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## DIGIT 2009

# Examining the Organizational Decision to Adopt Service-Oriented Architecture (SOA) – Development of a Research Model

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### ABSTRACT

What are the determinants of an organization's decision to adopt Service-Oriented Architecture (SOA)? Although the paradigms of service orientation and SOA have become quite omnipresent in the IS literature, research is still lacking to provide a comprehensive view upon drivers and inhibitors of the organizational decision to adopt SOA. Based on the mature strand of adoption research, this paper develops a conceptual model in order to increase the understanding of the determinants influencing this decision. Thereby, the drivers and inhibitors are distinguished in organization-specific and innovation-specific factors. The organization-specific factors cover two aspects: (1) the compatibility of technology and organization (i.e., SOA expertise of the employees, management support for SOA, IT/ Business alignment, degree of process documentation) and (2) management fad and fashion. The innovation-specific factors cover the perceived benefits, perceived complexity, and standardization of available technologies related to SOA. Beside developing this theoretical model for laying the foundation for future empirical research, a further contribution of this paper is the development of a comprehensive measurement model for SOA adoption, which differentiates between the IT and the enterprise layer.

### Keywords

SOA, Service-Oriented Architecture, Adoption, Organization, Compatibility, Standardization.

### INTRODUCTION

An increasing number of SOA implementations (Heffner 2008; Ren and Lyytinen 2008) provides evidence for growing acceptance of this new paradigm in practice. In their review of five cases, Yoon and Carter identified both business

motivations (i.e., improving business agility; lowering costs; getting timely, accurate data; improving customer service; and increasing business efficiency) and IT motivations (i.e., improving IT scalability / adaptability; efficient application development; decreasing IT maintenance costs; integrate systems or applications; and providing timely, accurate data) as driver for SOA implementation (Yoon and Carter 2007). While previous investigations have particularly focused on the technical aspects associated with SOA, more recent studies also deliver insights on the organizational performance impacts of this innovation (Baskerville et al. 2005; Brahe 2007; Schelp and Aier 2009; Vitharana et al. 2007). Other authors discuss the challenges of implementing SOA and the factors necessary for a successful SOA implementation (Kohnke et al. 2008; Yoon and Carter 2007). However, the academic literature remains fragmented and immature in terms of explaining why and to what extent organizations adopt SOA. Therefore, the aim of this paper is to integrate the existing aspects identified in the literature in order to develop a model for the adoption of SOA that frames the drivers and inhibitors influencing the SOA adoption decision at firm level.

Based on well proved dimensions, namely perceived complexity, compatibility and perceived benefits, we will derive factors which drive or inhibit the adoption of SOA which may serve as a foundation for empirical research.

## **RELATED RESEARCH**

Since the literature offers many different definitions and interpretations of the SOA term (Masak 2007; OASIS 2006), we (1) introduce a common definition of SOA for the following work, and (2) relate our work to research on the adoption of innovations in general, and to the existing body of literature concerning SOA, in particular.

(1) Bieberstein et al. (2005, p. 5) define SOA with respect to both IT and business as ‘framework for integrating business processes and supporting IT infrastructure as secure, standardized components - services - that can be reused and combined to address changing business priorities’. In practice, the reuse and recombination of services in an SOA is achieved by separating the entire architecture in different layers with existing legacy applications and application functionality as foundation on the bottom layer. The different functions of the applications are then integrated by technical services in order to decouple the next layer from the application systems and to offer coherent and standardized technical functionality. The following layer consists of enterprise services, which further integrate the technical services to offer the business functionality, which is needed in the business processes. Finally, each business process is supported by a portal or graphical user interface, which directs the user inputs to the particular enterprise services. Therefore, a business process relies on several enterprise services whereby the order of the service calls determines the workflow of a particular business process.

(2) Rogers defines adoption as the ‘decision to make full use of an innovation as the best course available’ (Rogers 2003, p. 177). As the adoption of innovations initiates a transformation process which directly affects the technological and social structure of organizations (Gopalakrishnan and Damanpour 1997), adoption research is part of an extensive field of research in which organizational innovation is observed from diverse perspectives. From the sociological perspective, characteristics of both organizations and innovations are analyzed with respect to their influence on the adoption of organizational innovations. In the field of organizational adoption, in contrast to the decisions of individuals, the adoption of EDI has been investigated intensively (Chau and Hui 2001; Chwelos et al. 2001; Teo et al. 1995).

As this paper analyzes the adoption of SOA within an organization, an overview of existing papers dealing with SOA follows next. First, existing empirical studies mainly investigate the business value of SOA and focus on single aspects in distinct contexts, such as the influence of SOA adoption on electronic supply chains (Kumar et al. 2007a; Kumar et al. 2007b), or the interrelation between SOA, organizational integration and competitive advantage (Oh et al. 2007). Additionally, several case studies permit further valuable insights. For example, Yoon and Carter analyze SOA initiatives of different organizations regarding the realized benefits and identify factors necessary for a successful SOA implementation (Yoon and Carter 2007). Similar to Yoon and Carter, Haines and Haseman analyze SOA initiatives with regard to identifying adoption patterns of SOA and paths of SOA adoption (Haines and Haseman 2009). By contrast, Schelp and Aier focus on the potential sustainable contributions of SOA to corporate agility (Schelp and Aier 2009). Furthermore, Beimborn, Joachim, and Weitzel choose an IT adoption perspective in order to develop a research model for assessing the business value, which is based on the assumption that organizations only adopt SOA when a positive business value is expected (Beimborn et al. 2008b).

In contrast to these previous publications, this paper proposes a research model which can be used in quantitative studies to explain why and to which degree organizations adopt SOA. Therefore, this paper will work out deeper insights into the crucial factors which influence an organization’s decision to adopt SOA. While previous studies investigated the influence of adopting SOA on different aspects, such as organizational performance or supply chain performance, this paper extends the existing body of literature by examining the factors that influence the decision to adopt SOA.

## **CONCEPTUAL MODEL**

Fichman suggests two types of innovations: (1) type I innovations, and (2) type II innovations (Fichman 1992). Type I innovations are characterized by a lack of user interdependencies and low demands in matters of knowledge and experience of potential adopters for making use of an innovation. By contrast, type II innovations show high demands on knowledge and experience, or imply significant user interdependencies. For type I innovations, the telling issue is the *willingness to adopt*,

while for type II innovations it is the *ability to adopt* (Fichman 1992). The implementation of an SOA is aimed at a radical transformation of the IT architecture. Due to the introduction of new technologies, principles, and concepts, profound changes do not only occur concerning software development or IT management, i.e., the qualification profile of the IT staff. Moreover, numerous new interdependencies between business units emerge. Consequently, SOA can be classified as a type II innovation. In adoption research that deals with type II innovations, the factors which potentially influence the adoption decision are commonly divided into two groups, namely organization-specific factors and innovation-specific factors (Premkumar and Potter 1995; Ramamurthy et al. 2008). This approach will be adopted for a first classification of the factors used in our conceptual model.

On the basis of an analysis of empirical and non-empirical studies, Kwon and Zmud (1987) identified five contextual factors which influence organizational innovation: (1) characteristics of the individuals involved in the innovation process, (2) characteristics of the adopting organization, (3) characteristics of the technology in focus, (4) characteristics of task-related factors which are affected by the innovation, and (5) environmental factors. Fichman points out that, an innovation may be highly compatible for one organization but not for another. Likewise, an organization may have a strong champion for one innovation but not for another. Therefore, compatibility and champions are most appropriately viewed as describing the *combination* of innovation and organization, rather than either one in isolation (Fichman 2000, p. 116). The factors our model is built on are chosen accordingly. Figure 1 shows our proposed research model which is developed in the following sections.

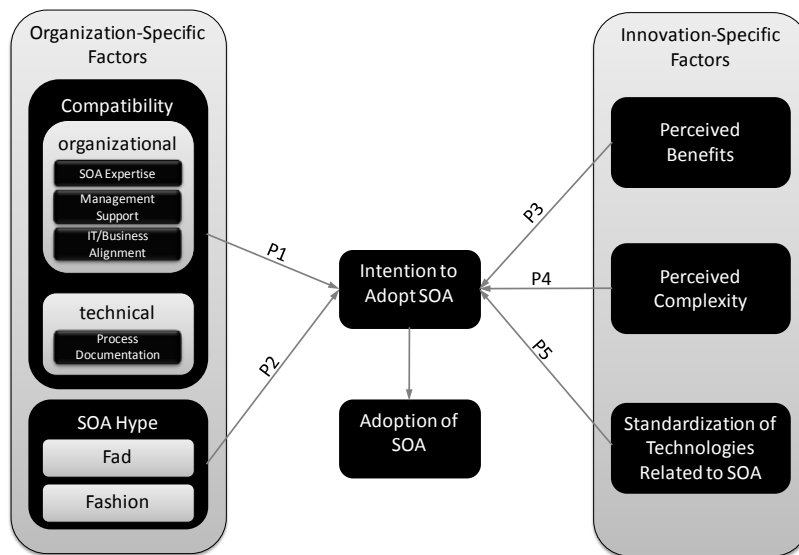


Figure 1. Proposed research model regarding the organizational decision to adopt SOA

### **Intention to Adopt and Adoption**

For our work, adoption is defined as the organizational decision to implement an SOA. Our conceptual model distinguishes between two endogenous variables, the intention to adopt SOA and the actual adoption of SOA. While the latter captures the decision to implement an SOA as well as the rate of adoption, the former serves as a predictor of whether or not an organization will implement an SOA. This differentiation is necessary, as the relationship between intention and adoption is influenced by other contingencies (such as budget constraints or firm characteristics) which could contort the empirical examination (Ajzen and Fishbein 1980). Although it is possible to assess the characteristics in a post-hoc fashion, Tornatzky and Klein note that ‘retrospective innovation characteristics studies are particularly suspect. Given what is known about the social psychology of decision-making [..] one would expect raters of an innovation’s characteristics to rate the innovation favorably once they had adopted it’ (Tornatzky and Klein 1982, p. 29). Thus, to allow insights into the factors influencing the adoption decision, the model draws on the intention to adopt. Intention to adopt is not only applied successfully on the individual level to predict behavior (e.g., Venkatesh and Davis 2000; Venkatesh et al. 2003). Researchers have also adapted it successfully from individual to organizational level adoption studies (Chwelos et al. 2001; Teo et al. 2003). Even though intention does not necessarily result in adoption, the correlation is significant (cf. Morrison 1979).

### **Organization-Specific Factors**

In the following we refer to the organizational factors by subsuming them in a composite construct named compatibility. These factors represent prerequisites for a successful implementation of SOA an organization has to comply with, and therefore address the question about an organization’s ability to adopt. In addition to this economic-rationalistic perception of SOA adoption, our model also draws upon management fads and fashions labeled as SOA hype to overcome the dominant paradigm, “where innovations are assumed to be technically efficient” (Fichman 2004, p. 327), generally questioning the assumption of the rationalistic assessment of an innovation by potential adopters. Fads and fashions might provoke the adoption of technically inefficient innovations (Abrahamson 1991) by influencing the relevance attached to their characteristics. Nevertheless, the potential adopters’ perception about an innovation’s characteristics is still a crucial driver for adopting it (Rogers 2003), and thus will be included in the model as well.

#### *Compatibility*

Compatibility is a classical factor of adoption research (Rogers 2003). It is defined as ‘the degree to which using an innovation is considered consistent with existing organizational values, experiences, and needs’ (Teo et al. 1995, p. 156), and can be denoted as organization-innovation fit (Fichman 2000). In their study about the determinants of EDI adoption, Teo, et al. (1995) distinguish two sub-constructs of compatibility: *technical compatibility* and *organizational compatibility*.

Technical compatibility refers to the fit between the innovation and the IT-infrastructure while organizational compatibility addresses the fit between the innovation and the current goals, processes, and qualifications of the personnel (Teo et al. 1995). The lesser the fit between an innovation and an organization's needs, strategies, resources and skills, the more the tendency to adopt the innovation declines (Fichman 2000).

Organizational compatibility is conceptualized by three factors: SOA expertise of the IT personnel, management support, and IT/Business alignment (cf. Figure 1). Technical compatibility is conceptualized as business process documentation.

**SOA Expertise.** At any given moment, organizations possess a bundle of knowledge and skills which has to be aligned with the bundle necessary to adopt a specific innovation successfully (Fichman and Kemerer 1997). Considering the new methods, concepts, principles, and technologies accompanied with SOA and the paradigm of service orientation (Papazoglou and van den Heuvel 2006; Zimmermann et al. 2004), SOA related expertise of the IT personnel is an evident condition preceding the adoption. It could be objected that, in terms of learning-by-doing, SOA related expertise is obtained through adoption (Arrow 1962). However, Atewell states that "firms delay in-house adoption of complex technology until they obtain sufficient technical know-how to implement and operate it successfully" (Atewell 1992, p. 1). Complex technologies are characterized by substantial knowledge barriers. In order to use an innovation effectively, these knowledge barriers have to be lowered. Fichman and Kemerer indicate innovations like relational databases, CASE tools and object-oriented programming as complex innovations, labeling them software process innovations (SPIs) (Fichman and Kemerer 1997). The adoption of SPIs causes process changes in regard to the development of applications. SOA is associated with service-oriented software development and hence can be attached to this group of innovations. Therefore, we propose that:

P1a: SOA expertise is positively related to the intention to adopt SOA.

**Management Support.** Support of the top management for a particular technology in terms of financial support or handling risks associated with the adoption is one of the main drivers for the adoption and usage of an innovation (Jeyaraj et al. 2006; Premkumar and Potter 1995). Typically, this factor encompasses only the top management. However, we extend this factor by incorporating the business units as a second group of decision-makers in order to investigate the influence of the business units on the adoption to SOA.

Management support is crucial for various reasons. It helps to ensure that adequate resources will be allocated if an innovation, e.g., SOA, is adopted (Premkumar and Potter 1995). Often, the first SOA projects are not profitable because they require high initial investments, while potential benefits may not be realized immediately (Linthicum 2007). Top

management support provides an appropriate strategic vision and direction (Premkumar and Potter 1995), and sends out signals about the importance of an innovation to various parts of the organization to sustain a favorable attitude (Ramamurthy et al. 2008).

Moreover, the implementation success of SOA heavily depends on the cooperation of the participating business units (Müller 2007), because business unit-spanning processes are supposed to be redesigned and supported by SOA. The main objective of this cooperation is to improve the applications' data and functionality through service encapsulation, generating reuse, and reducing redundancies. However, the required coordination also implies conflict potential (Höft 2007; Krafzig et al. 2005) in two ways: first, the service development for reuse increases the costs of the business unit developing the service (Heutschi 2007) because developers have to account for demands of potential and existing service users; second, business units worry about a loss of control due to the incorporation of other service users into the service development process (Krafzig et al. 2005).

Consequently, the adoption of SOA may go along with extensive changes of organizational structures, responsibilities, accountabilities, and dependencies. Therefore, we propose that:

P1b: Management support is positively related to the intention to adopt SOA.

**IT/Business Alignment.** Since SOA is built around the notion that services map to business functions (Datz 2004), researchers commonly point out the importance of a close cooperation between business units and IT to achieve good service design (Heutschi 2007; Müller 2007). In general, effective cooperation between business and IT is extensively discussed as IT/business alignment in the literature (For an overview compare e.g. Chan and Reich 2007). While many publications address IT/business alignment at a strategic level (i.e., congruence of business and IT plans, vision, goals,..)(Chan and Reich 2007), Wagner has introduced a model of operational IT/business alignment dealing with alignment in day-to-day operations, comprising three domains: (1) *interaction* reflects extent and quality of communication between IT and business units; (2) *shared domain knowledge* is related to the knowledge each of the two sides has about the other side's domain; (3) *cognition* is concerned with the level of mutuality between IT and business, meaning if and to what extent there exists e.g. mutual trust and respect (Wagner 2007). These aspects appear to be of considerable importance for the intention to adopt SOA for the following reasons. To encapsulate business functionality by means of a service, knowledge of the business processes to be supported and the business context it will be applied to are vital to success (Krafzig et al. 2005). The integration of the business units' knowledge and experiences into the service development process is crucial for realizing service reusability



(Elfatraty 2007). Simultaneously, from a business point of view, a service has to be self contained and has to encapsulate meaningful functionality (Elfatraty 2007). Therefore, a combination of the knowledge and experiences of both business and IT is essential (Starke and Tilkov 2007). However, knowledge transfer seldom happens by incident rather than through intensive and organized interaction between business and IT. Furthermore, interaction can also facilitate cognition (Beimborn et al. 2008a). When employees of both business and IT communicate regularly and actively exchange their knowledge, it is more likely that the benefits which may result from an SOA are acknowledged by either side, leading to a more positive attitude towards SOA. Therefore, we propose that:

P1c: IT/Business alignment is positively related to the intention to adopt SOA.

**Business Process Documentation.** Services act as automated units of work which are composed in support of business processes. In an SOA, those services should be derived directly from business process models (Sinz 2008), mapping them to business functions. The business processes are analyzed and then decomposed into sub-processes and single workflow activities to detect redundancies which are to be dissolved by shared services (Arsanjani et al. 2008; Müller 2007). Therefore, a prerequisite for the identification of services is process knowledge. This knowledge is obtained through the formalization of business processes in terms of process documentation. Ein-Dor und Segev act on the assumption that process formalization is crucial for a successful adoption of innovations (Ein-Dor and Segev 1978). To identify services, a process-oriented documentation on different aggregation stages is needed, so that the resulting workflow activities can be ordered to a workflow. This ordering allows the encapsulation of business functionality with strong cohesion to facilitate service reuse (Papazoglou and van den Heuvel 2006). Besides service identification, an extensive process documentation serves a second purpose: the identification of the processes which should be supported by SOA. In absence of a consistent and extensive business process documentation, the effort for service identification, the risk of inefficient resource allocation, to miss redundancies and consequently to waste synergies will increase. We propose that:

P1d: Business process documentation is positively related to the intention to adopt SOA.

#### *SOA-Hype*

'For most IT innovations, individual firms are free to adopt—or not adopt—based primarily on circumstances specific to their organizations' (Fichman 2000, p. 123). However, for some innovations the adoption decision is tightly linked among a group of firms. One reason is the positive relationship between an innovation's benefits and the number of its adopters (Habermeier 1989) resulting from network effects (Katz and Shapiro 1985). These increasing returns provide an economic explanation for

the bandwagon effect observed with many innovations (Fichman 2000). The bandwagon effect describes an adoption pattern of positive feedback so that the pressure to adopt a specific innovation increases according to the number of organizations which already adopted it (Abrahamson 1991). But, despite the fact that one of the SOA benefits lies in the improved interconnection with cooperation partners (Kumar et al. 2007a; Vitharana et al. 2007), Fichman adds that the decision to adopt an innovation is influenced by managerial fashions and fads (Fichman 2000).

The fashion perspective assumes that under conditions of uncertainty, organizations within a group imitate organizations outside this group. These imitated organizations are called fashion setters (Abrahamson 1991). Consulting firms, economic experts or business mass media are examples for fashion setters (Abrahamson 1996). Fashion setters do not have the coercive power necessary to force organizations to imitate them. Instead, their power “stems from their capacity to inspire organizations to trust their choices of technologies and to imitate them” (Abrahamson 1991, p. 596).

In contrast to the fashion perspective, the fad perspective assumes that under conditions of uncertainty organizations imitate organizations within their own group. Consequently, the question is not which innovation is to be adopted, but which organization is to be imitated (Abrahamson 1991). Possible explanations for this behavior are e.g. that organizations which are bad on certain characteristics tend to imitate organizations that are good on these characteristics, or that organizations imitate other organizations “in order to appear legitimate by conforming to emergent norms that sanction these innovations” (Abrahamson 1991, p. 597).

Accordingly, Fichman expects IT adoption to be influenced by fashions and fads (Fichman 2000). Although this is not always the case, we propose a positive relationship. SOA adoption is a risky venture where uncertainty is high. Under conditions of uncertainty we assume fashion and fad to have a positive effect, because organizations tend to lower risk by imitating others. Therefore, we propose that:

P2: Fashion and fad positively affect the intention to adopt SOA.

### **Innovation-Specific Factors**

Rogers proposes that the adoption of an innovation is highly related to its characteristics perceived by potential adopters. He determines five of these characteristics: *relative advantage*, *compatibility*, *complexity*, *trialability*, and *observability* (Rogers 2003). In a meta-analysis, Tornatzky and Klein identify *relative advantage*, *compatibility*, and *complexity* as the only factors significantly correlating with adoption across studies (Tornatzky and Klein 1982). As for type II innovations, various studies confirm their findings (O’Callaghan et al. 1992; Premkumar and Ramamurthy 1995; Ramamurthy et al. 2008).

While compatibility has already been discussed, we draw upon *perceived benefits* (relative advantage) and *perceived complexity*, supplemented by *standardization of technologies related to SOA* as innovation-specific factors influencing SOA adoption.

#### *Perceived Benefits*

Perceived benefits are the anticipated relative advantages resulting from a (potential) adoption of SOA in contrast to the status-quo of an organization. According to Yoon and Carter, we differentiate these potential benefits into business benefits and IT benefits (Yoon and Carter 2007).

Information technology can be an enabler but also an obstacle for the design and implementation of new business processes and strategies (Österle 1996). From a business perspective it is vital to have a flexible IT infrastructure which allows for an increase in the capability of existing applications to efficiently and effectively adapt in line with new business requirements. Duncan considers the flexibility of an IT infrastructure as determined by the "degree to which its resources are sharable and reusable" (Duncan 1995, p. 42). Therefore, flexibility is dependent on three criteria of an IT infrastructure: (1) Modularity; (2) integration (Byrd and Turner 2000); and (3) scalability (Chanopas et al. 2006). Modularity is determined by the degree to which a system's components can be separated and recombined (Schilling 2000). Integration enables components to connect to each other and share any kind of information (Byrd and Turner 2000). SOA facilitates such a flexible infrastructure by modularizing business functions in terms of loosely coupled, flexible services, which are accessible through standardized interfaces (Cherbakov et al. 2005).

Due to the technical decoupling of the infrastructure, SOA is frequently understood as a necessary condition for the realization of a Service-Oriented Enterprise (SOE) (Demirkan and Goul 2006; Janssen 2008; Vom Brocke et al. 2008). From a process point of view, SOA supports the modularization and re-orchestration of business processes through the central provision of corresponding business functions as services. The flexible integration of services within an SOA allows for dynamic coupling of process components, thus easing business process changes.

Because of SOA's potential for service reuse, functionalities do not have to be implemented, tested, and deployed repeatedly (Vinoski 2004). The modularity of the services in an SOA and their virtualization through the enterprise service bus (ESB) offer the potential for load balancing in case of fluctuating transaction volumes by allocating service calls to different service instances. Moreover, the consistent use of platform and language independent standards in connection with the ESB allow for

an easier integration of applications (Legner and Heutschi 2007) internally and externally, enabling a higher level of business process automation.

Therefore, the main reason to adopt SOA from a business point of view is to move towards a Service-Oriented Enterprise (SOE) by leveraging IT flexibility, which in turn increases business process adaptability to environmental changes. In contrast, from an IT perspective it is SOA's potential to reduce costs for implementation and maintenance of interfaces, which mainly result from point-to-point connections of the existing applications. Therefore, an SOA can reduce the complexity by decomposing the existing application landscape and decoupling of services through the use of an ESB, making point-to-point connections unnecessary and thus reduces the implementation and maintenance efforts. Furthermore, service reuse decreases redundancies of both application functionality and data, which reduces development and maintenance costs (Schwinn 2005; Vinoski 2004). Therefore, we propose that:

P3: Perceived benefits are positively related to the intention to adopt SOA.

#### *Perceived Complexity*

The complexity of an innovation is "the degree to which it is perceived as relatively difficult to understand and use" (Rogers 2003, p. 16). Although an innovation may appear to be useful to an organization, this organization may not have the necessary expertise to use it (Premkumar et al. 1994). In the literature it is assumed that the higher the complexity of an innovation, the higher an organization's efforts will be to adopt it (Grover 1993; Teo et al. 1995), since it "creates greater uncertainty for successful implementation and therefore increases the risk in the adoption decision" (Premkumar and Roberts 1999, p. 471). The complexity of implementing SOA depends on various factors, e.g., maturity and suitability of web services for implementation, migration of the existing application landscape, service design, SOA governance, and organizational change.

There are two important problems an organization has to deal with when implementing SOA with web services. First, web services are still classified as immature (Booth et al. 2004) and are to be further developed, implying risks like uncertainty about that development (Baskerville et al. 2005; Bieberstein et al. 2005). Second, using web services is at the cost of a loss in performance due to an additional XML layer which has to be parsed (Wong-Bushby et al. 2006).

To implement an SOA, "the existing application landscape has to be mapped, which represents a challenging task if systems have grown over time and documentation is lacking" (Beimborn et al. 2008b, p. 3). Krafzig, Banke, and Slama state that, "this is far from trivial" (Krafzig et al. 2005, p. 252). Tightly connected with the migration effort is the challenging task of

determining an economic level of service granularity for reuse (Ren and Lyytinen 2008). This means finding the optimal trade-off between reusability and the expenditure necessary for its realization.

Under the term of organizational change we subsume various alterations. First, as mentioned earlier, SOA adoption implies the adoption of new principles and concepts and the technologies needed to implement them. Technologies could be modeling and architectural methodologies, best practices, patterns, or technological standards like web services standards (Bieberstein et al. 2005). Though, the training of employees to establish the expertise necessary for implementing and operating an SOA is a precondition for adoption (Beimborn et al. 2008b). Second, organizational structures have to be transformed or altered. New governance structures have to be established. Theory points out (Kalex 2007) and practical experiences demonstrate (Yoon and Carter 2007) that the absence of an effective SOA governance leads to major problems concerning implementation and operation of an SOA. Third, tasks and roles have to be altered and new ones have to be defined (Kohnke et al. 2008). Consequently, SOA adoption has an impact on responsibilities, competencies, operation methods, and mindsets regarding business and IT. Changes to organizational structures in an SOA context have been subject of numerous studies, proving, that those changes are difficult to implement (Devos et al. 2007). Schneider, Brief, and Guzzo attribute this to the employees' resistance (Schneider et al. 1996).

Kwon and Zmud assume complexity to have a negative influence on the decision to adopt (Kwon and Zmud 1987). Later empirical studies support this negative relation (Grover 1993; Ramamurthy et al. 2008; Teo et al. 1995). Thus, we propose that:

P4: Perceived complexity is negatively related to the intention to adopt SOA.

#### *Standardization of SOA Technologies*

Amongst others, the value generated by SOA comprises bridging the technological gap between the various heterogeneous and proprietary standards utilized in an application landscape grown over time. This is achieved through establishing language and platform independent standards for interface description, data formats, and communication protocols. Thus, standardization of SOA technologies is defined as the degree to which mature and industry-wide standards for realizing SOA are available.

'Standards are an important mechanism for imposing meaning and order on a corpus of knowledge that otherwise provides too many potential options to be socially applicable' (King et al. 1994, p. 156). Therefore, standards define consistent rules for interaction. They facilitate compatibility and thereby the interconnection of business processes.

According to the literature, implementing SOA based on web services is common. Therefore the maturity and diffusion of web services standards is crucial for the adoption of SOA (Ciganek et al. 2006). Vitharana et al. suppose that web services standards are at an advanced stage (Vitharana et al. 2007). Other resources complain about an inadequate maturity (Brahe 2007; Haines and Haseman 2009). The maturity of security standards is considered as one of the main obstacles for SOA adoption (Ciganek et al. 2005). Additionally, the lack of an agreement about a standard is an outstanding problem (Heutschi 2007). Schulte et al. identify the lack of standardization as one possible inhibitor for SOA adoption (Schulte et al. 2008). Therefore, we propose that:

P5: The lack of standardization of SOA technologies is negatively related to intention to adopt SOA.

### **CONCLUSION AND CONTRIBUTIONS**

The development of the proposed research model shows that the decision of an organization to adopt SOA as well as to what degree is related to various aspects, which are derived from the literature. This paper has structured the existing body of literature regarding SOA and draws on the adoption of innovations theory in order to develop a comprehensive research model which distinguishes organization-specific factors and innovation-specific factors. Thereby, this paper is mainly based on well established constructs, such as compatibility, perceived benefits and complexity, but also extends this rational and economically driven adoption perspective by incorporating fad and fashion, i.e., the hype surrounding SOA.

In future research, this conceptual model could be operationalized and used in empirical research. While some of the constructs are well established in the empirical literature and thus are reflected by mature measurement models, some other of our model's components still need to be operationalized. First of all, the main variables (intention to adopt SOA and adoption of SOA) need to be explained. Since both the literature and practitioners are frequently confused about the actual meaning of SOA, a consistent operationalization will be a core issue. SOA can be understood in a non-technical way (service-oriented enterprise), in a purely technical way (e.g., integrating systems by using XML web services), or in a holistic way which covers and integrates both business and IT layers and represents SOA in a narrow sense. The theoretical argumentation of our research model draws on the holistic understanding of SOA. Consequently, we propose different measures when capturing the extent of SOA adoption of a particular firm. First, we focus on the technical layer and use different items which ask whether the IT architecture in place follows the SOA paradigm. Second, we propose a formative measurement regarding which technical components (such as ESB, service registries, BPEL engine, BAM, rule engines, SCA etc.) are used and to what extent within the IT infrastructure. Third, we suggest to investigate to what extent the IT support of particular business processes is based on SOA. Finally, the business layer should be captured by asking whether business activities are designed

and managed following a service-oriented paradigm (e.g., identifying redundant activities by drawing service/capability maps, using service-based design principles etc.). The combination of these measures (cf. Table 1) will allow for capturing a preferably complete picture of the degree of SOA adoption within the surveyed organizations.

Construct / Item	Scale
<b>SOA paradigm on the IT level</b>	
Our firm has realized its IT architecture in an SOA-oriented manner.	7-Likert scale from completely disagree to fully agree
Our IT landscape follows the SOA paradigm as far as possible.	
Service orientation is the primary design principle of our IT architecture.	
All of our applications are integrated via service-oriented interfaces.	
<b>Extent to which SOA-related technologies are used</b>	
To which extent are the following technologies used in your organization?	technology unknown, no use, pilot use, used in some projects, used in some divisions, used across multiple divisions, used across the whole firm
XML	
SOAP, WSDL	
ESB or other bus	
Service Registry/Repository	
BPEL or other orchestration technologies	
business activity monitoring	
rule engines	
service component architecture (SCA), service data objects	
<b>Extent to which the IT support of particular business processes is based on SOA</b>	
To which extent are the following processes supported by SOA?	5-Likert scale from no SOA to completely supported by SOA
production, operations	
procurement, B2B integration	
research & development	
marketing, sales, customer relations	
secondary processes (accounting, HR etc.)	
<b>SOE (SOA paradigm on the business level)</b>	
Redundant business activities have been consolidated.	5-Likert scale from completely disagree to fully agree
Follow service-oriented perspective when modeling business activities.	
Services are the primary structuration element on the non-technical level.	

**Table 1. Measurement Model for Adoption of SOA**

Also, for assessing the intention to adopt SOA, no mature measurement model which could be used to test the proposed research model exists. Thus, the items presented in Table 1 for assessing the degree of SOA adoption can be reformulated in order to assess the intention of an organization to adopt SOA with respect to the holistic understanding of SOA. However, the more detailed questions used for assessing the degree of SOA adoption (cf. Table 1), such as the ‘extent to which SOA-related technologies will be used’ or the ‘extent to which the IT support of particular business processes will be based on SOA’ are

expected to be difficult to answer in advance. Hence, a shorter approach to measure the particular intention of an organization to adopt SOA is shown in Table 2. This is based on the ideas of Chewlos et al. (2001) regarding their measurement of the intention to adopt EDI in their adoption model.

Construct / Item	Scale
In the future we want to integrate our applications based on SOA.	7-Likert scale from completely disagree to fully agree
We plan to introduce or extent our existing SOA.	
We have the intention to expand our SOA efforts.	
Service-orientation is supposed to be the primary design principle of our IT architecture.	
Our IT landscape will increasingly follow the service-oriented paradigm.	

**Table 2. Measurement Model for Intention to Adopt SOA**

This paper offers two main contributions for research: (1) Existing research models for the organizational decision to adopt a technology are adapted to the context of SOA as architectural paradigm in contrast to the adoption of, e.g., application systems. Consequently, additional aspects such as SOA hype in terms of management fad and fashion as well as the degree of standardization of SOA-related technologies are considered in our integrated model; (2) As no comprehensive instrument for measuring SOA adoption and intention to adopt SOA could be found in the literature, this paper suggests measurement models for both constructs which can be applied in future empirical studies. Thus, the developed research model can be seen as a first step towards a more precise and comprehensive understanding about the factors which influence the intention to adopt SOA as well as the SOA adoption, the interplay between these factors, and ways how to measure them. Finally, when the proposed model is tested successfully, we expect to have laid a foundation for better explaining differences in SOA adoption at firm level.

The main contribution for practice is that managers are able to analyze the appropriateness of SOA for their particular organization-specific setting in order to justify their adoption decision on rational arguments. With an extended model that incorporates all or at least most of the important aspects for SOA adoption, practical guidelines on how to identify enablers and inhibitors for SOA adoption can be developed.

Since our work is in a rather early stage, the model with all its constructs needs to be validated and, where necessary, refined.

One of the next steps is to test the model in an empirical survey within the German services industry.

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