Drivers and Inhibitors of SOA Business Value - Conceptualizing a Research Model

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ABSTRACT
What is the business value of Service Oriented Architecture? Although the SOA paradigm has become quite evident in IS literature, a comprehensive model of the SOA business value is still lacking. Based on a literature review and on a multi-theoretical foundation, drawing on the adoption of innovations literature and on the resource-based view as well as on resource dependency theory, we attempt to develop a research model which captures the business value of SOA, applicable to empirical research in subsequent studies.

Keywords
SOA, Service-Oriented Architecture, business value, IT, diffusion, adoption, business strategy.

INTRODUCTION
Although the Service-oriented Architecture (SOA) paradigm has become quite omnipresent, both in the business world and in academia, there is still a gap in answering one of the most fundamental questions associated with this new architecture paradigm: What is the business value of SOA? Or: How can we evaluate the business value of SOA?

We aim to develop a theory-based research model to help answer the research questions posed, by relating it to case studies and a survey by the end of 2008. The model will integrate theoretical arguments from the adoption literature and from strategic resource theories, namely the resource-based view (RBV) and the resource dependency theory (RDT). In order to exemplify this model, we will conduct three clearly separate iterations, which, step by step, will add a new level of detail to the model.

The next section will give a brief overview of SOA and related research on the business value of SOA (SOA-BV). Subsequently, the main part of the paper will consist of the model development, followed by the three detailed steps as described above. Then, in order to show its applicability, we will apply the model very briefly to selected case studies, already used in previous SOA research. The concluding section will provide a comparison of the SOA-BV model; the model developed throughout this paper compared with all other models found in the literature.

SERVICE-ORIENTED ARCHITECTURES AND RELATED RESEARCH
An IT infrastructure must allow the connection of application systems by supporting their communication in order to integrate them (Zhang and Tanniru 2005). As “SOA is an architectural style whose goal is to achieve loose coupling among interacting software agents” (He 2003), SOA promotes this communication through the use of an enterprise service bus (ESB) as their communication infrastructure is required by the loosely coupled services in order to interact. Even if SOA is often implemented using web service standards such as SOAP and WSDL (Patrick 2005; Zhang and Tanniru 2005) for interoperability (Kossmann and Leymann 2004), other proprietary service-based implementations exist as well. However, these proprietary middleware technologies such as CORBA limit the interoperability due to tight coupling (Datz 2004).

The SOA paradigm creates a view of IT from a business process perspective, which is contrary to other architectures. Various practitioners emphasize that “services” within a SOA encapsulate business functionalities (e.g. (Brabänder and Klückmann
suggests that SOA is able to provide loosely-coupled and interoperable services to enhance the business value of SOA in a section of large US firms, found that the adoption of SOA leads to better performance. The evidence of Oh et al. (2007), Kumar et al. (2007a, b), who did an empirical study of SOA adoption and information sharing in supply chain for a cross-section of US firms, found that the adoption of SOA leads to better performance. The evidence of Oh et al. (2007) suggests that “SOA is able to provide loosely-coupled and interoperable services to enhance flexibility for the integration of various organizational processes within the firm and with business partners” (Oh et al. 2007). Müller et al. (2007) focus on the economic potentials of SOA in the automotive distribution sector and the banking industry. Yoon and Carter (2007) present preliminary findings about realized benefits. While they focused on the factors, which are necessary for a successful SOA implementation, our model addresses the question of general business value for organizations and why they should or should not adopt SOA. The model of Yoon and Carter gives important insights for managers about how to implement a SOA or which factors have to be considered for a successful implementation. For a more comprehensive review of studies about the business value of SOA in information systems (IS) research see Table 1.

MODEL DEVELOPMENT

The development of our research model is divided in three subsections. The first starts with an IS adoption perspective. Therefore, compatibility, complexity and discrepancy are seen as drivers and inhibitors of the adoption decision as well as the business value of SOA. The following subsections provide a more detailed explanation of discrepancy as the critical driver of the SOA adoption decision. Moreover, we focus on discrepancy and not on compatibility and complexity as from our point of view discrepancy is directly influenced by the external environment and the business strategy of a company. Consequently, the next subsection focuses on the discrepancy of technology and outlines factors which may lead to this kind of discrepancy. Finally, the last subsection extends the concept of discrepancy to a business perspective.

Business Value of SOA

This sub-model uses organizational IT adoption theory in order to explain the business value of SOA. Therefore, we assume that the organizations are rational. Thus, organizations will only implement SOA (or: “adopt” the technology), if they perceive that SOA will increase their business value.

Consequently, the first question to answer is: What is the business value of SOA? Yoon et al. (2007) have analyzed multiple cases and suggest that realized benefits of SOA can be classified into two groups: improved business agility and cost reduction.

The main benefits contributing to an improved business agility are: easier integration of systems, better alignment of IT and business, and a quicker response to market change or customer demand (shorter time-to-market).

The second group (cost reduction) consists of: lower application development costs/time, reuse of existing functions (applications), and lower maintenance costs. Due to the reuse of existing functions, new applications can be developed in shorter time at lower costs. Moreover, the maintenance of the entire system landscape can be reduced, because redundant functions are implemented and thus maintained only once.

The next question is: What influences the adoption/perceived business value of SOA for organizations? While Rogers (1995) identified five characteristics of an innovation: relative advantage, compatibility, complexity, triability, and observability, Moore and Benbasat (1991) include another three characteristics: voluntariness, image and visibility. They also label two of the other characteristics differently: “complexity” to “ease of use” and “observability” to “result demonstrability”. In our
research model we draw only on three characteristics. This choice will be justified as follows: According to Cooper and Zmud (1990), compatibility and complexity affect IT implementation, where compatibility has a positive effect on IT implementation and complexity has a negative impact on IT implementation. According to Agarwal and Prasad (1998) perceptions of the relative advantage (perceived need), ease of use (complexity) and compatibility have an impact on the intention to use a new IT. Thus, Agarwal and Prasad (1998) added a new dimension to the previous two: relative advantage (perceived need), which we incorporated into our model as “discrepancy” between actual and desired level of resources and capabilities. The three resulting main concepts determining the business value (and, thus, the adoption) of SOA will be explained in detail in terms of the following: compatibility, complexity, and discrepancy.

**Compatibility**

Theoretically, the overall goal of SOA is achieving compatibility in a heterogeneous system of applications. Nevertheless, the actual compatibility of SOA with other existing technologies arises from platform independence and its potential to integrate systems. Existing systems can be integrated into a SOA via programming a service-oriented facade around the systems in order to make them compatible with SOA (Baskerville et al. 2005). This potential of integrating existing systems increases the compatibility as the move towards SOA can be done incrementally instead of replacing the entire IT infrastructure at once.

**Complexity**

While compatibility has a positive impact on the perceived business value of SOA and thereby on the adoption decision, complexity (“ease of use” in terms of the adoption literature) is expected to have a negative impact as it is associated with efforts and risks. These risks and efforts can be divided into: governance, technology, and organizational change.

**Governance** result from the need for an efficient and effective control (Larrivee 2007; Laurent 2007), finding a financing structure and achieving the necessary level of security. As Yoo et al. (2007) found out in their case study analysis, the establishment of a governance is a key factor for success. Next, **technology** focuses on four aspects: maturity and technology performance as well as the granularity of services and technological change. Although a SOA can be established in many different ways, we restrict our argumentation to web services as they are the most used vehicle for implementing SOA (Patrick 2005; Zhang and Tanniru 2005). Despite their widespread use, web services are still classified as immature by the W3C (Booth et al. 2004), leading to uncertainty about possible competence gaps and further technical development of web services (Baskerville et al. 2005). The use of web services in order to achieve platform and programming language independence is at the cost of a loss in performance due to an additional XML layer on top which has to be parsed. Also, complexity arises during determining the right level of granularity of services. If services are too fine-grained, orchestration and development can easily become too complex. In order to facilitate the technological change, the existing application landscape has to be mapped, which represents a challenging task if systems have grown over time and documentation is lacking.

The need for **organizational change** is reflected in the necessity for employee qualification, re-organization and alignment. Designing a SOA joins existing principles, e.g. encapsulation or modularization, with new aspects such as service choreography and service repositories, which have to be understood by the system architects (Zimmermann et al. 2004). To achieve an effective usage of an IT infrastructure, an adjustment of the organization is necessary (Zhu et al. 2006). Only if the organizational prerequisites are established, the IT can serve as a promoter for competitive advantage (Sambamurthy et al. 2003). Depending on the employees, re-organization can take a long time until the SOA principles are integrated into the company (Wong-Bushby et al. 2006). Another effort for setting up a SOA is the alignment of the service portfolio with business needs. Therefore, key managers of the business organizations should focus a great deal on the business importance of infrastructure and on the priority of web services and should be helped by the leading technology managers (Lawler et al. 2005). As the development of a service could require an inter-departmental point of view, new project management techniques are required, promoting the further education of employees and facilitating change within the organization (Zhu et al. 2006).

**Discrepancy**

Discrepancy captures the actual beneficial side of SOA. To describe the “usability” of SOA, we adopt the discrepancy approach used by Teng et al. (1995) which set the “desired” benefits from the new technology in relation to those of the technology already in place. Desired benefits represent the combination of both the additional potential benefit which comes with the new technology and the actual need for the benefit within the organization. For example, if SOA offers flexibility of applications in form of services but the firm has no need for flexibility, this particular advantage delivers no value to the firm.
Desired benefits lead to perceived needs (Teng et al. 1995) which can arise from a demand of reliability, flexibility, or upgradability, the three criteria of an assessment of the effectiveness of an IT infrastructure: “reliability, the ability to operate with low downtime; flexibility, the ability to quickly and economically adapt to changing business requirements; and upgradability, the ability to quickly and economically adapt to or deploy multiple, complex technologies as required” (Kumar 2004).

To summarize: compatibility, complexity (ease of use) and discrepancy (perceived need) determine whether an organization expects a positive business value from SOA and consequently adopts SOA.

**Figure 1. Business Value of SOA**

**Explaining the Discrepancy**

In a second stage of figure 1, the basic model developed above is extended by detailing the concept of discrepancy as it is expected to be a major driver for the business value of SOA. In doing so, discrepancy is seen as the main reason for the adoption decision, whereas complexity and compatibility are seen as necessary prerequisites or efforts in order to satisfy the perceived need. This subsection focuses on the explanation of the factors, which influence the discrepancy between the actual level and desired level of IT. As noted above, we follow Teng et al. (1995) in using a discrepancy model, which has already been used in the field of group-based decision behavior (Alutto and Belasco 1972). Based on Teng et al.’s adoption to IT
outsourcing research, we derive the basic hypothesis that a high level of perceived discrepancy positively affects the business value of SOA and the adoption decision.

The discrepancy in the effectiveness of the IT infrastructure results from: a difference between the actual level and the desired level of process bundling and modularization, the ability to support new or changed business processes, the wish to support in- and outsourcing, or from the need for integration of systems. SOA can achieve the three criteria for an effective infrastructure due to: the reuse of functionality, reduction of interface complexity, leverage of virtualization and grid computing, platform and programming language independence and its potential to integrate systems.

Process bundling and modularization is supported by the basic principles of SOA, as services should be designed at a level of granularity which promotes the reuse of functionality encapsulated in the services. Consequently, changes in business processes can be easily supported by SOA. In addition, new business processes can be built based on existing services reusing them. Therefore, the development efforts can be reduced which in turn leads to a shorter time-to-market, offering greater flexibility at lower costs to the organization (Baskerville et al. 2005).

SOA’s potential to promote independence of platform and programming language have already been explained above in the subsection about compatibility. This independence as well as the modularization allows easier in- and outsourcing of parts of business processes.

In a SOA, each service only has to offer one interface to the ESB in comparison to an architecture in which all application systems are connected with each other, the number and thereby the complexity of interfaces can be reduced dramatically. In terms of the modularization and independence due to open standards, this makes integrating systems easier. (Channabasavaiah et al. 2004).
business strategy represents: an important variable in determining the desired level of process bundling and modularization, the ability to support new or changed business processes, the wish to support in- and outsourcing, and the need for the integration of systems.

The concept of deriving an organization’s IT requirements from the business strategy is usually called “strategic Business/IT alignment” in the literature (e.g. Chan 2002; Henderson and Venkatraman 1993; Kearns and Sabherwal 2006). SOA may deliver great opportunities for multiple areas of application, but it always depends on the business strategy whether a new technology, system, or infrastructural paradigm matches with the organization’s requirements and thus with the resulting IT strategy (Luftman 2000, 2003). Consequently, strategic Business/IT alignment is necessary as a foundation in order to tie the different pieces of our framework together. If business and IT strategy are not aligned, the actual benefits from a potential SOA implementation cannot be evaluated from a strategic perspective.

The set of available business strategies usually depends on a particular application domain and regularly transcends generic types such as cost leadership vs. differentiation (Porter 1985) or prospector vs. analyzer vs. defender (Miles and Snow 1978; Sabherwal and Chan 2001). For example, in the financial services industry, typical business strategies are: increased customer orientation, industrialization by automation and modularization, outsourcing and shared services, and merger and acquisitions. In contrast to consumer goods or capital goods financial services are virtual products because their design, distribution and clearing depend on information systems. Therefore, the information systems are strongly influenced by changes in the strategy or organization (Winter 2007).

In order to explain why organizations choose a particular business strategy we look at the competitive environment of the organizations. The financial services industry especially faces regulatory changes, e.g. Basel II, which have to be supported by their information systems. Moreover, an increasing disintermediation takes place in the financial services industry, as more and more direct sellers come into market (Dombret and Kern 2003; Hamoir et al. 2002). Consequently, the customers gain increasingly more power against their retail banks. The increasing globalization promotes the number of mergers and acquisitions strengthening the need for a flexible architecture.

**RBV and RDT Determine Business Discrepancy**

A flexible and adaptive IT architecture enables the organization to extend its business by integrating systems or services from outside their own IT infrastructure. Business process outsourcing (BPO) has become one of the most promising fields in the global outsourcing market (TPI 2007). SOA represents a technical paradigm which directly matches the long demanded flexibilization of firm borders where dynamic configuration of business processes from business activities, regardless of being located outside or inside an organization, takes place (Krafzig et al. 2005). Therefore, SOA offers a technical platform which allows selectively offering (insourcing) or purchasing (outsourcing) business activities (or “services”).

The main strategic theories explaining decisions about out- and insourcing of business activities are the resourced-based view (RBV) (Barney 1991; Penrose 1959; Wernerfelt 1984) and the complementary resource dependency theory (RDT) (Aldrich 1976; Pfeffer and Salancik 1978). While the RBV defines what makes own resources valuable in terms of leading to a competitive advantage, the RDT explains B2B relationships by the fact that a firm never possesses all the necessary resources for being successful and, thus, has to cooperate with other firms who own these vital resources. Consequently, both RBV and RDT have been successfully applied to outsourcing research and numerous empirical studies show a lack of internal resources and capabilities to be a major force for outsourcing decisions (Cheon et al. 1995; Dibbern et al. 2004).

Transferring this to our application domain, it becomes apparent that a particular business value spent by SOA comes from a discrepancy between the current sourcing configuration of the firm and the desired one. In the following, we call this business discrepancy and enrich the “discrepancy” concept with this perspective. On the one hand, the current non-modular IT architecture might force a firm to do things which can be more efficiently done by external providers. Consequently, introducing a modular architecture enables selective outsourcing of those tasks. As a result, a firm can focus more easily on its actual core competencies and even better utilize them by offering particular services to other firms (Lammers 2004). This was, until now, inevitably embedded within a business process and could not be extracted, offered only as a stand-alone service. For example, if a bank has developed unique capabilities in credit rating, it cannot only use them in its own loan granting processes but also offer them as a self-contained service to other banks and, thus, generate additional revenue from realizing new business models.

Consequently, our model adopts this dual perspective on structurally equivalent insourcing vs. outsourcing decisions of activities (Lammers 2004; Roy and Aubert 2002). This is based on an interplay of RBV and RDT arguments, to describe business discrepancy, which in turn is a part of the overall discrepancy construct. The following figure tries to clarify this relationship:
Obviously, both theoretical perspectives would now attach the causal arguments which determine 1) the existence of a “valuable resource” (RBV) or 2) the requirement to acquire resources located outside the firm (RDT). However, since we do not focus on sourcing decisions for services, but on the adoption of the architecture which enables this kind of selective sourcing, we can refrain from this extension and nevertheless achieve a self-contained model.

EXAMPLES FROM CASE STUDIES

In this section we draw on a case study from Baskerville et al. (2005), in which the potential and achieved results of SOA implementations of a northern Europe bank and a central Europe bank are reported. While the first bank implemented SOA based on EAI integration platform and pure XML, the latter used web services instead of pure XML.

Both banks were able to reuse existing functionality leading to a more agile development in order to support changes in business processes faster. However, the northern Europe bank was able to achieve better value preservation in mergers and acquisition, as the cases of two successful purchases have also shown that the bank was able to integrate existing systems with more than 1000 operations in its SOA. In contrast, the central Europe bank had no merger and acquisition activities in the last few years. This bank also has only a limited success in the integration of systems, as the employees had to be trained in order “to manage the CMS [Cash Management System] application under the complex new service oriented architecture” (Baskerville et al. 2005). The central Europe bank has also faced drawbacks “due to immature technology and overall complexity (WS security, performance, management …)” (Baskerville et al. 2005).

This short comparison of two cases shows that the business value of SOA is very different depending on different organizations, even within the same industry. For example, had the latter bank also have had mergers and acquisition activities in the last years, the business value of SOA for this particular bank may have increased.

CONCLUSION AND OUTLOOK

The review of the literature shows that not much has been published about the business value of SOA, yet. Our model for SOA adoption enhances the existing body of literature by integrating compatibility, complexity, and discrepancy and including the downsides of SOA. Moreover, considering the RBV and RDT as a foundation in order to assess the SOA adoption decision is another suggested contribution, as existing papers, which use the RBV together with SOA, only look at the benefits and not at the adoption decision, and vice versa. The next step will involve us validating and refining our research model by conducting a series of case studies to then authenticate our results in a quantitative study.
<table>
<thead>
<tr>
<th>Paper</th>
<th>Methodology</th>
<th>Findings</th>
<th>Differences to our research model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extensible Architectures: The Strategic Value of Service-Oriented Architecture in Banking (Baskerville et al. 2005)</td>
<td>Comparative, cross-cultural case study</td>
<td>The comparison of two banks shows that both achieved architectural extensibility with SOA.</td>
<td>Limited to banks. Does not analyze the general reasons for the decision to adopt SOA. Does not compare efforts and risks with the realized benefits in order to determine the business value of SOA.</td>
</tr>
<tr>
<td>Impact of SOA on Enterprise Information Architectures (Patrick 2005)</td>
<td>Conceptual</td>
<td>SOA leverages existing investments in IT infrastructure while incorporating new capabilities in order to improve business productivity.</td>
<td>Discusses the general benefits, problems, and risks arising when exposing information sources as services. The paper focuses on the exposure of information sources as services, i.e. only a small part of SOA’s potential to contribute to business value.</td>
</tr>
<tr>
<td>Does SOA Improve the Supply Chain? An Empirical Analysis of the Impact of SOA Adoption on Electronic Supply Chain Performance (Kumar et al. 2007a)</td>
<td>Empirical</td>
<td>SOA adoption leads to higher performance of the electronic supply chain. SOA moderates a firm’s ability to leverage electronically integrated customers to achieve better electronic supply chain performance.</td>
<td>Focuses solely on the performance of the supply chain and does not evaluate negative effects nor the actual reasons for the SOA decision.</td>
</tr>
<tr>
<td>Impact of SOA Adoption on Electronic Supply Chain Performance (Kumar 2007) &amp; SOA and Information Sharing in Supply Chain: “How” Information is Shared Matters! (Kumar et al. 2007b)</td>
<td>Empirical</td>
<td>SOA adoption mitigates the negative effects of information sharing complexity, but also reduces the positive benefits of information sharing transparency.</td>
<td>Draws on resource-based and configuration theories in order to assess the influence on organizational integration and sustained competitive advantage.</td>
</tr>
<tr>
<td>Service-oriented Architecture and Organizational Integration: An Empirical Study of IT-Enabled Sustained Competitive Advantage (Oh et al. 2007)</td>
<td>Empirical</td>
<td>SOA is able to provide loosely-coupled and interoperable services to enhance flexibility for the integration of various organizational processes within the firm and with business partners.</td>
<td>Does not look at the reasons for the decision to adopt SOA and does not evaluate the risks and efforts (complexity) of SOA.</td>
</tr>
<tr>
<td>Investigating the Antecedents and Benefits of SOA Implementation: A Multi-Case Study Approach (Yoon and Carter 2007)</td>
<td>Five case studies from literature databases</td>
<td>SOA requires strong organization-IT alignment to achieve reported benefits. Other important factors include SOA registries, governance, effective pilot projects, top management support, trust among business units, personnel training, and change management.</td>
<td>Focuses on the factors which are necessary for a successful SOA implementation, not on the benefits and disadvantages themselves.</td>
</tr>
<tr>
<td>General Requirements of Banks on IT Architecture Paradigm (Schulte et al. 2007)</td>
<td>Empirical</td>
<td>SOA is suited to fulfill the requirements of commercial banks.</td>
<td>Only focusing on the relevance of requirements on IT architectures and the restrictions for the adoption of SOA, but did not develop an integrated model explaining the influences on the business value of SOA.</td>
</tr>
<tr>
<td>Service-Oriented Enterprises and Architectures: State of the Art and Research Opportunities (Vitharana et al. 2007)</td>
<td>Conceptual</td>
<td>SOA can be used to make supply chains more agile and more adoptive.</td>
<td>Does not look at the reasons for the decision to adopt SOA and does not compare efforts and risks with the realized benefits in order to determine the business value of SOA.</td>
</tr>
<tr>
<td>Service Oriented Architecture (SOA) Implications for Large Scale Distributed Health Care Enterprises (Vasilescu and Mun 2006)</td>
<td>Conceptual</td>
<td>Through SOA-based components and services, integration and interoperability can be scaled up and bridge clinical and related administrative entities with improved flexibility regardless of platform and physical location.</td>
<td>There is no integrated model for assessing the adoption or the business value of the developed SOA.</td>
</tr>
<tr>
<td>Towards Understanding the Sources of the Economic Potential of Service-Oriented Architecture: Findings from the Automotive and Banking Industry (Müller et al. 2007)</td>
<td>Qualitative model</td>
<td>Analyzes the economic potentials of SOA in the automotive distribution sector and the banking industry.</td>
<td>Does not incorporate efforts and risks in the model in order to determine the business value of SOA. Does not look at the adoption of SOA.</td>
</tr>
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Table 1. Studies on the Business Value of SOA in IS Research

REFERENCES


