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Value potential and challenges of service-oriented architectures - A user and vendor perspective.

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VALUE POTENTIAL AND CHALLENGES OF SERVICE-ORIENTED ARCHITECTURES - A USER AND VENDOR PERSPECTIVE

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Abstract

This article summarizes the results of 25 expert interviews, regarding the value potential and challenges of the Service-oriented Architecture (SoA) paradigm for users and software vendors.

On the user side, the SoA value potential most often mentioned by experts was agility, followed by process optimization. Cost reduction, through a more efficient development, or consolidation of redundant IS landscapes are also seen as a value potential. In contrast to the literature, reuse of services seems not that significant and is highly debated among the experts. In order to realize the value potentials, users have to overcome certain challenges. Here, the experts mention the financing of the investments, the setting up of a proper governance and the creation of a common understanding of the SoA paradigm as biggest hurdles.

For the software vendors, experts mention that SoA-based solutions create new market opportunities as lock-in-effects are lowered and offerings can be easier enhanced by third-party services. Regarding cost, there is potential to harmonize existing product portfolios or integrate acquisitions more easily. Development cost reduction is less evident at the current stage of adoption. It is assumed that lower lock-in effects also lead to increased competition, which could become a major challenge especially for established vendors.

Keywords: Service oriented Architecture (SOA), Business value of IT, Empirical study, Economics of IS

1   INTRODUCTION

IT departments are currently facing the challenge of determining whether they should adopt Service-oriented Architectures (SoA) as their key architecture paradigm. One reason why they are struggling with that decision is that it is still unclear whether SoA-based solutions can actually deliver the many promised value potentials. The basic idea behind the SoA paradigm is the support of business processes by IT systems consisting of services. Those services are clearly capsulated, and loosely coupled entities, which deliver a defined business functionality. (Erl 2008, p. 290ff), (Papazoglou & van den Heuvel 2007, p. 389). The SoA concept itself is technology-independent; however, SoA is mostly seen in direct correlation with the Web-Service technology and associated standards.

A first analysis shows that the main research into SoA is focused on technical integration questions, as well as on the design and management of services (Kaczmarek & Wecel 2008, Tab. 7, p. 56). So far there is a lack of independent and reliable studies on the actual value of SoA (Vitharran 2007 et al., p.7 f.). Whereas a large set of statements regarding the value potentials for SoA can be found in literature, correct theoretical deductions of the value arguments are very rare. In fact, most of the potentials are only non-revisable claims described at a very generic level. This lack of clear evidence leads to a critical discussion of SoA value in practice (e.g. Graegert (2007)).

The target of our research is to analyze which of the many SoA value potentials discussed in literature can be actually realized in practice. We do not aim for a complete return-on-investment or business case consideration, since such an analysis has to be case-specific (for a full framework to determine the RoI of SoA we refer to Beimborn & Joachim & Weitzel (2007)). The goal is rather to deliver more detailed findings for the value side of the equation, which is usually much harder to determine than the costs. We assume, that the costs for a SoA-based implementation can be quantified using classical IT cost estimation techniques, therefore we focus on the quantification of the benefits. In differentiation to the work of vom Brocke & Sonnenberg & Thomas (2008) who investigate the impact of SoA from a process perspective, we approach the question of SoA value from the perspective of added value of SoA to the entire enterprise. The underlying value concept is the economic value in terms of the EBIT impact, which focuses on the quantifiable effects in terms of revenue increase or cost reduction for the whole company. Effects that contribute only indirect to these two quantitative value drivers are considered as "qualitative" value.

It is important to distinguish two types of companies that can benefit from this value: On one hand, there is the rather small group of software vendors, meaning companies who develop software based on SoA in order to sell it. On the other hand, there are the companies who use these SoA-based software products or develop their own individual solutions while applying the concept (further on named "users"). As there are many similarities in the actual usage (e.g. both groups try to reuse services while developing a system) but also different motivations for the use of SoA, we incorporated both views in our study and try to gain an additional explanatory value from comparing the two sides.

Based on a literature analysis, an explorative expert-study was conducted from end of May till beginning of August 2008. A broad focus was chosen in order to determine as many relevant potentials as possible. After a short introduction into the methodology, this article summarizes the major results of the literature review and 25 expert interviews. Chapter 3 shows the categorization of value potentials based on the literature review. The next chapter then presents the results of the expert interviews by showing the order of mentions and describing the categories of SoA value potentials in more detail. Wherever possible, supporting examples from the interviews are shown. To emphasize that realizing the SoA value potentials requires significant effort, a paragraph on the challenges facing users and software vendors deducted from the expert interviews completes this chapter.

Due to the qualitative method used here, the results are not fully representative. Therefore, the article concludes with a critical discussion of the results and the prospect for the further research opportunities aiming for fully representative answers.

2   METHODOLOGY

Our overall research, targeted to identify the SoA value potentials observable in practice, is structured in three major steps: 1. State-of-the-Art analysis (literature review), 2. Qualitative survey (expert interviews) and qualitative evaluation, 3. Quantitative empirical survey (planned for early 2009)

This article summarizes the first and second step with a focus on the qualitative survey. The expert interviews followed an explorative approach, in order to determine a broad spectrum of value potentials. Semi-structured expert interviews were chosen, as they are a frequently used and well-suited method for this purpose (Denzin & Lincoln 2000, p.653). In this context, an expert is defined as a person, who possesses special knowledge on the subject. This knowledge results from a day-to-day occupation with the concept of SoA in practice. It has been rumoured that Europe, or Germany in particular, would be lagging behind in SoA adoption; however, we have not found any scientific evidence to support that claim. We therefore assumed that the geographical location had no influence on the realization of SoA value potentials. In light of this, the survey was limited to the German-speaking regions for reasons of cost and practicability. The interviews were mainly conducted by phone. As Sturges and Hanrahan (2004) have shown, there are no significant differences between a telephone and a face-to-face interview regarding the quality of the gathered data.

The interviews were targeted at 4 groups (users, software vendors, IT providers and IT consultants), and the structure was based on a modularized interview guideline. In addition to 10 core questions, which were identical for all the groups, a specific set of questions was formulated for each individual group. Note that IT consultants and IT providers were only asked about the SoA value potential for users and software vendors, as they are seen as unable to profit directly from SoA itself. Vendors were asked for the impact of SoA in their own business as well as for the value on the user side. Although statements of vendor representatives bear the risk of being biased for marketing reasons, their opinion on the user value was considered relevant, as they usually have insight in several SoA projects and can therefore provide information which is more representative. The experts were chosen based on internet research and contacted via mail or telephone. The expert status was guaranteed by choosing individuals who were either known through multiple contributions to practical oriented SoA conferences and/or were engaged in several specific SoA implementation projects. 28 experts were contacted and 25 agreed to participate in an interview. The interview sample included eight users, six IT consultants, six software vendors, five IT providers. The users came from five different industries (banking, insurance, telecommunications, retail and logistics). This supported the broad explorative focus of the approach and ensured the diversity needed to create meaningful results. The interviews were recorded digitally before being transcribed. In 10 of the 25 interviews a recording was not possible, either because the interviewee declined to be recorded (six times) or due to technical problems (four times). In these cases a protocol was made on the basis of notes that were taken during the interview (Yin 2002, p. 92). The evaluation was performed according to the methodology of qualitative content analysis according to Mayring (2000).

3   "SOA VALUE" IN THE LITERATURE

An analysis of 20 literature sources revealed 145 text passages describing SoA value potentials. These potentials were extracted by paraphrasing before being aggregated into 16 categories (see Table 1). Although some sources stated different arguments belonging to the same category, they were counted as 1 nomination only. SoA value potentials mentioned only once among all sources were grouped into the category "other". The literature analysis considered the major English books on SoA (including scientific and practical oriented literature), as well as papers from leading IS conferences (01/2000-

05/2008) and IS journals[1] matching the keywords "SoA" and "value"/"benefits". It has been interesting to note that there are only a few sources dedicated to the question of SoA value. Most sources are limited to a small list of potentials with a short explanation of each, however, no explicit discussion or logical deviation can be found. The number of mentions per source differs between three and 16 potentials. Only three of the analyzed sources ((Erl 2008), (Krafzig & Banke & Slama 2007), (Müller & Viering & Riempp 2007)) discuss the subject in a broad manner over several pages. Note that, the method of the qualitative analysis assigns statements to a certain category based on defined rules. This ensures that every category contains at least one clearly defined and therefore distinctive core argument, which minimizes overlaps. However, we found in our explorative analysis that there are dependencies between the categories (e.g. reuse can be seen as facilitator for agility). In our further research, we aim to examine possible dependencies more deeply (rf. chapter 4.1 for first approaches).

Description of value potential	Mentions	Source
Group of users	**N*=20**	
Agility (Flexibility and speed for the business)	16	3,4,5,6,8,9,10,11,12,13,14,15,16,18,19,20
Reuse (Reduction of development investments)	15	1,2,3,4,5,8,9,11,12,13,15,16,18,19,20
Process optimization (Automation and management of processes)	11	4,5,6,11,12,14,15,16,17,18,19
Strengthening of IT/Business alignment	9	3,4,6,8,9,10,11,13,20
Simplified third party integration (E.g. along Supply Chains)	9	1,2,8,9,11,14,15,17,18
Facilitation of software development (Via standardization)	8	1,4,8,11,13,15,16,19,20
IT-landscape consolidation (Harmonization of IT applications)	6	8,11,14,16,18,20
Facilitation of maintenance (Via transparency and capsulation)	6	1,4,7,11,14,16
Enablement of new functionality and business models	4	13,14,16,19
(Software) vendor independence	4	2,8,11,14
Improved information quality and availability	4	6,7,11,20
Management of IT complexity	3	3,10,19
Simplified Outsourcing	3	2,3,14
Simplified execution of M&A activities	3	1,4,18
Risk reduction (Via evolutionary IT modernization)	3	10,13,16
Improved project management	2	6,11
Other value potentials with reference to business aspects	7	
Other value potentials with reference to IT aspects	10	

Legend
Sources: 1 = (Baskersville & Cavallari & Hjordt-Madsen 2005), 2 = (Beimborn & Joachim & Weitzel 2008), 3 = (Bieberstein 2006), 4 = (Bloomberg & Schmelzer 2007), 5=(Brown 2007) 6 = (Carter 2007), 7 = (Cohen 2007) 8 = (Erl 2008), 9 = (Hurwitz 2007), 10 = (Josutis 2007), 11 = (Krafzig & Banke & Slama 2007), 12 = (Liebhard 2007), 13 = (McGovern & Jain & Little 2006), 14 = (Müller & Viering & Ahlemann & Riempp 2007), 15 = (Pullier & Taylor 2006), 16 = (van den Berg & Bieberstein & van Ommeren 2007), 17 = (vom Brocke & Sonnenberg & Thomas 2008), 18 = (Woods 2003), 19 = (Woods & Mattern 2006), 20 = (Yoon & Carter 2007)   * N = Statistical population

Table 1 Ranking of SoA value potentials according to the results of the literature analysis

As there was a very limited discussion of value potentials for the software vendors, this aspect was not included in Table 1. However, it should be mentioned that one source named two main advantages, while discussing the impact of modularization, standardization and loose coupling on the software value chain. Firstly, it enables vendors to outsource the development of services thereby creating new ways of collaborative software development. Secondly, by integrating third party services from niche players, the existing offers from large vendors can be enhanced, leading to a restructuring of the value chain (Messerschmitt & Szyperski 2003, p. 172 ff.).

Concerning the challenges of realizing value by applying SoA, the situation was similar to the question of vendor potentials; explicit literature sources were very rare. Only three challenges could be found consistently in more than one publication: the issues related to governance, complexity and

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[1] Note that no relevant articles were found in journals, this is in line with a recently published overview on SoA value papers from Beimborn & Joachim & Weitzel (2008)

financing. Governance is about adapting the organization and the processes in order to efficiently manage a SoA. Doing this right was mentioned by 11 sources as a major hurdle to leveraging the SoA value potentials. (A good overview on the aspects of governance can be found in (Bieberstein 2006)). The challenge of complexity, mentioned twice, addresses the problem that the fine granularity and distribution of services require significant additional effort in the design phase as well as in the run phase, compared to monolithic systems. Two sources state the challenge of financing the investment in SoA, however with little detail. All other challenges were technology related (e.g. limited data throughput performance of SoA-based solutions). As they were only mentioned sporadically and described very heterogeneously, they were aggregated in one category "Technology issues" (seven mentions). Several sources refer to "success factors", which could be interpreted as the logical counterpart of challenges. However, they are mostly generic to IT projects and not SoA specific, therefore they could not be related to the question of SoA value and are not considered in our study.

It is interesting to note that several of the examined sources on the topic have at least one chapter on SoA benefits (e.g. "Advantages and Motivation" in (Krafzig & Banke & Slama 2007) chapter 11). However, apart from (Erl 2008) none of these sources have an explicit chapter on "challenges" and most work merely addresses the issues implicitly while describing how to implement SoA. This observation, in combination with the fact that several books have very positive titles such as "Succeeding with SoA" (Brown 2007) while only one subtitle (McGovern & Jain & Little 2006) speaks of "Challenges", strengthens the hypothesis that there is a lack of critical and profound discussion of the actual value of the SoA paradigm.

4 RESULTS FROM THE INTERVIEWS REGARDING VALUE POTENTIALS AND CHALLENGES OF THE SOA PARADIGM

The following paragraph shows the main results from the expert interviews concerning the question of what kind of value potentials users and software vendors can draw from applying the SoA concept. It will conclude with a discussion of the challenges which complicate the realization of those potentials. Regarding the current hype about SoA and the marketing activities of software vendors and consultants, it is important to mention that all the experts' arguments were critically reviewed. The experts were consistently asked to provide examples during the interviews. Most of the interviewees (21/25) could base their argumentation on personal practical experience. Many of them were also clear about the fact that the value of some potentials is hard to quantify or to measure - which is why the value discussed here is only "*potential*" or "*expected*" value rather than actually "*realized*".

4.1 Value potential for users of SoA based software systems

Table 2 provides an overview of the interview results sorted by the number of positive mentions of the SoA value potentials for users in the expert interviews. The rightmost column indicates whether the experts' opinion was homogenous or not on this potential. Potentials marked with a "+" were not doubted among the experts and based on several arguments and at least one specific example. If there were no specific examples and many weak arguments, the potential was marked with "+/-". A "-" shows that the potential was debated among experts and there were even some critical voices negating this potential. As you can see in table 1, the categories were grouped by two dimensions: a) the type of value they are providing according to our value model: revenue, cost (logically split into business- and IT-related cost) and qualitative effects; b) the "layer of impact" which classifies the layer of the company the value is created in. The layer structure follows the model of Österle (1995), who states that the design of information systems has impact on the strategic layer, the process layer, and IT layer of a company. This structure helped to minimize redundancies (e.g. all potentials with a effect on IT-cost have to consist of mutually exclusive arguments) and allow to explain dependencies between categories, which mainly exist between layers (e.g. reuse on the IT-layer can be seen as a precondition for agility on the strategy layer). Due to space limitations, only those potentials mentioned by more than 10 experts will be discussed in the following.

Description of value potential	Impact Layer	Impact Type	Expert Mentions	Validity in interviews
Users			**N*=25**	
Agility (Flexibility and speed for the business)	S	R	25	+
Reuse (Reduction of development investments)	IT	IT-C/Q	20	-
Process optimization (Automation and management of processes)	P	B-C	17	+
Facilitation of software development (Via standardization)	IT	IT-C	17	+/-
IT-landscape consolidation (Harmonization of IT applications)	IT	IT-C	13	+
Improved information quality and availability	P	IT-C	13	+
Strengthening of IT/Business alignment	S	Q	12	+/-
Enablement of new functionality and business models	S	R	12	+/-
Simplified third party integration (E.g. along Supply Chains)	P	B-C	9	+
Management of IT complexity	IT	Q	9	+
Facilitation of maintenance (Via transparency and capsulation)	IT	IT-C	9	-
Simplified execution of M&A activities	S	B-C/IT-C	4	+
Simplified Outsourcing	S	B-C/IT-C	2	+
Risk reduction (Via evolutionary IT modernization)	IT	Q	1	+
(Software) vendor independence	IT	IT-C	1	-
Improved project management	IT	Q	1	-

Legend
Impact Layer: S= Strategic Layer, P = Process Layer, I = IT Layer
Impact Type: R = Revenue (increase), IT-C = IT-cost (reduction), B-C = Business cost (reduction), Q = Qualitative effect
* N = Statistical population

Table 2 Ranking of SoA value potentials for users according to expert interviews

All interviewed experts mention the improved <u>agility</u> of an enterprise as a SoA value potential. The arguments and examples thereby are centred around two main aspects: The first aspect is speed: agility is expressed by a faster adoption of the IT to business changes (measured by a reduction of the so called "time-to-market" of change requests). Several experts report a significant reduction of the implementation time of new requirements. Four interviewees (three consultants and one user from the industry) mention the telecom industry as a good example in this context. The introduction time of new tariff models, can be reduced by applying the SoA concepts. Starting with the completed concept in product management to the actual positioning in the market, a time saving of between 20% and 50% is stated by three experts, compared to the old architecture. Two interview partners phrase the advantage: "We came down from a question of months to a question of weeks"[2]. In this case the effect can be explained by the decoupling of customer centric from network- and infrastructure-related systems by applying the concepts of SoA. Following this, a new product, e.g. a so called bundle-offering, is maintained on only one system and can be changed independently of the complex systems administering the telecom network infrastructure. The second aspect of agility besides speed is an increased flexibility in IT systems. Most interview partners explain this increased ability to change, by the architectural separation of dynamic logic (process) from the static logic (service). The dynamic logic is more likely to be subject to changes and can be adapted more easily. Although agility can be separated into the two aspects mentioned it was contained as one category. As agility can be seen as an overarching term for several aspects, according to the definition of Yusuf et al (1999): "Agility is the successful exploration of competitive bases (speed, flexibility, innovation pro-activity, quality and profitability)". During the interviews most interview partners did not differentiate between the terms agility, speed and flexibility and even used them synonymously.

The majority of experts agree that <u>reuse</u> is a value potential of SoA (20/25), however, there are also very critical voices. Two interview partners express their concerns that the design of reusable services is very difficult and they never saw a real value from reuse in practice. Especially in the early phases

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[2] This and all following citations are translated from the German transcript into English.

of SoA maturity, it would be very difficult to achieve a consensus on the functionality among the stakeholders, as there is no experience about how a reusable service would look like. Another expert points out that reuse is not a new subject in computer science. He claims that earlier approaches - like modularization or object orientation – did not fulfil the expectations of high reuse either. There are also limitations among those experts who were positive regarding reuse. Four experts state that reuse exists and is a value potential, but it is limited and can only be achieved after a long period of SoA experience. They explain that there are only a few services in an enterprise that can be reused frequently (e.g. services for the management of customer or product data, or basic services like printing or calendaring). Three experts cite analyses that measured a reuse factor (i.e. average reuse-of one service in different contexts in the same period of time) between 1 and 2. One software vendor reports on his customer, an Austrian bank, which measured a reuse factor of 1.3. An IT-consultant cites an internal analysis measuring a reuse-factor of 1.5 among several companies. One user states that, in his company, a few services were frequently reused (up to 14 times), however, the majority, and therefore also the average, had a reuse factor below 2. Contrastingly, there are interview partners who strongly believe in reuse. An IT provider reported the development of a new core banking system able to be finished ahead of the planned time because many services (approx. 10 %) could be reused. He states the example of a service for transferrals which is reused for the web portal as well as for the ATM and the teller application. Two interview partners from the user side point out the business value of reuse in this context: Reusing an existing service allows standardizing functionality; for every process using the service the same proven business logic is applied enterprise wide. One reason for the obviously contradicting opinions about reuse might be the variety of interpretation of the concept. Most experts understand reuse to be the usage of the same service in multiple processes at the same time ("multiple usage"). Others also mean the reuse of one service in a different context at another time, which means that the service is "used again" but only by one user. Another group of experts describes a "reuse" of legacy systems by encapsulating existing functionality and providing it via a Service interface. This approach allows the prolongation of existing systems' lifecycles by using their functionality in new processes with new user interfaces. Some experts also phrase this value potential explicitly as "prolonged usage" instead of "reuse".

The vast majority of experts (17/25) report that process optimization in particular is the main motivation for users wanting to adopt SoA. Especially vendors and consultants report that there is a strong demand among their customers to integrate and automate process flows, especially across line of business or even enterprise boundaries. SoA is seen as the best basis for Business Process Management (BPM) systems, as it allows the process-oriented integration of IT systems, leading to a more automated IT support of processes. The value can be measured by known process key performance indicators, e.g. shorter cycle times or reduction of required manpower. One user reports that process optimization was the only reason why the insurance company he works for adopted SoA. By automation of a claims settlement process across several silo systems, the cost could be cut to 1/50 of the old manual process. It is obvious that not the full amount of this savings potential can be assigned to the SoA-based IT solution, however the interviewee pointed out that SoA was a necessary precondition to realizing this value, as other attempts to realize the potentials failed before. It is also worth mentioning that according to three experts, SoA is especially valuable when it comes to the harmonization and standardization of processes in a globally acting enterprise.

17 experts state the value of facilitation of software development[3] driven by the standardization of interfaces which leads to less mapping efforts. Standardization of tools and methods for model-driven development reduces coding. However, there are, as yet, no concrete examples or data points available for this potential and some experts are uncertain whether this potential could be actually captured.

The potential of IT-landscape consolidation is directly tangible in the context of systems operation. Implementing a certain functionality only once in a IT-landscape is a core concept of SoA and allows

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[3] Note that this category does not include efficiency effects from reuse as reuse is a category of its own.

the identification of redundancies. Two interview partners point out that this value potential can already be leveraged by the mere introduction of SoA Management tools, such as the development of a domain map, without actually implementing SoA at a technological level.

The subject of <u>improved information quality and availability</u> addresses the typical "Master-Data Management" questions. Through consolidation of customer data in a central service, for example, the integrity and consistent availability of that information within the enterprise is improved.

The increased <u>IT/Business Alignment</u> is debated, which is partly due to the different interpretations of that term. If a better IT/Business Alignment is defined as a better fitting of IT solutions to the business problems, the majority of experts agree. This is explained by the process orientation of SoA, which leads to a business proximity. Some experts interpret the IT/Business Alignment as the cooperation between IT and business departments. The picture regarding this interpretation is more unclear. Some experts state that SoA enables IT to make architecture questions more understandable for people outside the IT department and creates "a common language". However, some users also state that there has been no improvement in IT/Business cooperation through the introduction of SoA; on the contrary, the already existing problems only became more obvious.

The idea of <u>creating new functionality</u> via SoA is valued more in practice than in literature. Interestingly it is not so much about providing functionality as a service externally, but rather about offering new products by integrating third party services, or even building up new business models on that idea. One consultant reports the case of a retail company that integrated the Web-Services of a bank in order to offer the customer a loan at the point of sale. Two other experts name the Hypoport AG as an example of an SoA based business model. Hypoport acts on the technological basis of a SoA platform as a broker for financial services. (For a more detailed description of Hypoport's business model see (Hypoport 2008)). These examples could also been realized in a different way. However, the SoA paradigm and the underlying technology ease the integration and make it cheaper. This lowers the integration hurdles and new, collaborative business models become more attractive.

Concerning the value potentials on the strategy and process layer, it can be stated that most potentials identified in the literature analysis can be realized in practice. Regarding the SoA value potentials on the IT layer, the discussion is much more controversial. The majority of IT related potentials are marked with a "+/-" or "-" in table 2, meaning that their validity is low in average.

4.2   Value potential for software vendors

Four different value potentials were identified for software vendors among eight interviewees (Consisting of the six vendors and two consultants).

All vendors, in particular smaller ones, state that the standardization allows them to integrate in existing product landscapes from other vendors more easily (Two already leveraged this potential). It is also easier to sell software as a service (SaaS) when software is based on SoA principles. These two arguments were summarized in the value potential category of <u>new market opportunities.</u>

Most experts (5/8) also agree that an <u>integration of acquisitions</u>, or already existing heterogeneous portfolios, is much easier when software is based on SoA principles. The standardized interfaces and clear capsulation eases the combination of different products to an integrated solution and helps to reduce redundancies. Two vendors have already actually realized specific value from this potential.

Vendors can also <u>enhance their product offerings</u> by integrating third party services. This results in a more complete and therefore more attractive product for the customer. Based on capsulation and standardization this enhancement can be done quickly and the vendor does not need to invest in the development of the new functionality himself. Some experts also claim that the capsulation leads to the effect that software offerings could be more modularized (i.e. sold in smaller pieces), which allows vendors to offer customers a more individual product instead of a big "all-in-one"-solution. This could attract new customers that are interested only in a dedicated part of the existing solution. Specific

statements concerning revenue or cost effects of this potential could not be garnered from the interviews. However the arguments were consistent among all experts and therefore the validity is "+".

Description of value potential	Impact Layer	Impact Type	Expert Mentions	Validity in interviews
Software vendors			**N*=8**	
New market opportunities (Including SaaS)	M/S	R	6	+
Simplified integration of acquisitions (Resp. harmonization of the portfolio)	PD	C	5	+
Enhanced offering (Via modularization and third party integration)	M/S	R	3	+
Facilitation of software development (Via standardization)	PD	C	2	+/-
Legend Impact Layer: M/S = Marketing and Sales, PD = Product development Impact Type: R = Revenue (increase), C = Cost (reduction)				

Table 3 Ranking of SoA value potentials for software vendors according to expert interviews[4]

Two of the six software vendors also explained that they had realized a facilitation of software development through SoA. Others said it was too early to measure that, but they would also expect benefits in this area, one expert however was sceptical. Therefore this potential was marked with "+/-".

Comparing the results from the qualitative analysis of the vendor potentials and the results from the user side, only the SoA value potential "facilitation of software development" can be found on both sides. The judgement on this potential is consistent, as both groups expect an improvement, whereas there are only few proof-points yet. It is interesting to see that reuse was not mentioned as value argument from the vendors themselves. This supports the hypothesis from the user side that this value potential is – at least to the current stage of adoption – very hard to realize. Although the consequences are different, the basic arguments for SoA value are the same, as they relate to the same core aspects of SoA (especially capsulation and interface standardization). Overall, one can summarize that according to the number of mentions on the vendor side SoA value is seen to be more about creating new opportunities (in terms of revenue) than improving efficiency (in terms of reducing cost). This pattern could also be identified on the users' side. The matching results of the analysis confirm the value of comparing both views. However, due to the small number of statements on the vendor side, a more comprehensive and structured data gathering is needed to derive further results.

4.3   Challenges for vendors and users in realizing the potential values of the SoA concept

During the interviews, it became quite clear that SoA does not only bring new value to a company, it also introduces new challenges, or at least different ones than typical challenges of new IT technologies. Table 4 gives an overview of the challenges related to the concept of SoA[5], identified during the interviews from the user perspective. As the discussion of challenges was less controversial then the one on value potentials, all statements can be seen equally valid and therefore no validity was assigned. Some of the statements were not directly focused on the question of value realization, but on the question of challenges with SoA adoption in general. However, it is obvious that a challenge hindering a company to adopt SoA is a challenge to get value out of SoA too.

According to the experts, the most important challenge is the question of financing of the investment.

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[4] Note that the stated "Impact Layers" differ from the user side. As the model of Österle (1995) does not apply for software vendors, we assign the identified potentials to the steps of the software business value chain which consists in our definition (based on Messerschmitt & Szyperski 2003) of 8 steps: 1) "Research", 2) "Product Development", 3) "Documentation", 4) "Marketing and Sales", 5) "Consulting", 6) "Implementation", 7) "User Instruction", 8) "Maintenance".

[5] Related to SoA means in this context, that the challenge has its root cause in one of the core aspects of SoA according to our definition in chapter 1 ("process orientation", "loose coupling", "capsulation", "(Interface) standardization"). Statements on general project challenges that are not SoA specific (e.g. "Find a strong project manager") were not included in the analysis.

In the past, the different systems could easily be assigned to one owner on the business side. Only a rather small part of shared applications were financed by a collective budget. SoA incurs a much bigger part of collective infrastructure. In addition, the services (especially when there is reuse) do not have explicit owners anymore either. The SoA enablement of legacy software, as well as the infrastructure investments, requires significant investment and it is, as yet, unclear in many companies how this cost should be divided among different stakeholders.

Description of Challenge	Mentions
Users	**N=22**
Financing (Funding and accounting of initial invests and operation costs)	12
Long-term nature of value (Insufficient economic justification)	11
Governance (Adaption of organization and processes to SoA principles)	11
Comprehension (Clear and common understanding of the term SoA)	10
Missing semantics (No "plug-and-play" integration)	4
Service-Design (High effort to design a reusable service)	3
Technology issues (Performance, Security, Transaction integrity)	2
Availability of Services on the market (There is no SoA "out of the box")	2
Complexity (due to low granular and distributed services)	0

Table 4 Challenges for users in realizing the potential values of the SoA concept

Another big challenge to realizing SoA value is the set up of a proper business case because of the long-term nature of the value: As most of the potentials are only expected in the long run, and therefore are hard to calculate, it is difficult to show a credible calculation proving the investment is worth it. According to the experts, many companies that have so far adopted SoA did it because they "believed" in it, rather than having a solid business case calculation. It is obvious that if nobody really thought about the specific potentials upfront it is hard to capture the value afterwards.

As already explained in chapter 1, the adaptation of the organization to SoA is difficult, 11 experts mention aspects concerning this challenge, which were categorized by the term "governance".

As one can see from the issues described with the definition of the value from IT/Business Alignment or reuse (rf. chapter 4.1), there is still much uncertainty about what SoA actually is. The experts report that this effect results in a significant effort for a company to define what is actually meant by the term SoA, and to align all people, especially on the business side, with one common view. This is why 10 experts name "comprehension" as a big challenge in realizing value from SoA.

Although integration is eased by common syntactic standards, there is still the issue of missing semantic standards. Until there is a common semantic model available, integration will still require project effort, and the IT world is far away from "plug-and-play" scenarios. Compared to the issues before, this challenge seems rather small, as it is mentioned only a few times. The same is true for the design of a service or sourcing a service out of the box from a software vendor. Regarding technological issues like security and performance, there are also voices that explicitly do not see them as issue anymore. Software vendors in particular claim that nowadays the issues regarding technology have been solved, and most scenarios can be supported via SoA securely and with high performance. Interestingly "complexity", a challenge identified in literature, was not mentioned in the interviews, in contrary nine experts claim that SoA helps the users to manage complexity better (rf. Table 2).

Regarding the software vendors, data about challenges could not be collected. In the interviews the vendor experts were quite reluctant to talk about challenges for themselves. Although the results were guaranteed to be anonymous, they might have been afraid of undermining their reputation as leading SoA vendors by talking about these issues in public. This hypothesis of hidden agenda in positive marketing is supported by another phenomenon that occurred during the interviews. Regarding the question "What is your unique and differentiating value proposition in the SoA market?", five out of six vendors answered that their solution is the only one that would offer the complete range of tools. Whereas four out of eight users asked for vendor strategy answered that they would source a best of breed solution, as no vendor could deliver a full tool portfolio. Despite this lack of data, it is possible

to logically derive some hypotheses from the results on the user side: Apart from the question of internal accounting, the challenges are assumed to be the same for vendors and users of software based on the SoA paradigm. It is imaginable that the vendors also are facing the challenge of justifying the architecture shift in their products economically. They might have struggled in adapting their governance in order to manage a service rather than a product portfolio. And it seems possible that they are also struggling with missing semantics, technology and the difficulties of service design. Creating new market possibilities for one vendor because of standardization, and therefore lower integration hurdles, means a direct threat for those vendors that have profited from a lock-in effect so far. The big, established vendors in particular could face increasing competition when it becomes easier for niche players to integrate and enhance existing applications with their services.

5 CONCLUSION AND FURTHER RESEARCH

Summarizing the results discussed, it can be stated that the SoA value potentials postulated in literature are, at least partly, evident in practice. On the user side, the value potentials "process optimization" and "agility" seem to be most evident in the current phase of the SoA adoption process. Nevertheless, some of the value potentials remain highly debated. Generally, our interview series identified more value potentials on the user than on the vendor side. On the user side, the provable potentials are mainly found on the strategy and process layer, IT (cost) potentials are less evident. This matches the results from the vendors, where the value arguments were centered around new revenue opportunities instead of development cost reduction. The experts pointed out that the majority of the promised SoA value potentials, especially those regarding cost reductions on the IT side, are only achievable in the long run. As the current experience horizon with SoA is too short for most users, those value potentials are still only "expected".

As the expert interviews were not designed to gather specific and comparable data points about the absolute economic impact of the potentials, it is hard to bring them into a relation. It is imaginable that the economically quantifiable and measurable benefits from process optimization might be bigger than the potential from facilitation of software development, although both can be seen as equivalently important potentials according to table 2. Concerning this question, a broad empirical study could deliver further insights.

It also became transparent that most value potentials of the SoA concept can only be realized with significant investments in infrastructure and service enablement of applications. In addition, governance questions have to be solved and a common understanding about SoA in the respective company has to be achieved to make the realization of value possible. The discussion with the experts showed that it is very hard to generalize the value of SoA. Therefore there is no generic answer and every user company and software vendor has to do its own calculation concerning the individual profitability of a SoA adoption. It strongly depends on the individual usage scenario, such as the industry or the functional context which the architecture is used in. Based on the interviews, we developed first hypothesis on such influence factors, which will be tested in further research.

We are currently working on an even more detailed structure of the SoA value potentials, allowing to identify dependencies and to derive clearly defined and representative indicators to measure the potentials. As the study presented here was not designed to be a representative analysis, a quantitative empirical study evaluating such indicators could be a promising field for further research. We hope that the proposed categorization of value potentials and challenges is a first step towards a more precise and fact-based value argumentation in the controversial discussion about the value of SoA.

6 ACKNOWLEDGEMENT

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