[SRE+07] *Stefan Schulte, Nicolas Repp, Julian Eckert, Rainer Berbner, Korbinian von Blanckenburg, Ralf Schaarschmidt, Ralf Steinmetz*; **General Requirements of Banks on IT Architectures and the Service-Oriented Architecture Paradigm.** In: 3rd International Workshop on Enterprise Applications and Services in the Finance Industry (FinanceCom 2007), December 2007. ©D

General Requirements of Banks on IT Architectures and the Service-Oriented Architecture Paradigm

Stefan Schulte[1], Nicolas Repp[1], Julian Eckert[1], Rainer Berbner[1], Korbinian von Blanckenburg[2], Ralf Schaarschmidt[3], and Ralf Steinmetz[1]

[1] Multimedia Communications Lab (KOM)
Technische Universität Darmstadt, Germany
schulte@kom.tu-darmstadt.de
Phone: +49-6151-166187
Fax: +49-6151-166152
[2] Institute of Public Finance
Westfälische Wilhelms-Universität Münster, Germany
12kobl@wiwi.uni-muenster.de
[3] IBM Global Business Services, Germany
ralf.schaarschmidt@de.ibm.com

Abstract. The Service-oriented architecture (SOA) paradigm has been gaining momentum over the last few years. Although the banking industry has often been mentioned as an early adaptor of service-oriented technologies, there is still a lack of knowledge concerning bank requirements on IT architectures and whether an SOA is suited to meet them. In this paper, we present the results from an empirical study which quantifies the qualification of service-oriented technologies for the German banking industry. By using data collected from the German banking industry, it turns out that SOA is apparently suited to meet predefined needs of this industry. However, there are differences in the expectations among various groups of banks. In addition, this paper presents the status quo of SOA adaptations in German banks.

1 Introduction

Although service-orientation is based on well-known concepts like autonomy and the loose coupling of software components, the adaptation of Service-oriented architectures (SOA) in the research community, as well as, in the software industry has been stimulated in recent years by the standardization of Web service technologies. When considering SOA for the banking industry, most of the academic discussions address how SOA can be applied to predetermined domain-specific problems like the management of capital market systems [17,18] or the core banking system [4,25]. Other research approaches focus on quality aspects and other related concepts (e.g., [2]).

In contrast, only a few empirical studies (cp. Sect. 2.3) have been conducted regarding to the impact of SOA on the banking industry in general. Therefore,

we decided to extend our previous research in the field of SOA by analyzing the German banking industry based on an empirical survey [19].

In this paper, selected results from a survey we conducted among CIOs, CTOs, IT architects, and enterprise architects from Germany's 1001 largest banks (with respect to their balance sheet totals) are presented. The rate of return was 5.19%.

The key focus of this survey was to access whether SOA is a major trend or mere hype for the German banking industry – thereby determining whether SOA is suited to meet the requirements of the German banking industry. Furthermore, the status quo of SOA adaptation in German banks was also investigated. Consequently, the following research question was the key motivation behind the survey:

Is SOA a major trend or hype for the German banking industry?

The remaining part of this paper is structured as follows. In the next section, the basics and common benefits of SOA, its potential impact of SOA on banks, and relevant related work are introduced. Based on this theoretical foundation, nine statements were identified which formed the basis of our questionnaire (Sect. 3). Following this, the results of our empirical study are presented in Sect. 4. Finally, the paper concludes with a summary of the findings in this paper and an outlook of our future work.

2 Theoretical Foundation

In order to answer our research question, it is necessary to define SOA and evaluate its potential role in the banking industry. Hence, we introduce SOA with regard to the banking industry in the following paragraphs. In Sect. 2.1, we briefly explain the SOA paradigm. Subsequently, Sect. 2.2 introduces the potential benefits and effects of SOA on the banking industry. Relevant related work is also included in Sect. 2.3.

2.1 The Service-Oriented Architecture Paradigm

Since the term SOA was coined in 1996 by Gartner [20], several publications have redefined it. In recent years, SOA has often been used synonymously with Web service technologies, even though there are great differences between the actual implementation of an SOA with a certain technology (i.e., Web services) and the underlying concepts which constitute the SOA paradigm. As the term "paradigm" implies, SOA is not a technology but a holistic approach to design an application architecture. By using service-oriented concepts, it is possible to model business processes independent of actual technologies or tools [18].

In order to define the architectural part of SOA, we make use of the following principles [5]:

1. All functions (e.g., business functions) are defined as services.
2. All services are independent and can be used without paying attention to the actual implementation.
3. Services can be accessed by an invokable interface without any knowledge of its location.

Accordingly, an SOA is *"an application architecture within which all functions are defined as independent services with well-defined invokable interfaces which can be called in defined sequences to form business processes"* [5].

By using this definition, it is possible to apply the SOA paradigm to an application architecture in general or to map exactly one aspect of a company's business model [13]. Business-oriented services may be mapped to (parts of) business processes, thus allowing new internal and external users to access processes, replace business functions, reorganize processes, or build new business functionalities from existing services.

In order to design services or processes in an SOA, it is necessary to identify and comprehend the business aspects of an organization [6]. Thus, the IT perspective of SOA is strongly related to its business perspective. Otherwise, there is also a strong relationship between the business side and SOA. SOA enhances the agility and flexibility of companies, making it possible to offer new products and services. As a result, business processes might have to be adapted in order to tap the full potential offered by service-oriented technologies [24].

Today, the technology most commonly associated with the implementation of SOA are Web services. With standardized Web service technologies like SOAP [14], WSDL (Web Service Description Language [3]) or UDDI (Universal Description Discovery and Integration [7]) it is possible to apply service-oriented concepts on the web [15].

2.2 Current State of Research on SOA and the Banking Industry

The banking industry is often recognized as a technology leader in terms of its early utilization of new information technologies (e.g., [18,23]). In the following, we briefly present effects of SOA on banks.

Most commonly mentioned benefits of implementing an SOA include the ability to build agile enterprise systems architectures, which are able to support business flexibility and organizational speed. Adaptation and active application of service-oriented technologies are the foundation for transforming a business model (e.g., by realizing new outsourcing strategies) [13]. Furthermore, service-oriented technologies are considered to be able to solve strategic challenges like application integration, value reconfiguration processes, value preservation after mergers and acquisitions, and enable more agile forms of IS development [1].

Rabhi et al. state that banks especially benefit from the implementation of an SOA due to the reusability of services across several business processes and the ability to provide legacy system functionalities without exposing underlying logics. On the other hand, SOA involves performance drawbacks and requires extra development time due to the need to develop additional service wrappers

[18]. Homann et al. dwell especially on the evolution from the formerly monolithic value chain towards a more fragmented value net in which separate activities (i.e., services) have to be fulfilled by specialized entities. Accordingly, information systems have to be coupled in order to enable communication within companies and between an organization and external partners. SOA provides an approach which reduces the complexity and costs of these requirements [10].

Apart from these academic considerations, there are several examples where banks have already implemented an SOA. For example, *Credit Suisse* began deploying service-oriented concepts in 1998 in order to uncouple their platforms and functional groups of applications [9,16]. The primary objective was to reduce the complexity of Credit Suisse's IT ecosystem, thereby increasing its comprehensibility. The system landscape was partitioned into 90 components, hence, instead of administrating a large and complex landscape, it is now possible to manage smaller and less complex components on the one hand and clearly defined interfaces on the other hand.

While Credit Suisse is a large organization with its own internal IT management, a large portion of the German banking industry consists of local savings banks and credit unions which outsource most of their IT infrastructure to data processing service centers established by their umbrella associations. *Sparkassen Informatik* for example, provides such IT services supporting more than 230 German savings banks. As a result of its large number of customers, the application landscape is highly distributed and heterogeneous. In order to tackle the challenges due to the centralized character of the application landscape (e.g., the fast and inexpensive business process integration between Sparkassen Informatik and the savings banks or a highly heterogeneous front end landscape) a Web services-based SOA was implemented in order to meet IT strategy requirements, e.g., minimization of interfaces required, decrease of data transferred, and reduction of development efforts by minimizing interface complexity [4,25].

2.3 Related Work

To the best of our knowledge, this is the first ever survey to analyze the impact of SOA on the German banking industry in detail. However, surveys have been conducted which are related to our study regarding content. *ibi research* (University of Regensburg, Germany) interviewed 21 IT architecture experts from German credit institutions and other related industries (e.g., Deutsche Bank, Credit Suisse, and SAP) in 2005 [12]. While there are certain similarities between this survey and our approach, the focus of these surveys differ especially concerning IT architectures, which is examined in more detail within our study. Furthermore, ibi research interviewed employees of large banks and companies primarily, while we invited CIOs, CTOs, IT architects, and enterprise architects from the 1001 largest (including smaller and medium-sized) German banks to participate in our survey. Major results of ibi research include the following findings [12]: 1. Cost reductions are the primary goal of SOA. 2. SOA is the foundation for an efficient collaboration between business and IT departments. 3. SOA exceeds the

pure technological aspects and includes functional architecture, organizational structure and a governance model.

While these findings helped to describe the current implementation efforts of German financial institutions, the study did not evaluate whether SOA is the most qualified application architecture paradigm to fulfill the requirements of the financial industry.

Another brief analysis of SOA in the German financial industry was carried out by *Fraunhofer IRB* in 2005 [22]. Furthermore, non-academic surveys – e.g., by *Infoworld* and *Gartner* – investigated SOA among other topics, in 2005 and 2006 respectively [8,11].

3 Methodology and Sample Characteristics

Within this section, the methodology used is discussed. In addition, we present the characteristics of the target audience of this survey.

3.1 Methodology

As mentioned in Sect. 2, we identified nine statements which formed the foundation for our questionnaire [21]:

- A company has to adopt an SOA if it wants to stay competitive and achieve continuous growth.
- The active adaptation and use of an SOA enforces innovation in a company's processes and products.
- Flexible and agile business processes are only possible if an SOA is adopted.
- The SOA paradigm is a holistic approach not limited to IT or business only.
- Companies have a need for action regarding SOA.
- The SOA paradigm will have an impact on both the development of custom software and standard software.
- Service-orientation is a critical success factor for future outsourcing activities.
- SOA offers protection of investments.
- The adaptation of service-oriented technologies leads to cost reductions.

For this survey, the 1001 largest banks in Germany were chosen, based on their total assets as reported officially in 2003. All banks were contacted by phone to identify possible participants. This group of contacts included CIOs, CTOs, IT architects, and enterprise architects of the banks selected. We identified one contact per bank. As a large number of banks does not participate in surveys in general and a number of people contacted were not able to participate due to time constraints and other reasons, we invited 288 out of 1001 banks to fill out our online questionnaire made up of 27 questions with more than 120 variables.

In total, 52 analyzable questionnaires were returned. This equals a response rate of 18.06% among the invitees and 5.19% among the 1001 largest banks.

Table 1. Participants

	1001 largest banks		Rate of return	
German banks	Number	Percentage	Number	Percentage
Commercial banks	51	5.09%	5	9.62%
Credit unions	495	49.45%	32	61.54%
Savings banks	455	45.45%	15	28.85%
Total	1001	100%	52	100%

3.2 Sample Characteristics

The German banking industry is divided into three types of banks: commercial banks, credit unions, and savings banks. While credit unions and savings banks often supply their products to customers within a certain geographical area, commercial banks are not limited to any particular region.

As shown in Table 1, the rate of return of commercial banks and credit unions is higher than expected while the rate of return of savings banks is lower than expected. A contingency analysis showed that the distribution of participating banks did not match the distribution in the basic population of the 1001 largest German Banks. Hence, the distribution of the banking groups is not representative (cp. Sect. 4.4).

In order to analyze the data with reference to the previous knowledge of the participants, we asked for a self-assessment regarding the concepts/terms service-orientation and SOA. The evaluation scale spans from "not familiar" to "familiar" on a five-point Likert scale. As shown in Fig. 1, almost 77% of the par-

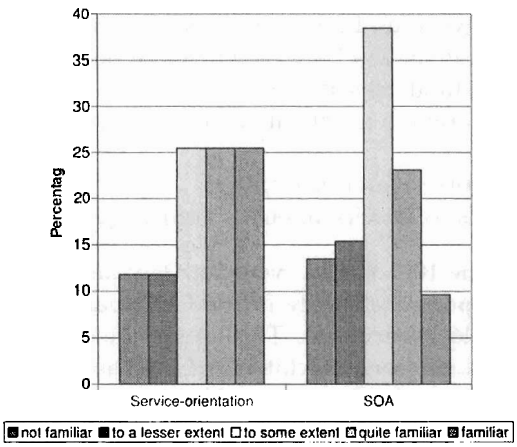


Fig. 1. Familiarity with the concepts Service-orientation (n_1=51, μ_1=3.41, σ_1=1.31) and SOA (n_2=52, μ_2=3.00, σ_2=1.15)

ticipants are "to some extent familiar" with the concept of service-orientation, about 51% are even "quite familiar" or "familiar" with this concept. By examining the results of the SOA concept, the figures are similar, with nearly 71% of the participants being familiar with this concept "to some extent". Nearly 32% are "quite familiar" or "familiar" with the concept SOA.

4 Empirical Results

In the following results from our survey are presented. First, the current and future relevance of requirements on IT architectures are assessed in Sect. 4.1. Subsequently, the status quo of SOA adaptation in the German banking industry is presented. Section 4.3 introduces restrictions for the adaptation of SOA. Limitations and the transferability of our results are considered in Sect. 4.4.

Table 2. Classification of criteria

	Criterion is met by an SOA	Criterion is partially met by an SOA	Effect of SOA implementation on criterion is difficult to measure
Flexibility of business processes	X		
Turnover increase			X
Cost savings			X
Reduction of time-to-market		X	
Integration potential	X		
Scalability		X	
Reduction of risks			X

4.1 Assessment of current/future relevance of requirements on IT architectures

Seven core requirements of banks on IT architectures were identified by a panel of experts before the actual empirical study. As not all criteria can be met to the same degree by an SOA, the requirements were classified by their feasibility to be met by an SOA (cp. Table 2).

Participants of our study separately assessed the current and future relevance of the seven requirements. The evaluation scale spans from "not relevant" to "most relevant" on a five-point Likert scale.

As shown in Table 3, the criterion *cost savings* has the highest mean of all specified requirements. The relatively low standard deviation of 0.65 (current relevance) and 0.61 (future relevance) establishes the particular relevance of this criterion. More than 90% of the survey participants deem cost savings "relevant" or "most relevant". There are no significant deviations of means between the different groups of banks presented in Sect. 3.2. While the criteria *flexibility of*

Table 3. Relevance of requirements on IT architectures (n=52)

	Current relevance		Future relevance		Difference	
	μ_1	σ_1	μ_2	σ_2	Δ_μ	Δ_σ
Cost savings	4.35	0.65	4.46	0.61	+0.11	-0.04
Flexibility of business processes	3.96	0.79	4.31	0.73	+0.35	-0.06
Reduction of risks	3.92	0.95	4.33	0.73	+0.41	-0.22
Turnover increase	3.60	0.98	4.04	0.84	+0.44	-0.14
Reduction of time-to-market	3.58	1.00	3.87	1.03	+0.29	+0.03
Scalability	3.40	0.87	3.62	0.93	+0.22	+0.06
Integration potential	3.33	1.00	3.25	1.23	-0.08	+0.23

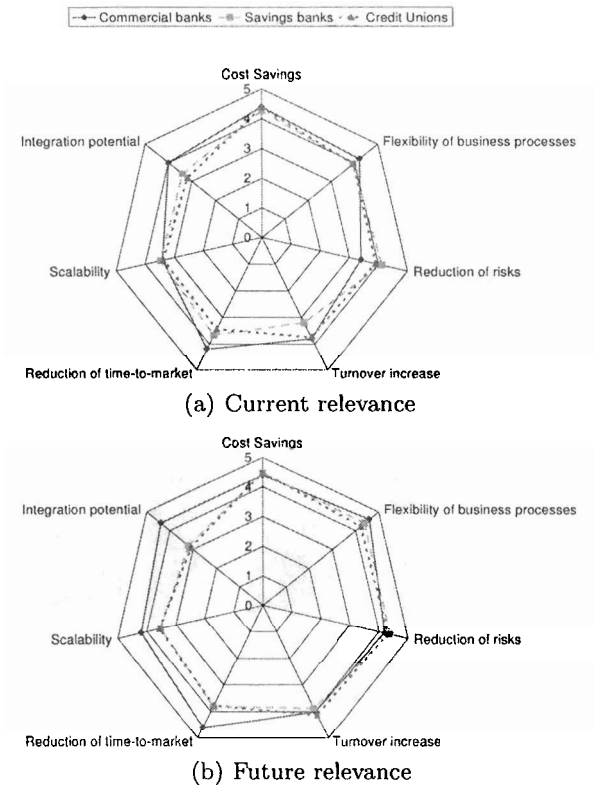
business processes (μ_1=3.96, μ_2=4.31) and *reduction of risks* (μ_1=3.92, μ_2=4.33) have significant impact, *turnover increase* (μ_1=3.60, μ_2=4.04) and *reduction of time-to-market* (μ_1=3.58, μ_2=3.87) are of secondary importance. *Scalability* (μ_1=3.40, μ_2=3.62) and *integration potential* (μ_1=3.33, μ_2=3.25) feature the lowest means amongst the requirements observed.

Except for *integration potential*, all means observed are significant deviations from the expected value "to some extent relevant (3)" at the 0.01 level. The mean of *integration potential* is a significant deviation at the 0.05 level for the current relevance, but there is no significant deviation from the expected value for the future relevance of this requirement.

When comparing the results of this part of our survey with the classification presented in Table 2, the results have to be analyzed critically. *Integration potential*, which is one of the both criteria presented that is definitely met by an SOA, is rated as less relevant than any other criterion. The criteria *reduction of time-to-market* and *scalability*, which are partially met by an SOA, are relatively unimportant, too.

Beside *integration potential*, *flexibility of business processes* is the second requirement definitely met by an SOA within the context of this study. Only the requirement *cost savings* is rated more relevant than *flexibility of business processes*. This shows that a large part of the banking industry attaches great importance to flexible business processes. Consequently, this requirement has to be met by an application architecture.

Otherwise, *integration potential* is rated as more relevant by commercial banks than by savings banks and credit unions, with means of 4.00 (current relevance) and 4.40 (future relevance). The mean of future relevance has a significant deviation at the 0.05 level from the mean of all savings banks and credit unions (3.13). Regarding the future relevance, *reduction of time-to-market* is also assessed more relevant by commercial banks (mean of 4.60) than by all other banks (mean of 3.79) with a significant deviation at the 0.10 level. The attitude of different banking groups towards individual requirements is depicted in Fig. 2.



(a) Current relevance

(b) Future relevance

Fig. 2. Relevance of requirements on IT architectures

The higher need for *integration* in commercial banks might be explained by the different IT strategies of savings banks and credit unions. While last-mentioned groups of banks often outsource most of their IT department to data processing service centers established by their umbrella associations, commercial banks mostly operate their own IT infrastructure and do not outsource to the same extent. However, outsourcing is part of the IT strategy of commercial banks, too.

Therefore, IT architecture experts from commercial banks have an increased recognition for the need to integrate (legacy and other) systems. Furthermore, *integration potential* is especially needed if a bank has to deal with mergers and acquisitions. This explains the higher requirement for integration in commercial banks, too, as mergers and acquisitions are rather a characteristic of the business model of commercial banks than of credit unions or savings banks.

4.2 Status Quo of SOA Adaptation in the German Banking Industry

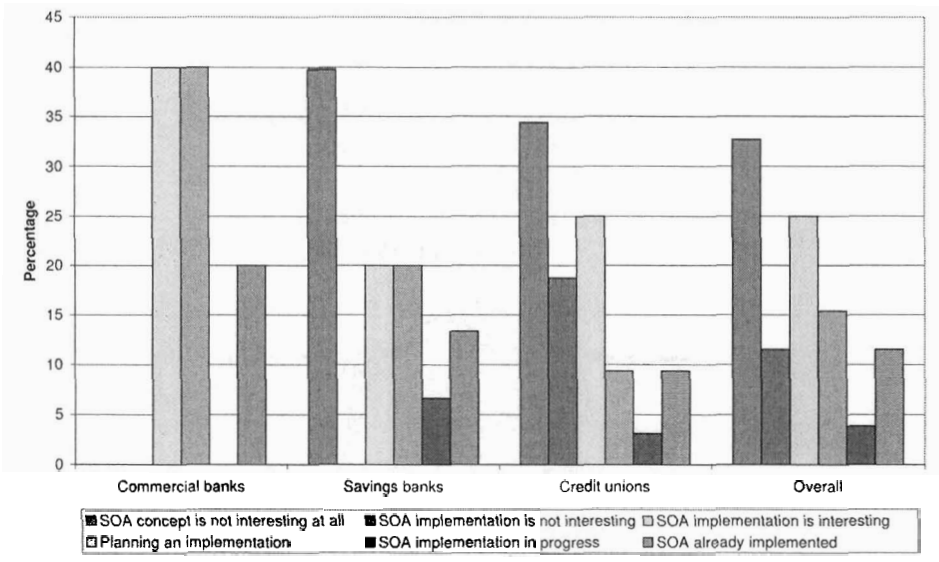


Fig. 3. Status quo of SOA adaptation in the German banking industry

Apart from general requirements on IT architectures and reasons against SOA adaptation (cp. Sect. 4.3), we examined the current status of SOA implementations in the German banking industry. The participants were requested to estimate the progress of the adaptation of SOA in their company. As shown in Fig. 2, 30.77% of the participants state that their organizations *plan an SOA implementation*, *are currently implementing an SOA* or *have already implemented an SOA*. Further 25% *consider an implementation interesting*.

Although the acceptance of SOA in the surveyed banks seems to be surprisingly high with nearly one third of the banks bringing an SOA into operation or already operating an SOA, it should be taken into account that the propagation of service-oriented technologies in the German Banking Industry is promoted either by external parties (e.g., data processing service centers or consulting companies) or by internal IT departments. For example, Sparkassen Informatik (cp. Sect. 2.2) supports one tenth of the German banking industry (or half of all savings banks) with its Web services-based SOA [4,25]. Otherwise, it should be noted that only 13.33% of the participating savings banks claim that they already have an SOA in production.

This data conflicts with the assumptions we made earlier and should be further observed in the future. One possible explanation for this discrepancy

between estimated and actual values could be the low visibility of technologies in use in the data processing service centers. Nevertheless, the results show the extensive distribution of SOA in German banks with 11.54% of all participating banks operating an SOA.

Concerning the different banking groups, our presumptions from Sect. 4.1 regarding the higher need for SOA-related requirements in commercial banks are confirmed (cp. Fig. 3). 60% of the commercial banks plan an SOA implementation or have already implemented an SOA. The percentage of credit unions planning or currently performing an SOA implementation or running an SOA is considerably lower (21.88%). With 40%, the percentage of savings banks ranges between the values for the other banking groups.

4.3 Restrictions for the Adaptation of SOA

While the results from Sect. 4.1 and Sect. 4.2 indicate that SOA meets the requirements of German banks and is already well distributed in this sector, a large percentage of banks also have no plans to or interest in adapting service-oriented technologies at the time of the survey.

Prior to the actual empirical study, the following possible reasons for the lack of interest in SOA were identified by a panel of experts:

- SOA-technologies are not standardized
- Lack of experience in the SOA field
- Short-/medium-term benefits are not identifiable/measurable
- Insufficient budget
- Assumptions about the future market environment do not apply
- Organizational restrictions
- Strategic restrictions

Table 4. Restrictions for the adaptation of SOA

	Overall n=52		Commercial banks		Savings banks		Credit unions	
	μ_1	σ_1	μ_2	σ_2	μ_3	σ_3	μ_4	σ_4
Lack of experience	3.52	1.13	3.00	1.22	3.20	1.37	3.75	0.95
Organizational restrictions	3.23	0.90	3.60	0.89	2.93	0.88	3.31	0.90
Technologies are not standardized	3.13	1.01	2.80	0.84	3.27	1.10	3.13	1.01
Insufficient budget	3.06	0.98	2.60	0.55	2.67	0.90	3.31	1.00
Short-/medium-term benefits are not identifiable	3.04	1.01	3.00	1.41	2.73	0.88	3.19	1.00
Strategic restrictions	2.94	0.89	2.60	0.89	2.67	0.90	3.13	0.87
Assumptions about the future market environment do not apply	2.62	0.93	2.00	1.00	2.33	0.82	2.84	0.92

The participants of our study assessed these cases on a five-point Likert scale spanning from "does not apply" to "applies".

As shown in Table 4, *lack of experience in the SOA field* has the highest mean (μ_1=3.52) of the identified obstacles. *Organizational restrictions* (μ_1=3.23) and the assumption, that *SOA-technologies are not standardized* (μ_1=3.13) show relatively high means, while *insufficient budget* (μ_1=3.06) and *non-identifiable short-/medium-term benefits* (μ_1=3.04) are of secondary importance. *Strategic restrictions* (μ_1=2.94) and *incorrect assumptions about the future market environment* (μ_1=2.62) feature the least means of all reasons identified.

The observed means for *lack of experience* and *incorrect assumptions about the future market environment* are significant deviations from the expected value "neutral (3)" at the 0.01 level, the mean of *organizational restrictions* is a significant deviation at the 0.10 level. There is no significant deviation for the means of the remaining criteria.

IT experts in the field of SOA (i.e., participants that considered themselves to be familiar with SOA in Sect. 3.2) assess the reasons of *non-standardized technologies* (mean of 2.40) and *non-identifiable short-/medium-term benefits* (mean of 2.00) significantly lower at the 0.05 (*technologies*) respectively 0.10 (*benefits*) level than all other participants (means of 3.21 and 3.15).

The different banking groups also assessed the particular reasons very distinctly. Credit unions tend to rate most criteria higher than savings banks, while commercial banks tend to evaluate most criteria lower. It should be noted that *organizational restrictions* are exceptional as commercial banks rate them higher than any other banking groups. Furthermore, this criterion possesses the highest mean of all criteria for commercial banks (cp. Table 4).

As a result, the means of credit unions for the reasons of *non-standardized technologies* and *incorrect assumptions about the future market environment* are significantly higher at the 0.05 level compared to other banks. Furthermore, the reasons *lack of experience* and *insufficient budget* are significantly higher at the 0.10 level. Especially the *lack of experience in the SOA field* confirms the finding from Sect. 4.2 that SOA is less distributed in credit unions compared to other banking groups.

4.4 Limitations and Transferability of Results

There are two limitations on the research presented. First, the survey data was collected at a specific point of time (i.e., at the end of 2006 and the beginning of 2007) and therefore provides a snapshot perspective. Future rollouts of this survey will show the development of SOA in the banking industry and if the SOA adaptations planned in banks (cp. Sect. 4.2) have been realized.

Furthermore, generalization made from the data collected is limited due to the low response rate of 5.19% from the 1001 banks in scope. Besides, the distribution of participating banks within the banking groups does not match the distribution of banking groups for the 1001 largest German banks (cp. Sect. 3.2).

However, we still believe that the results are able to provide insight into application architectures within the German banking industry. This industry is largely characterized by its organization into three banking groups, but continues undergoing massive changes due to regulations and adjustments in the market.

As we analyzed the results within each banking group, it is possible to transfer the results for commercial banks to countries that are more characterized by, e.g., commercial banks. Nevertheless, the results are only indicative for other industries or countries.

5 Summary and Future Work

In this paper, we have presented results from a survey we conducted among CIOs, CTOs, IT architects, and enterprise architects from Germany's 1001 largest banks. The goal of this survey was to identify whether SOA is regarded as a major trend or mere hype within the German banking sector.

It has been shown that the criteria requested by banks are difficult to measure, i.e., *cost savings*, *reduction of risks* or *turnover increase*. *Flexibility of business processes*, which is a typical characteristic of SOA, is also requested. Otherwise, SOA-typical requirements like *integration potential* and *reduction of time-to-market* are requested by commercial banks in particular, while these criteria only play a minor role for the German banking industry by large. This indicates that SOA is especially suited to fulfill the requirements of commercial banks. This assumption is further supported by the fact that SOA is already more widespread in commercial banks compared to credit unions. Furthermore, credit unions tend to assess reasons against SOA adaptation more strongly than all other banks.

Therefore, we interpret that SOA is already *more than just a hype* for commercial banks.

However, SOA is not relevant for every banking group to the same extent. While commercial banks seem to be technology leaders [18,23], especially credit unions are currently not adopting the SOA paradigm. It is most likely that the divergences between the banking groups result from the different expectations these groups have towards an IT architecture. Credit unions and savings banks often do not operate an extensive application architecture. Hence, these banks do not have a need for *integration potential* or *scalability* of a particular IT architectur paradigm. This assumption is supported by the presented data. As a result, in order to answer the question if SOA is a major trend or hype for the *whole* German banking industry, it should be investigated in what way credit unions and savings banks might benefit from the SOA paradigm.

It seems reasonable that SOA-related projects have already been set up or will be initiated in credit unions (and savings banks) by the service organizations established by their umbrella associations. In order to investigate the propagation of service-oriented technologies in these banking groups, we will set up a multi-participant case study in cooperation with the E-Finance Lab e. V. and IBM. This case study addresses the service organizations of both the credit unions and savings banks. The goal of this case study is to analyze the different strategies that service organizations follow while implementing SOA, as well as the impact of SOA implementation on affiliated credit unions and savings banks.

As aforementioned, the survey presented provides a snapshot perspective. Therefore, we intend to conduct further surveys in the following years in order to show the development of SOA within the German banking industry. While the intention of the presented survey was to get an overview of SOA in the German banking industry, future surveys and case studies will have a different focus, e.g., the actual value creation of SOA.

Acknowledgements

This work is supported in part by the E-Finance Lab e. V., Frankfurt am Main, Germany (www.efinancelab.com).

References

1. Baskerville, R., Cavallari, M., Hjort-Madsen, K., Pries-Heje, J., Sorrentino, M., Virili, F.: Extensible Architectures: The Strategic Value of Service-Oriented Architecture in Banking. In: Proceedings of the Thirteenth European Conference on Information Systems (ECIS 2005), Regensburg, Germany (2005) 761–772
2. Berbner, R., Grollius, T., Repp, N., Heckmann, O., Ortner, E., Steinmetz, R.: An approach for Management of Service-oriented Architecture (SoA)-based Application Systems. In: Proceedings of the Workshop Enterprise Modelling and Information Systems Architectures (EMISA 2005), Klagenfurt, Austria (2005) 208–221
3. Booth, D., Liu, C. K.: Web Services Description Language (WSDL) Version 2.0 Part 0: Primer. http://www.w3.org/TR/2007/REC-wsdl20-primer-20070626, accessed at 2007-08-18, W3C Recommendation (2007)
4. Brandner, M., Craes, M., Oellermann, F., Zimmermann, O.: Web services-oriented architecture in production in the finance industry. Informatik Spektrum **27** (2004) 136–145
5. Channabasavaiah, K., Holley, K., Tuggle Jr, E.: Migrating to a service-oriented architecture, Part 1. http://www-128.ibm.com/developerworks/library/ws-migratesoa/, accessed at 2007-08-19. IBM DeveloperWorks (2003)
6. Cherbakov, L., Galambos, G., Harishankar, R., Kalyana, S., Rackham, G.: Impact of service orientation at the business level. IBM Systems Journal **44** (2005) 653–667
7. Clement, L., Hately, A., von Riegen, C., Rogers, T. (eds.): UDDI Version 3.0.2 – UDDI Spec Technical Committee Draft. http://uddi.org/pubs/uddi-v3.0.2-20041019.htm, accessed at 2007-08-16, OASIS Standard (2004)
8. Gartner Group: User Survey Analysis: SOA, Web Services and Web 2.0 User Adoption Trends and Recommendations for Software Vendors, North America and Europe, 2005-2006. (2007)
9. Heutschi, R., Schemm, J. W.: Fallstudie: Serviceorientierte Architektur bei der Credit Suisse. St. Gallen: Institut für Wirtschaftsinformatik, Universität St. Gallen. http://www.alexandria.unisg.ch/publications/29504, accessed at 2007-08-13 (2005)

10. Homann, U., Rill, M., Wimmer, A.: Flexible Value Structures In Banking. Communications of the ACM **47** (2004) 34–36
11. InfoWorld Market Research: An Overview of the SOA Market, March 2005. Conducted by IDG Research Service (2005)
12. Koch, M., Rill, M.: Serviceorientierte Architekturen bei Finanzdienstleistern. ibi research an der Universität Regensburg GmbH, Regensburg, Germany (2005)
13. Krafzig, D., Banke, K., Slama, D.: Enterprise SOA: Service-Oriented Architecture Best Practices (The Coad Series). Upper Saddle River, NJ, USA, Prentice Hall PTR (2004)
14. Mitra, N., Lafon, Y.: SOAP Version 1.2 Part 0: Primer (Second Edition). `http://www.w3.org/TR/2007/REC-soap12-part0-20070427/`, accessed at 2007-08-18, W3C Recommendation (2007)
15. Papazoglou, M.P., Georgakopoulos, D.: Service-Oriented Computing. Communications of the ACM **46** (2003) 25–28
16. Ploom, T., Kurmann, A., Hagen, C.: Kombination der MDA und SOA als Mittel zur IT-Komplexitätsreduktion bei Credit Suisse. MDD, SOA und IT-Management (MSI 2007), Workshop, Oldenburg, Germany (2007)
17. Rabhi, F. A., Benatallah, B.: An Integrated Service Architecture for Managing Capital Market Systems. IEEE Network **16** (2002) 15–19
18. Rabhi, F. A., Yu, H., Dabous, F. T., Wu, S.Y.: A service-oriented architecture for financial business processes. Information Systems and E-Business Management **5** (2007) 185-200
19. Repp, N., Schulte, S., Eckert, J., Berbner, R., Steinmetz, R.: An Approach to the Analysis and Evaluation of an Enterprise Service Ecosystem. In: Proceedings of the 1st International Workshop on Architectures, Concepts and Technologies for Service Oriented Computing (ACT4SOC 2007), Barcelona, Spain (2007) 42–51
20. Schulte, R. W., Natis, Y. V.: "Service-Oriented" Architectures, Part 1, SPA-401-068. Gartner Group (1996)
21. Schulte, S., Repp, N., Berbner, R., Steinmetz, R., Schaarschmidt, R.: Service-oriented Architecture Paradigm: Major Trend or Hype for the German Banking Industry? 13th Americas Conference on Information Systems (AMCIS 2007), Keystone, Colorado, USA (2007)
22. Spath, D. (Ed.), Engstler, M., Praeg, C.-P., Vocke, C.: Trendstudie »Bank & Zukunft 2006«– Wettbewerbsfähigkeit durch Innovationen im Vertrieb und industrialisierte Prozesse. Stuttgart, Germany, Fraunhofer IRB (2006)
23. van Hillegersberg, J., van Oosterhout, M., Valkenier, R., Waarts, E.: Business Agility Requirements in Financial Services: Implications for IT Architectures. Second International Workshop on Enterprise, Applications and Services in the Finance Industry (FinanceCom05), Regensburg, Germany (2005)
24. Woods, D., Mattern, T.: Enterprise SOA: Designing IT for Business Innovation. USA, O'Reilly Media, Inc. (2006)
25. Zimmermann, O., Milinski, S., Craes, M., Oellermann, F.: Second Generation Web Services-Oriented Architecture in Production in the Finance Industry. In: Companion to the 19th Annual ACM SIGPLAN Conference on Object-Oriented Programming Systems, Languages, and Applications (OOPSLA '04), New York, NY, USA, ACM Press (2004) 283–289