banking for several reasons [10], [17]. Reference [3] indicated that the factors influencing the adoption of SOA in e-banking have not been fully discussed in the previous related literature. More importantly, the methodological frameworks to understand these factors from different perspectives are missing. This paper presents an extensive literature review of the factors influencing SOA acceptance in e-banking. It will investigate important aspects including e-banking services and SOA technology. The factors of SOA adoption in e-banking will be enumerated and explained, and a methodological framework from the related literature will be briefly presented and discussed. For a better understanding, case studies that were conducted on banking sectors will be provided and analyzed along with their key findings. The study will conclude by analyzing the positives and the negatives of SOA adoption in e-banking.

## II. E-BANKING

In modern global market, banking environment becomes extremely competitive. As a result, banks are moving for the latest technologies to modernize their services and gain competitive advantages [15]. While banking services have for a long time been delivered through physical bank branches, the evolution of technology has enabled banks to open new channels to provide customers with flexible and high quality services. Reference [2] defined e-banking as "an automated supply of products and services to the customers via electronic interactive channels of communication" (p.162). E-banking services can have a variety of forms, including credit and debit cards, ATM, internet banking, telephone banking, mobile banking, Tablet banking, Electronic Funds Transfer (EFT), and E-cheques. From customers' perspectives, e-banking presents a wide range of services with more flexibility and better control. First, customers can access their accounts' information at any time wherever they are in the world. Customers can remotely make balance inquiry and request for services. They can also make online purchases of goods and make online payments much more easily. Furthermore, e-banking can improve customers' life, especially elderly and ill people, by avoiding arduous trips to the physical branches, thus saving costs and time [2].

Likewise, banks have found several advantages in using e-banking. First and foremost, it helps them to save money in different ways. For example, e-banking reduces the need to customers' visits to physical branches, which in turn reduces costs that will be spent on hiring employees. It also eliminates the need for printing and mailing paper statements to customers. From marketing perspective, e-banking is an effective tool of promotion of variant schemes of a bank such as online advertisements. For these reasons, banks consider online banking as a significant strategy to address competition and improve services in the banking sector environment. Considering the history of e-banking, it is unclear when exactly the concept of e-banking was first introduced. However, reference [18] mentioned that e-banking arose since the release of the Internet in the mid-1990s. Reference [2] also indicated that the renowned banks in the US launched a service called "Home Banking" during the late 80's. At that time, people were able to do some banking transactions while sitting at homes using special and expensive networks. Today, the technological advancements have changed the way of delivering banking services and have also changed customers' expectations; consequently, banks are shifting from traditional banking to e-banking and the adoption levels are growing worldwide. Reference [2] presented significant statistics based on a research conducted by Deutsch banking in 2011 regarding e-banking adoption in different countries. The statistics show that the Northern European countries have the higher rates of adoption levels where Norway is in the top by (83%). The US and the UK have an adoption level of (45%). With respect to France and Germany as countries with developed economy, their e-banking adoption is between (43%) and (53%). Chart 1 illustrates this information.

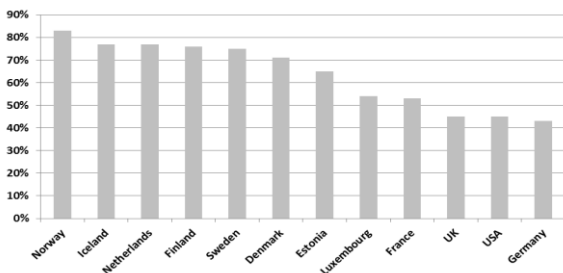


Fig. 1 E-banking adoption rates [2].

Source: Influential Factors of SOA Adoption in E-Banking, Basias et al. (2012).

Information technology is a key factor to address competition in the banking environment. While banks seek to improve their services by shifting from traditional banking to online banking, researchers believe that the transition is slow due to the integration problems. With this regard, SOA is a new approach to address these problems. In order for successful implementation of SOA, it is important to have a clear understanding of the related issues behind this technology. The next section of this paper introduces SOA technology. Service Oriented Architecture (SOA) SOA is an architectural design that supports communication between services. It can define how two or more application programs

interact with each other in the form of services. A service is defined using a description language, and each service is self-contained and loosely-coupled (independent of other services). Different technologies can be used to implement SOA. However, XML web services technology is the most preferable choice because of its ease of use and flexibility. XML-based technology can standardize the interfaces between heterogeneous systems, and it can be implemented in any programming framework such as J2EE or .Net, and the interfaces are isolated from the implementations.

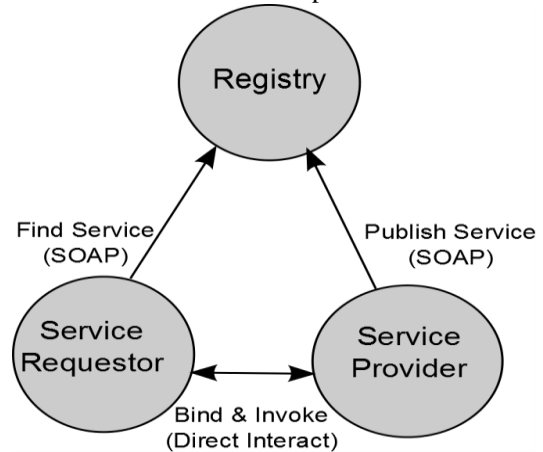


Fig. 2 XML Web Services Architecture for SOA

The SOA consists of three elements as shown in figure 1 above. First, the service provider is responsible for creating and managing the service. The second element is the service requestor or consumer, who requests the service. The communication between these two elements is implemented using the XML wire protocol SOAP (Simple Object Access Protocol) message. The third element in this architecture is the registry. The registry enables the service provider to publish the service, and the service requestor uses the UDDI (Universal Discovery, Description, and Integration) protocol to find out the published service that is needed to accomplish the intended goal. Today, organizations are more complex, have different platforms, and are distributed across different geographical locations [11]. An important aspect organizations are encountering today is to find an effective way to manage this complexity in order to reorganize different information resources into independent and reusable services [19]. In addressing this issue, SOA has the potential to support communication and interaction between services. In fact, SOA does not require any specific technology but is a set of design principles, and large industries can realize the benefits of applying it. In this context, banking sectors can be an interesting domain to implement SOA [3]. A SOA can provide banks with the robust and flexible IT infrastructure they need to integrate businesses and to optimize customers' services. Moreover, it can guarantee security and integrity of information. Reference [13] reported that a significant number of organizations in the US and Australia used SOA in IT control by (40.6%) and (32.9%) respectively; while in the UK, some organizations used a SOA application as a part of

the enterprise. The same study [13] also shows that the major organizations in Germany and France utilized SOA applications by rates (30.6%) and (45.2%) respectively. However, many business industries admitted that they were not able to obtain the benefits from implementing SOA in their projects [9], [10]. Banks are one of these industries that have failed to achieve SOA benefits. According to reference [2], studies regarding the factors influencing SOA adoption in e-banking and the decision frameworks for SOA are limited in the previous literature. Reference [3] also indicated that there are a few empirical studies about the organizational impact of SOA in banking projects. Reference [12] mentioned that the comprehensive frameworks to understand the strategic and economic impact of SOA are few. However, the lack of governance plays as the main reason for the failure of SOA in companies' projects [9]. In addition to governance, there are three other challenges reported by IBM experts about the adoption of SOA in organizations. These challenges are program management, organization, and technology [13]. Other reasons that contributed to SOA acceptance are organizations' sizes and the surrounding environmental factors [6]. Hence, it is important to investigate all the different factors that might challenge the implementation success of SOA in e-banking. Banks and other business industries must engage in a deep analysis of the implications before making their decisions about SOA adoption. The next sections will discuss in detail the influencing factors of SOA adoption.

### III. INFLUENCING FACTORS OF SOA ADOPTION IN E-BANKING

SOA is a new approach in the domain of information systems' design and architecture, and it requires people to work and collaborate closely to leverage its adoption, especially in the financial and banking services, because of the potential benefits that this technology can present. So far, many studies have been conducted on SOA, little is known, however, about the factors affecting its use in e-banking and other business institutions. As mentioned earlier, the main subject of this study is to analyze the various factors influencing SOA adoption in e-banking sector. These factors as reported in the previous literature include technical factors, organizational factors, business factors, and SOA governance. The study of these factors will result in better understanding of this technology, and ultimately lead to better adoption in the future.

#### A. Technical Factors

One problem facing many firms today is that they were established in the past few decades with heterogeneous systems and architectures. Banks are one of these institutions that suffer from legacy systems that are inflexible in terms of change and integration. In addition, the general restrictions imposed on banks resulted in IT infrastructures that are difficult to merge [3]. However, banks are under pressure to find ways to integrate as the online banking is growing

increasingly. Today, the IT trend is to make use of services that cover all the business processes that are involved in the enterprise. This may require the replacement of legacy systems in order to respond to the changing environment [10]. In this context, SOA has the ability to integrate different business units and firms more quickly [8]. As a result, businesses will be able to bring their products together into a single shared place, and benefit by reducing costs resulting from the shared usage. In addition, this can provide better and improved customers' services. Banks and other business institutions find difficulty in integration because of the "closed architectures." This term was introduced by reference [3] to refer to the organizations' trend to avoid the problem of incompatible hardware and software in their communications by relying on a single vendor package. Possibly the most interesting feature of SOA is the ability to build a standard-based connection with partners and customers. As stated earlier, the SOA with XML web services can standardize the interface between different systems running on different platforms. This can help to create interoperability between these systems and to guarantee encapsulation of services [12]. Furthermore, using SOA with XML web services enables banks to establish a faster and more secure connection with other partners as well as customers than with traditional techniques. However, the large number of interfaces in SOA with many administrative domains may result in a complex architecture that is difficult to manage [11]. In the context of architecture complexity, there are four basic challenges that are strategic to banks, and these challenges can emphasize the value of SOA technology [4]. First is the demand for "integration of applications." The rapid growth of products and services that are managed by different systems and running on different platforms will result in a more complex banking environment. The IT architecture of most of these systems was built a long time ago, and even though their architectures can be similar to some extent, they were basically built to be separate. Consequently, it becomes very difficult for these systems to get connected to each other. Applications' integration is critical in today's banking environment, and a well-developed IT is important for successful integration of applications. The second challenge is the need for "value reconfiguration processes." In order for banks to achieve their objectives, they put a special emphasis on their individual main capabilities, and this result in allocation of their value chain to a number of self-dependent functional units. When the capabilities are at their top level of performance, the functional units are then aggregated into shared "value networks." These value networks can be useful because they respond better and faster to the market needs and opportunities in the complex and dynamic environment rather than value chains. The third challenge is the ability of banks to "preserve value after merge and acquisition." The merge and acquisition lead to a reconfiguration of value. Therefore, it is important to ensure that the knowledge and practices of the old system are kept

after the replacement is done. The fourth challenge is the need for banks to provide more agile IS development. This can be justified because of the dynamic nature of the banking environment, and this can lead to frequent change in systems. Another important issue that needs to be addressed in SOA adoption is the security and management of risk. Possible security threats to online banking include the ability to get an unauthorized access to the financial information, target a website by hackers with an intention to make an interruption in services, or the unintended failure in the design of the system. It is important to consider that as online banking increases, banking systems are more likely to expose to security risks [1]. As a result, banks must impose the most strong and reliable procedures to prevent any risky behaviors that may compromise a system's security. Even though many business industries have realized the benefit of SOA adoption, there is a lack of standards regarding security [11]. This can be a big issue for banks as security threats can lead to loss of customers' confidence. SOA can ensure security of data and systems as long as security is implemented as a service [1]. Nevertheless, SOA have not addressed some critical issues of integration such as the presence of adequate security features [14]. Building systems that enable communication of information in all formats, and providing a comprehensive awareness of security are considered as a continuous challenge that faces banks and other enterprises to adopt SOA.

### **B. Business Factors**

The number of enterprises investing in SOA has been increasing due to the significant business value this technology can provide. Reference [2] reported that the business factors of SOA receive more attention than technical factors. The same study [2] also reported 14 business factors that affect SOA adoption; these factors are: (1) agility, efficiency, and flexibility, (2) financial advantages, (3) frequent change in market, competition, and regulation, (4) business-client involvement, (5) customers' need, (6) innovation, (7) change in the organizational management, (8) sponsorship of the company's senior managers, (9) leadership of the business units' senior managers, (10) leadership of the technology departments' senior managers, (11) strategic planning, (12) contribution of the architecture to improve processes, (13) acceptance of service orientation, (14) reusability of assets. Despite the obvious benefits that have been realized in SOA adoption to improve business and IT values in organizations, business potential of SOA remains an area that needs more investigation [11]. Reference [12] indicated that SOA benefits can be easily seen in the context of technical improvements, but it is difficult to prove its benefits economically, and this is due to the fact that most of the studies conducted on the strategic and economic values of SOA are exploratory, and the suitable comprehensive frameworks are absent. Based on the definition of SOA described early in this study, one may find it confusing whether SOA is a technical service or a business service.

From a technical perspective, SOA is defined as an application architecture with functions or services that can be reused. From a business perspective, it is a way to improve IS agility to support business processes. Additionally, customers' viewpoints are important for better understanding of the service and its components [11]. The goal of SOA, however, is clear for many organizations. SOA can address the organizations' needs to integrate their systems, access to market more quickly, respond to the change in a business environment, reduce costs through reusability, improve business processes, and improve customers' services. Therefore, SOA can be perceived as a way to build systems with IT architecture that is capable to respond quickly and effectively to the dynamic business environment, and to serve organizations to achieve their business goals more quickly [6]. One important factor for achieving the business value of SOA is to maintain a close interaction between the IT department and the business units, thus resulting in flexible business processes [5]. Successful SOA adoption depends on the alignment of the organization IT and business processes. As a result, it is important that both sides work closely in order to be able to understand the needs of the other. Furthermore, educating employees about the business benefits that SOA can bring to the organization is required to motivate them to consolidate the effort to achieve the intended goals. However, this may lead us to ask whether it is important to the IT employees to learn business processes in order to be able to perform the transition into SOA. According to reference [5], IT people do not prefer to incur the details of business processes, and these details can be a difficult task to them to learn. Therefore, it not mandatory for all IT employees to go into the details of business processes. Instead, the business value should be made clear to the IT department, and the IT staff should be able to collect the required information they need to accomplish their task. This can be done using different requirements gathering techniques such as questioning and observation. To conclude this part, SOA is the vehicle to align the IT strategy of an organization with its business strategy; helping that organization to meet business values and respond more quickly to the change in market conditions. Close interaction between the organization's business units and the IT departments is necessary for successful implementation of this technology. In addition, it is important to have more studies to investigate the potential economic aspects of SOA adoption.

### **C. SOA Governance**

SOA governance refers to the process of controlling services in a SOA. This means that SOA governance should be able to manage any problems that may occur as a result of the implementation of this technology in a particular organization. This also includes the ability of aligning IT processes with business processes. SOA governance is particularly important in large IT systems where several internal and external entities to the organization interact with each other. Reference [9] indicated that only 20 percent of

organizations who applied SOA to their businesses have obtained the expected benefits of its use. Many researchers believe that there is a strong relationship between the failure of SOA adoption and the absence or the lack of its governance. In addition, previous literature about SOA governance was not supported with quantitative evidence to investigate its relationship to the successful adoption of SOA. Recently, the focus of many business industries, including banks, is on the use of services to address integration issues. SOA governance is a key factor that needs to be addressed when considering successful implementation of SOA. The ability to control services within the organization is important as the number of services increases. However, IT governance is usually tied to the SOA governance because with the deployment of services across the organization, the IT infrastructure should be flexible enough to control these services and to be able to successfully utilizing SOA. Reference [9] proposed a model for SOA governance mechanisms. This model classifies the factors challenging SOA governance into: structures, processes, and employees. This model shows that each one of these factors has a potential impact on IT flexibility and service reuse. It is important to have a comprehensive SOA governance framework as previous studies revealed a correlation between the impacts of governance of this technology on the decision regarding its adoption in organizations. Although considerable researches have been conducted on SOA, there are a few studies about SOA governance and management techniques. SOA governance is important to manage services throughout the organization. Thus, Understanding the effect of SOA governance will help different organizations and business industries to achieve the intended benefits from its adoption in the future, such as reducing costs and increasing service reuse.

#### ***D. Organizational Structure, Culture, and Strategy***

There are some organizational aspects that are crucial for successful implementation of SOA. These are organization structure, culture, and strategy [11]. With regard to structure, organizations have to change their way of work to be able to meet the new needs and to obtain the desired goals of SOA. This includes the ability of firms, especially geographical distributed firms to map their businesses with their IT infrastructures to attain business agility, and this also requires minimizing centralization of management. Organization structure is also one category that has an impact on IT flexibility and service reuse. Reference [9] discussed two issues regarding the structure of organizations. The first issue is to create a new decision making authority, in addition to the existed authority within the organization, to address SOA implementation challenges. This new authority can be a group of the business ownerships, IT specialists, and SOA experts, and this group can also work together to plan and accomplish the tasks related to SOA implementation in the organization. The other issue is the use of standards that help in deciding whether a function should be applied as a service, and to

create new standards regarding interfaces of the system. Reference [11] pointed out that the use of SOA in organization structure can help to classify groups of employees to work on specific tasks (services). Ultimately, this will help the organization to address future opportunities and challenges. As indicated in previous literature, further investigations about SOA related to organizational structure are needed to obtain the full benefits of this technology. Organizational culture is another aspect that has an impact on SOA implementation in organizations. Organizational culture refers to the shared values and behaviors that can govern people in the organization and shape the organization own personality. It also includes shared attitudes, beliefs, and assumptions. Reference [11] reported that the fact of introducing new business processes that help in linking technical services can create a new culture within the organization. SOA requires the use of services, and this as a result may require a change in the relationship between different organizational units. In this case, it is important that employees understand and adapt to the new situation. Reference [5] indicated that the chance of successful implementing of SOA in the organization increases when the IT and business departments collaborate appropriately. In addition, employees have to have the required skills in order to be able to deal with the new demands of implementing SOA in their organizations. This may require educating and training people to better understand the service-based business environment [9]. In the context of SOA adoption, organizational strategy is also an important aspect to consider. Organizations seek to stay competitive and respond more quickly to market changes through investment in new technologies [4], [11]. In addition, investment in information technology is important to firms to meet their long-term objectives. Today, SOA is an emerging technology that has attracted many business industries [14]. Banks are among these business industries that are moving to the adoption of SOA. This technology can provide astonishing benefits to the organizations implementing it. However, like any new technology, SOA adoption decisions may need a considerable time and effort to investigate its implications on a firm from different dimensions. It is important to understand that SOA adoption depends on different factors that have a dynamic nature. Consequently, this can affect the organizations' strategic decisions to adopt SOA. Reference [13] analyzed the impact of SOA on some organizational elements including strategy, governance, complexity, ROI, and alignment between IT and business processes. Reference [6] presented a model that examines that effect of SOA diffusion on organizations agility. Reference [3] conducted a case study on two banking industries to investigate the strategic values of SOA adoption. While a significant amount of researches have investigated the technical issues related to SOA, a few of them have addressed the strategic values that organizations can gain from investment in SOA [12]. In addition, it is not clear how the organizations adopting SOA can map it to their

strategy [4]. This ambiguity increases with the organization diffusion as well as interconnection with other industries. So far, this paper examined the related literature about the factors challenging SOA adoption in banks and other business industries. Contributions and gaps in previous studies were mentioned and explained as well as recommendations for further studies. Table 1 below summarizes the preceding sections regarding these factors.

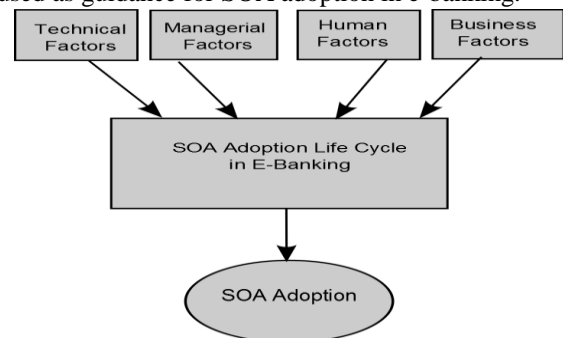
**Table 1: Summary of the Factors Influencing SOA Adoption in E-Banking**

Factors	Description	References
Technical factors	Most of the large business institutions were established in the past with legacy systems that are difficult to merge. SOA can standardize the interface between these systems, but the large number of interfaces in SOA can create a complex architecture that is difficult to manage. Another issue is the lack of standards in SOA regarding security features.	[1], [3], [4], [8], [10], [11], [12], [14].
Business factors	Business factors affecting SOA include agility, efficiency, flexibility, frequent changes in market and competition, organizational strategy and management, and the alignment between IT and business processes. There is a lack of a comprehensive framework regarding the economic values of SOA.	[1], [11], [12], [6], [5].
SOA Governance	There is a correlation between the failure of SOA adoption and the lack of its governance. In addition, previous literatures were not supported with quantitative evidence to address this issue. Other factors affecting SOA governance include structures, processes, and employees.	[9].
Organizational structure	Large organizations should be able to adjust their work to align their businesses with to their IT infrastructures. This may also require minimizing centralization of management. Decision making authorities, business ownerships, IT specialists, and SOA experts should work together to plan and accomplish tasks related to the SOA implementation.	[9], [11],
Organizational culture	The introducing of SOA in any organization may require a change in the relationship between different organizational units.	[5], [9], [11].

	Employees are required to have the necessary skills in order to be able to deal with new demands. Educating and training people about the new based-service environment is important.	
Organizational strategy	Decisions about SOA adoption depends on factors that have dynamic nature. There are a few studies about the strategic values an organization can gain from investment in SOA. In addition, the existing literature showed uncertainty regarding how SOA can be mapped to the organization strategy.	[3], [4], [6], [11], [12], [13], [14].

#### IV. SOA ADOPTION IN E-BANKING: A DECISION FRAMEWORK

As indicated earlier in this study, one of the major reasons reported in the literature about the failure of SOA projects in e-banking is the absence of the methodological framework that clarifies and explains the previous mentioned factors. In this regard, a methodological framework proposed by reference [1] will be explained in this section. It can be considered as a comprehensive framework that forms a roadmap for future research about SOA adoption in e-banking. Reference [1] framework indicates a correlation between online banking and SOA adoption. The framework classifies the factors affecting SOA adoption decisions into four classifications. The first class contains the business factors that include obstacles, advantages, and cost. The second class contains the human factors that involve tiredness, personnel, pressure, and reluctance to change. The fourth class is the managerial factors that include alignment of business, communication, setting of goal, risk, and strategy. The fourth class is the technical factors that include IT infrastructure, security, and support from external parties. In addition, the framework provides a SOA implementation life cycle that has three phases, which are initiation, planning, and decision. Figure 3 represents an abstract framework that can be used as guidance for SOA adoption in e-banking.



**Fig. 3 Abstract Representation of a Framework for SOA Adoption in E-Banking.**

## V. SOA ADOPTION IN E-BANKING: CASE STUDIES

To provide a clear insight of the issue, this section presents a number of case studies that were conducted on different banks that have adopted SOA. Reference [1] conducted a case study on a large American bank. For the purpose of privacy, they gave this bank an anonymous name “Lambank.” The bank has customers and operations worldwide. As a result, this bank needed to integrate all the operations with its customers in order to be able to enhance the services presented to those customers, such as e-banking and m-banking. However, as reported in the study, the bank encountered several difficulties with this integration project. Ultimately, SOA was adopted to address this complexity. The results indicate that SOA helps this bank to achieve its goals from integration. In addition, the results confirmed the relationship between the factors described before in this paper and the success of SOA implementation. Factors reported in the study include organizational factors, IT infrastructure, business and IT alignment, security and risk, financial factors, SOA governance, and SOA adoption life cycle. Reference [3] presented a comparative case study on two banks located in two different countries in Europe. The purpose of that study was to assess the strategic value of SOA in banking. The first one is a private Switzerland bank or as anonymously named “Central Europe Bank”, and this bank has operations worldwide. By nature, Switzerland banks are careful regarding risks. As a result, this bank has its own internal Enterprise Architecture Integration (EAI). In this regard, the bank intended to perform a low risk project by using SOA to establish a new Cashier Management System (CMS). The results indicate that this project drives many benefits to the Switzerland bank. First, the old CMS was replaced with the new one. More important, the integration was accomplished through EAI and SOA, and the project has enabled to achieve a strategic value by enhancing information system development learning process in the bank. The second bank that was investigated in the same study is a large Danish bank and was anonymously named “Northern Europe Bank.” This bank also presents services to private customers in three countries in northern Europe. The bank provides customers with a variety of services such as e-banking. In addition, as part of its IT strategy, the Northern Europe bank has a strong central IT infrastructure that has separate application systems, and this IT infrastructure serves all of the bank divisions work. However, the open market conditions in Europe as well as the increasing technological advances created a highly competitive environment. In order to maintain its outstanding position among other peers, the Northern Europe Bank adopted SOA in 2003 to integrate its separate banking applications together. Currently, a service layer is implemented across the company and supports all of the different bank applications running on different platforms. Furthermore, with the use of web services, the bank has been able to improve its work with external customers and partners. The IT architecture of the Northern Europe bank becomes

more flexible, and helps the bank to reduce costs. The last case study presented here is conducted on German banks to study the effect of SOA adoption [7]. The study focused on SOA adoption, SOA operation, and the results of SOA during Merge and Acquisition (M&A) process. In this study, four banks were interviewed, and each one of these banks has to some extent implemented SOA. During the interviews, SOA adoption was classified into conformance, realization, and implementation. Regarding conformance, the study revealed that SOA is driven by the high degree of IT maturity in each bank rather than the management. With regard to realization, German banks perceived SOA adoption as a result of a project need rather than a process need. SOA operation was also classified into SOA life cycle management and practices. In this context, the study reported incomplete application of this life cycle in the German banks. Finally, SOA during M&A process was also discussed in terms of the architecture and the SOA success. The results revealed the applicability of SOA in small M&A projects. Unlike banks with high M&A background, banks with limited background recommend SOA adoption.

## VI. POSITIVES AND NEGATIVES OF SOA ADOPTION IN E-BANKING

SOA is a new concept in the Information Systems discipline. It is an architectural design that can support communication and interaction between heterogeneous systems in the form of services. However, like any technology, SOA can have its advantages as well as drawbacks. It is important to consider both of them before adopting this technology in any organization. As the focus of this paper is on SOA in e-banking, a special focus will be placed on the banking sector regarding the positives and the negatives. Starting with the pros, SOA as a modern technology can provide banks with the reliable and flexible IT infrastructure they need to integrate their businesses more easily regardless of any compatibility problem. In fact, IT flexibility plays a vital role in e-banking work, and banks are considered as one important business area in terms of IT investment [2]. The flexibility of the IT architecture can help banks to create an integrated and collaborative environment that can support them with their end-to-end banking operations to reach their customers more quickly. Another important benefit of SOA related to cost reductions. Due to the shared usage of services, banks will be able to reduce operational costs and maximize their investments. They can also benefit by reducing the cost and time spent on development, testing, and maintenance. Last but not least, SOA can help to address business agility by aligning IT and business processes to respond quickly to the dynamic market in the banking environment. All of these benefits are good motivations for SOA adoption in e-banking. In terms of cons, security and risk management can be an issue in SOA. The lack of security features in SOA remains an area that needs more investigations [14]. Security is very important because

with the use of e-banking, the system is more likely to expose to security threats. In e-banking, customers' financial information must be kept secure. In this regard, security should be implemented as a service level instead of an application level. Reference [16] also presented three risks that may result from SOA use. First, the organization may lose its independency (e.g. outsourcing of assets). Second, the company may lose customers' loyalty due to encapsulation of services in SOA (e.g. requesting bank loan). Third, the flexibility in access to services of different providers that SOA can offer may lead to loss of potential clients. SOA is also not useful to use for GUI applications because of the complexity associated with the transfer of large amount of datasets. Finally, managing SOA can be a problematic with the increasing number of services.

## VII. CONCLUSION & DISCUSSION

This study presented a literature review about the factors affecting SOA adoption in e-banking. The rapid growth of e-banking has enabled banks and other financial institutions to open new channels to offer their products and services to the potential customers. Banks have found several advantages in the use of e-banking to address market competition. However, while banks intend to improve their services through integration, they face several integration problems. In this regard, SOA as a new technology has the ability to address these problems. Researchers indicated that the adoption of SOA in e-banking is slow, and many banks have failed to achieve the desired benefits of SOA implementation. One reason is that the influencing factors of SOA adoption have not been fully discussed. In addition, the methodological frameworks that explain these factors from different perspectives are absent. It has been proven that e-banking is a promising area to implement SOA technology. Understanding the different factors that affect SOA in e-banking is necessary to increase its adoption in the future. These are the factors that were mentioned and explained in this study, including technical factors, business factors, organizational factors, and SOA governance. As reported in the previous studies, each one of these factors may have its own effect on the decisions made regarding SOA adoption. For this reason, it is important to have more studies that can extend the body of knowledge about this issue. This paper also provided a model that can be used by organizations as a roadmap for successful adoption of SOA in the future. Banks and other organizations should also be aware of the positives and the negatives associated with SOA implementation. As a result, they will be able to obtain the benefits and avoid the problems that might occur. Integration, collaboration, reusability of services, and business agility are some benefits driven by SOA adoption. Despite these benefits, SOA is an emerging concept that needs further investigations. For future studies, it is recommended to perform a quantitative evidence of successful adoption of SOA in e-banking. This will help the banks and other financial institutions to have clear insights of the

consequences before the implementation of this technology in their businesses. In addition, the process of introducing new technology to any organization is a challenging task that requires a change in the workplace. To the best of my knowledge, a few studies have discussed the impact of SOA adoption on the managerial tasks; particularly, its impact on the workflow and business process management. The study also revealed a strong correlation between the failures of the majority of SOA adoption projects and its governance. Therefore, more investigations are required to discover and overcome the obstacles behind these issues. Risk and security are other important areas to research to fill in the current gaps.

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