Readiness and Maturity of Service-oriented Architectures in the German Banking Industry

A Multi-Participant Case Study

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Abstract—Currently, the realization of Service-oriented Architecture (SOA) implementation in the German banking industry varies, whereas some banks are in the adoption phase and others are already in the SOA operations phase. This paper focuses on specific implications concerning the SOA readiness and the SOA maturity of German banks as well as the role of SOA in the context of M&A scenarios. In particular, key findings of the SOA readiness and maturity case study within the German banking industry are presented and discussed.

Keywords-SOA, SOA Readiness, SOA Governance, SOA Case Study

I. INTRODUCTION

Service-oriented Architecture (SOA) as an architectural paradigm has gained importance in the financial industry. SOA represents a paradigm, which aims to decentralize the IT landscape using loosely coupled services with Web services currently being the dominating implementing technology. Both the services themselves and the communication between them are standardized so that services can offer a high degree of reusability and flexibility in the IT landscape [14, 1, 6].

Services represent the basic elements of a SOA. Each has a specific granularity and can be executed or composed to other services or workflows. The general philosophy of a SOA in terms of design is the independency of any specific vendors and technologies. In addition, there are not many implementation restrictions for services. A SOA merely requires that services are described in a specific description language. The intention of a service is rather the representation of a specific functionality with a standardized interface. Besides others, three fundamental characteristics for services in a SOA can be identified. Services have to be self-contained, i.e., the service maintains its own state. Services have to be platform independent (standardized) and they can be dynamically located, invoked, and (re-)combined [9].

With the help of SOA, banks and financial service providers are able to implement flexible and agile business processes [13, 4]. A recent survey, the SOA Check 2009, highlights the following three major goals for SOA implementation: increased flexibility, business process optimization, and time-to-market [5]. 37% of the interviewed companies state that they plan a SOA implementation and 47% state that they have already implemented a SOA, whereas the remaining 16% do not plan to implement a SOA. From the companies which already have a SOA, 17% state that they are in the planning phase of a company-wide SOA, and 25% have started a companywide SOA implementation. Already 58% of the companies are in the implementation phase or have already implemented a company-wide SOA. This highlights that a SOA may have one specific SOA maturity level indicating the progress of SOA implementation.

However, most of the previous research was focusing on surveys to find out percentage numbers. In this context only the results of SOA decisions, cognitions, and experiences were measured, but not the reasons for them. Therefore, we have conducted a case study in which three different research objectives are analyzed and evaluated. The research objectives are: SOA adoption, SOA operation, as well as the consequences of SOA during Merger & Acquisition (M&A) conduction. Furthermore, the SOA readiness and SOA maturity of German banks with a special regard to SOA Governance is analyzed and evaluated.

II. RESEARCH OBJECTIVES

The focus of the case study is on assigning the levels of SOA implementations in German banks to an already existing SOA Maturity Model [7]. This approach includes the following three major research questions:

1. How are SOA adoptions in the German banking industry implemented?
2. How appropriate are SOA operations in the German banking industry?
3. Which consequences does the adoption of SOA imply during M&A conduction?
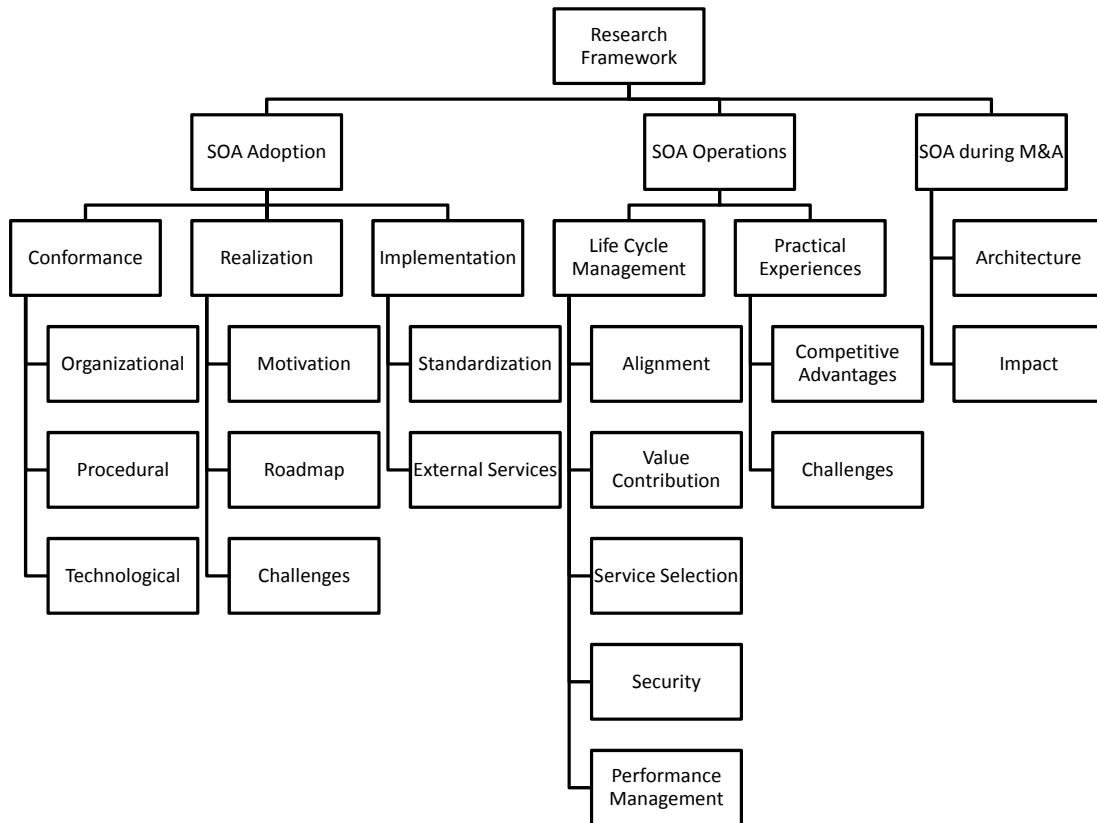
Figure 1: Research framework of the case study

The answers to those questions help to understand how SOAs in German banks are implemented, why it is done, in which way, and to which extent. Furthermore, an evaluation of the impacts a SOA has in the context of the financial industry including both competitive advantage and cost reduction is supported. SOA adoption, SOA operations, and SOA during M&A conduction represent the three research objectives of SOA implementation in banks, which are mostly derived from SOA Governance issues [11, 12]. These parts are summed up in the research framework as depicted in Figure 1, serving as foundation for the questions which have been used for the personal interviews.

SOA adoption as the first research objective comprises three subtopics: conformance, realization, and implementation. In the first subtopic, organizational, procedural, and technological conformance issues are discussed: the company's organizational structure and adjustments of responsibilities, the progress of process documentation, process analysis, and process optimization as well as the maturity of technology. The second subtopic discusses roadmaps and motivations for a SOA adoption as well as upcoming challenges. Furthermore, the degree of SOA experiences a bank acquired on its own and the influences of external consultants are discussed. The degree of standardization, representing the ratio between the self-developed SOA solutions in the IT departments and the parts that are bought from external IT providers as well as the determination of the procurement of external services, is discussed in the third subtopic.

SOA operations as the second objective of the research framework emphasizes on SOA Life Cycle Management as well as practical experiences and issues. In order to differentiate between banks with high and those with low service-orientation, it is investigated to which extent processes are implemented with the usage of services and how many services already exist. Life Cycle Management comprises five issues being derived from SOA Governance which are adapted to the banking industry. The conformity between goals of the IT and goals of the management are subsumed in the subtopic alignment. Furthermore, performance management tools for business critical services, value contribution of each service as well as service selection processes are investigated. Moreover, security issues for purchasing and using services from external providers and third parties are subject of the study. The second subtopic, namely practical experiences, focuses on the suitability of daily use of services in the banking industry dealing with competitive advantages and challenges that may occur due to the operation of services.

Due to the increasing importance of M&As in the German banking industry, both the architecture and the success of SOA during M&A conduction are analyzed in the third research objective, *SOA during M&A*. This implies the analysis of the impact of a flexible architecture on the ease of integrating both parties. Also generic questions are evaluated, such as how a SOA influences an M&A conduction and how a forthcoming M&A influences a SOA.

III. ORGANIZATION OF THE STUDY

Based on the research method described by Yin [15] and Myers [10] a case study has been developed, the objective of which is to analyze the SOA implementation qualitatively and to investigate the context of decisions that influences the status of the SOA and the kind of the technologies used.

The case study is mainly based on the results of personal interviews with four IT architects of German banks. Questionnaires have been created which could be used as guidelines during the interviews. The interview results were evaluated with the help of an interview analysis, a key aspect identification, a case composition, and an evaluation of the findings. The latter activity comprises the development of new propositions derived from the previous findings, which facilitates the development of new perceptions on the SOA topic. Therefore, this may trigger a reaction on both theoretical foundations and current focus areas.

IV. CASE STUDY FINDINGS

Although the number of already implemented services and SOA-supported processes varies, the findings of the different cases are not contradictory to each other. On the contrary, the single cases complement one another. Therefore, it is possible to give a generalized overview of the SOA maturity and readiness of the German banking industry, which is presented in the following.

A. SOA Adoption

The first aspect under investigation is SOA Adoption. An initial finding is that the basic technical platform has already been developed for each bank and all technical issues in this regard could be solved appropriately. However, only few processes are completely implemented using services. Instead, services are often implemented as single, separate "islands", where service communication is restricted to some legacy applications which are enhanced by service functionalities. In addition, services are mostly used in parts of the architecture intended for interaction with the customer, i.e., supporting sales processes with service-based web applications.

The general motivation for implementing a SOA was always driven by the bank itself and not by external consultants or vendors. However, in the actual SOA implementation phase, external consultants have often been involved.

Differences emerge with regard to both the Enterprise Service Bus (ESB) and the Service Registry. An ESB represents a specific middleware that enables a SOA to become more scalable, more reliable, and location-independent [2], whereas a Service Registry provides a library which enables the user to find and to bind new services according to the users' preferences. Only one of the interviewed institutions can offer both an ESB and a Service Registry, while the others cannot. This is exactly the institution which integrated an off-the-shelf-product. In contrast to that, the SOAs of the other banks are self-developed solutions.

The main reason for this phenomenon is that when buying standard SOA technology, the ESB and the Service Registry are mostly included. By contrast, in self-developed SOAs, the development objective is rather the creation and enhancement of single services than the implementation of appropriate tools for organizations and flexible middleware. Especially due to the latter, often no XML-based ESB is available in self-developed SOAs and the services are mostly organized in simple sheets, e.g., using MS-Excel.

Another important aspect is the conformance of processes. Our study shows that process documentations have partially been created. However, holistic process documentations due to SOA adoptions have never been made. Documentation was created for single projects or single divisions only. The banks were rather organized project-oriented than process-oriented, so that SOA is mostly focusing on domains and less actually focusing on business processes.

With regard to the organization, only in one case the entire organization has been involved in the SOA implementation, so that each employee could gain the required SOA awareness. In the three other cases, only the divisions of the banks responsible for SOA adoption were involved, while SOA awareness of other employees – which are potential end-users – is missing. In these cases, SOA is regarded as a technical topic only and does not receive much support from the business side.

B. SOA Operations

The second focus of our research is on already established SOAs, which refers to the so-called SOA operations phase. Since SOA adoption in the examined German banks is nearly completed, the next step is to check the SOA Life Cycle Management as well as competitive advantages and challenges.

Although none of the interviewees assumes that SOA represents a general security issue, they state that it has to be ensured that the used SOA does not lead to any security issues as it evolves. According to the interviewees, keeping track of security issues as the SOA grows is critical. In order to guarantee a high level of security, external services are used only for special cases, such as SCHUFA requests. However, in all other cases, if an external service is involved, the provider is also part of the bank group or the service is specified together with the provider. The communication channel is secured and only individually specified dedicated communication channels were used. A registry based on the common UDDI-standard is used in none of the cases while no services are included in a flexible and loosely coupled manner either.

Further issues in the phase of SOA operations are the poor reusability of services, the change to newer versions, and low performance of services in the core banking functionality. Performance monitoring is seen by the interviewees as an appropriate method to check and enhance the value of the SOA. However, in practice this is done rarely since either no monitoring components exist or they are not in use yet. Reusability is almost always the only metric which exists in a SOA and which is measured.

The study shows that an important point is the choice of the services' granularity. This choice has to be made carefully, since the performance is low for too small designed services, whereas the reusability is low, if the services are dimensioned too large. In any case, much time is needed to redesign the services, so that a high amount of costs occurs.

Often issues arise concerning the exchange of services due to newer versions, in the case that no ESB is used. As mentioned in [6], an XML-based ESB can support the SOA in making the communication easier and solving coordination conflicts. Since there is mostly no XML-based ESB available in self-developed SOA implementations, especially these kinds of problems arise. Mostly the legacy applications do not support XML and are restricted to apply comma separated files only to communicate between service purchaser and service user.

Another objective was to investigate competitive advantages. Concerning this matter, an often mentioned argument is that SOA makes the outsourcing of processes easier. In fact, all interviewed banks agreed on this argument. As explained by one of the participating banks, process orientation is a key objective for adopting SOA, thus, process outsourcing represents rather a requirement than solely an advantage. Another bank could already achieve a reduction of complexity due to the outsourcing of SOA-supported processes. In spite of its high potential, process outsourcing with SOA is used to a low extent in practice. The most important issue in this context is the coordination and the definition of standardized services in the banking industry, which are actually accepted by all investigated German banks.

All in all, in the initial phases, a SOA incurs a lot of costs, thus, SOA should be seen as an investment for the long-term. Since the observed SOAs have not been in operation long enough, competitive advantages could not been proven yet.

C. SOA during M&A phases

The third focus of our research is SOA during M&A phases. The investigation has shown that the motivation for involving SOAs during such phases is almost always driven by aspects of cost reduction. Especially, when both the buyer and the acquired company can offer a well established SOA, the actual conduction of the M&A is expected to become easier from a technical perspective and the cost reduction becomes significant.

An often mentioned motivation for SOA adoption is that in phases of M&A a best-of-breed approach can be used. However, such an approach was used by none of the interviewed banks. The interviewees argue that it is too difficult, time-consuming, and expensive in practice to decide which of the available services offers the highest value contribution, since the SOAs are not as well established as to let this decision be made by the SOA automatically. Additionally, the already existing services ensure a higher level of compatibility to the existing architecture of the buyer than the others. Often, these issues result in choosing poorer services instead of superior ones.

Currently, the observed German banks prefer to keep only the architecture of the buyer and to import all required data of the IT architecture from the acquired company. As a

B1	T	O	P
1	+	+	+
2	+	+	+
3	+	0	0
4	0	-	-
5	-	-	0

B2	T	O	P
1	+	+	+
2	+	+	+
3	+	0	0
4	0	-	-
5	-	-	-

B3	T	O	P
1	+	+	+
2	+	+	+
3	+	+	0
4	0	0	-
5	-	-	-

B4	T	O	P
1	+	+	+
2	+	+	+
3	+	0	0
4	0	-	-
5	-	-	-

Figure 2:   SOA TOP-View

consequence, most parts of the IT architecture from the acquired company will be discarded.

While no best-of-breed approach is used in practice, a SOA could offer some other advantages in M&A phases. Prior to the M&A phase, organizing the SOA adoption results in a high-level overview of the bank's IT architecture. The interviewees argue that this overview enables the bank to make decisions easier regarding the merger of both IT architectures. However, this advantage is just a subjective perception of the interviewees and could not be quantified in practice.

V. DETERMINATION OF THE SOA MATURITY LEVEL

To sum up the findings of the case study and to offer a high-level overview, the SOAs of the investigated German banks have been rated using the SOA Maturity Model from Johannsen and Goeken [7].

Figure 2 depicts the results of the maturity levels visualized as SOA TOP-Views (Technical, Organizational, and Procedural Aspects). This kind of visualization enables the reader to get a quick high-level overview of the SOA maturity in the examined German banks. The rows are derived from the Common Capability Maturity Model Integration (CMMI) model [3, 8]. "Initial" (level 1) means that no SOA exists but the first SOA awareness is available. In level 2 ("Managed") some processes are already implemented in a service-oriented way. The SOA is "Defined" (level 3) as soon as the entire enterprise is covered by the SOA. "Quantitatively Defined" (level 4) means that performance measuring tools are commonly integrated and used. Finally, when the level 5 ("Optimizing") is achieved, the SOA is getting refined continuously.

Fields containing a plus (+) display already achieved levels, fields marked with a zero (0) denote levels which are not yet achieved, since they are still in progress, and the sign minus (-) means that this level of maturity probably cannot be achieved in the short-term.

The result of this rating is remarkable: Contrary to the states of the banks, the actual results from the investigated banks are very similar to each other. This finding is also reflected in the maturity level. Although the technical aspect can always offer the highest level of maturity, all in all the investigated banks can be assigned to maturity level two.

A special case represents the first bank (B1) and its procedural aspect. This is because B1 has an institution for optimizing IT and SOA.
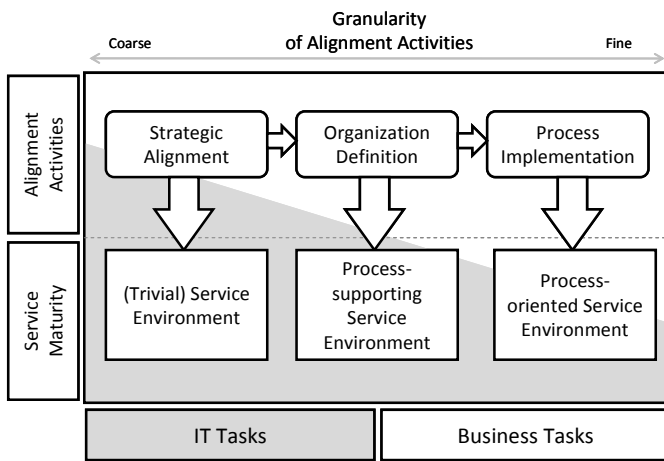
Figure 3:   Maturity of the service landscape

These are exactly the requirements for reaching level five for the process aspect. However, since level four has not been achieved yet, the overall maturity of B1 cannot reach the next level.

VI.   CONCLUSIONS AND OUTLOOK

This paper presents the findings of the SOA readiness and maturity case study within the German banking industry. It builds on an already established research framework regarding SOA maturity and SOA readiness. The evaluation of the conducted interviews has shown that SOA readiness is already present in the German banking industry. On the other hand, the maturity levels of SOAs in the observed German banks are very similar to each other: a basic technical platform is established, but a holistic and mature enterprise SOA including a well established SOA Life Cycle Management could not be found – therefore, all investigated banks are assigned to maturity level two, making progress towards level three.

A major issue which hinders higher maturity levels is the missing alignment between management and IT. This results in weak management support in topics that regard SOA and too much responsibility for the IT departments. This issue leads to SOAs which are not process-oriented, since the IT has the responsibility but not the opportunity to align SOA on the business processes, because only poor documentation is available. On the other hand, the business is almost always project-driven only and does not offer business process support.

As a result of this issue, the dependencies between the granularity of management activities and the maturity of the service landscape are visualized in Figure 3. Here, the granularity of alignment activities represents the independent variable, whereas the maturity of the service landscape is the dependent variable. This model focuses on the maturity of the services and not on the entire SOA, since, as we found out, the functionality of the services gains the highest importance for the interviewees. An initial strategic alignment is required to create a trivial service environment. If additional roles are defined and the organization structure is redesigned according

to SOA, the service landscape is able to support the processes. If and only if the business side of the enterprise both creates process documentations and supports the IT by implementing these processes, a process-oriented service environment can be created.

The case study shows that SOA in German banks has some room for further improvements. Therefore, it would offer interesting insights to conduct a longitudinal analysis by repeating this investigation again in a few years, in order to compare the findings and to observe the improvements over time.

VII.   ACKNOWLEDGMENTS

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