How do Service-oriented Architectures Influence Organizational Agility?

Research-in-Progress

Janek Richter
University of Cologne
janek.richter@wiso.uni-koeln.de

Dirk Basten
University of Cologne
basten@wiso.uni-koeln.de

ABSTRACT
Managing unanticipated changes in turbulent and dynamic market environments requires organizations to reach an extended level of flexibility, which is known as agility. Agility can be defined as ability to sense environmental changes and to readily respond to those. While information systems are alleged to have a major influence on organizational agility, service-oriented architecture (SOA) poses an opportunity to shape agile information systems and ultimately organizational agility. However, related research studies predominantly comprise theoretical claims only. Seeking a detailed picture and in-depth insights, we conduct a qualitative exploratory case study. The objective of our research-in-progress is therefore to provide first-hand empirical data to contribute insights into SOA’s influence on organizational agility. We contribute to the two related research fields of SOA and organizational agility by addressing lack of empirical research on SOA’s organizational implications.

Keywords
Information systems, service-oriented architecture, organizational agility, flexibility, case study.

INTRODUCTION
Organizations increasingly face turbulent and dynamic market environments. Business changes, for example enforced by ever-changing customer needs, occur at a rapid rate and are mostly unforeseeable for the affected companies. Considering foreseeable changes, companies have established an appropriate degree of organizational flexibility, which allows them to successfully handle anticipated changes (van Oosterhout, Waarts and van Hillegersberg, 2006). Managing unanticipated changes requires an extended level of flexibility – known as agility (Overby, Bharadwaj and Sambamurthy, 2006). A viable strategy for companies striving to survive in dynamic business environments is to strengthen their organizational agility (Trinh, Molla and Peszynski, 2012). Recently, business agility has been ranked among the top three concerns by international senior IT executives (Luftman and Derksen, 2012; Luftman and Zadeh, 2011). What agility exactly means in organizational contexts and how organizations become agile is not entirely understood yet (cf. section Theoretical Background). Though, a reoccurring theme of agility is to quickly cope with continuous unanticipated change in order to survive unprecedented threats as well as to embrace change and to take advantage of opportunities in the business environment (van Oosterhout et al., 2006).

Information systems (IS), which constitute socio-technical systems that to a large degree yield for value proposition within organizations (Piccoli and Ives, 2005), are alleged to strongly influence organizational agility of contemporary businesses (Sambamurthy, Bharadwaj and Grover, 2003). In this context, some researchers refer to the concept of IS agility (Choi, Nazareth and Jain, 2010; Galliers, 2006). The question is therefore how organizations can ensure that IS attain a form of agility to support organizational agility. The literature is inconclusive regarding this relationship; IS are seen as both enabler and inhibitor of agility (Trinh et al., 2012). Thus, investigating this relationship needs to account for the context and provide a holistic picture. Service-oriented architecture (SOA) accompanied by its related organizational mechanisms poses an opportunity to shape agile information systems and ultimately organizational agility (Barry, 2003; Bieberstein, Bose, Fiammante, Jones and Shah, 2006; Erl, 2004, 2009; Hagel and Brown, 2001; Kraffzig, Banke and Slama, 2004; Merrifield, Calhoun and Stevens, 2008; Pulier and Taylor, 2005). Becker, Buxmann and Widjaja (2009) identified agility as most frequently mentioned value potential of SOA. Within the scope of this study, SOA is defined as a business-oriented architectural style that supports organizational agility by encapsulating functionality in services and comprises several technical design principles (cf. section Theoretical Background).
The relationship between SOA and organizational agility is not entirely understood. Previously, SOA research primarily dealt with technical topics—often in combination with specific forms of SOA implementation technologies like web services (e.g., McGovern, Tyagi, Stevens and Mathew, 2003; Umapathy and Purao S., 2007). Recently, researchers have begun to look into business benefits and organizational impact of SOA, but empirical research is still scarce (Joachim, 2011; Viering and Legner, 2009).

Despite the proposition SOA being a major driver of organizational agility, most existing studies comprise theoretical claims, which still need to be empirically validated. Empirical research focusing on the relationship between SOA and agility is limited to few studies to date. Quantitative research indicates that SOA and its organizational requirements affect organizational agility (Joachim, Beimborn and Weitzel, 2013). Case-based research primarily investigates SOA and its benefits with the help of secondary data or industry cases only (Kraffig et al., 2004; Müller, Viering, Legner and Riempf, 2010; Yoon and Carter, 2007). Furthermore, case-based research so far has focused on generalizability, thus choosing multiple case designs (Baskerville, Cavallari, Hjort-Madsen, Pries-Heje, Sorrentino and Virili, 2005; Schelp and Aier, 2009). However, we still lack an in-depth understanding on how these effects are generated. Therefore, our research objective is, while providing first-hand empirical data, to contribute to the endeavor of assessing how aspects of SOA influence organizational agility. Accordingly, we pose the following research question:

How do service-oriented architectures influence organizational agility?

To answer this research question, we apply a case-based research approach. So far, there is significant lack of case-based research investigating this relationship in an in-depth, intensive manner. Such research (focusing on explaining this how question) would verify experts’ proposition of and complement studies indicating SOA as a driver of agility. Aiming to arrive at robust theory for prediction, strong explanations of investigated phenomena are prerequisite (Gregor, 2006).

The remainder of this research-in-progress is as follows. Next, we describe the theoretical background on organizational agility, service-oriented architectures, and the interrelatedness of these concepts. We then describe our case study design. Finally, we provide an outlook on expected contributions.

THEORETICAL BACKGROUND

Organizational Agility

The idea of agile business originates from manufacturing and is proposed as a means to maintain competitive advantage in increasingly dynamic business environments that are characterized by uncertainty and turbulence (Sharifi and Zhang, 2001). Contrarily to lean concepts associated with efficient use of resources, agility is concerned with quick responses to ever-changing environments and being productive at the same time (Dove, 2001). However, no common understanding of the term agility prevails in IS literature (van Oosterhout et al., 2006). Various notions exist that emphasize different aspects of organizational agility and define the concept on different levels of abstraction. Overby et al. (2006) define agility as ability to sense environmental changes and readily respond to those. These two components of agility (i.e., sensing and responding) apply to both strategic and operational issues (Overby et al., 2006). Consistently, Lu and Ramamurthy (2011) differentiate two types of agility, namely market capitalizing agility and operational adjustment agility. While the former focuses on an entrepreneurial mind-set, the latter emphasizes speedy execution/implementation within the organization. Opposing Overby et al. (2006) who see agility as outcome provided through several organizational capabilities, Sambamurthy et al. (2003) consider agility one of several significant organizational capabilities, which eventually affects the quality of organizations’ competitive actions. Such organizational capabilities can be dynamic, that is, they represent the ability to integrate, build, and reconfigure internal and external competences to rapidly address changing environments (Teece, Pisano and Shuen, 1997). However, for Overby et al. (2006) agility strongly relates to the concept of dynamic capabilities insofar as “agility can be thought of as being enabled by a specific subset of dynamic capabilities” (Overby et al., 2006, p. 121).

A recurring theme of agility is to quickly cope with continuous unanticipated change in order to survive unprecedented threats as well as to embrace change and to take advantage of opportunities in the business environment (van Oosterhout et al., 2006). Throughout our research, this rather broad notion of agility will be the working definition to cover a likewise broad context of possible organizational implications related to agility.

Service-oriented Architectures

SOA encapsulates elements of an IS architecture into interoperable services (Erl, 2009). This key feature of SOA is based on the IS paradigm called service-oriented computing (Papazoglou and Georgakopoulos, 2003), in which “services represent the fundamental element for developing applications” (Baskerville et al., 2005, p. 4). Services in the SOA context are
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architectural elements encapsulating business or application functionality (Ren and Lyytinen, 2008). SOA can be described as architectural style (Erl, 2009; Fielding, 2000) as it comprises several design principles and is not bound to any particular implementation technology (McGovern et al., 2003). According to Müller et al. (2010), relevant SOA design principles are modularity of services, loose coupling of services, and the use of standards. Modularity requires services to be self-contained and aggregated into an application by few well-known dependencies. The degree of dependencies between services refers to the degree of their coupling. The design principle of loose coupling depicts that dependencies between services are as few as possible and that services are ideally connected by a single well-defined interface (Brown, Delbaere, Eeles, Johnston and Weaver, 2005; Krafzig et al., 2004). Adhering to this principle enables a service consumer to be independent from the actual implementation of a used service. The use of standards (e.g., open standards for interfaces or data representation) supports the goal of interoperability and integration (Jardim-Goncalves, Grilo and Steiger-Garcao, 2006), especially in heterogeneous environments or when different implementation technologies are used.

To implement SOA in its entirety, organizations are required to thoroughly adopt all above principles. However, in practice SOA is usually fragmented and selectively implemented, that is, SOA-adopting organizations do not adhere to all principles (Hirschheim, Welke and Schwarz, 2010). This fragmented adoption might result from inherently varying degrees of compliance with design principles of particular SOA implementation technologies; the most prominent being web services (Luthria and Rabhi, 2009; McGovern et al., 2003). Naturally, companies are also reluctant and cautious to adopt new technologies for their entire business, especially when benefit realization is difficult to predict (Choi et al., 2010; Hau, Ebert, Hochstein and Brenner, 2008).

However, effectively implementing SOA must not only comply with these technical design principles but also be business-oriented (Ren and Lyytinen, 2008). Business-oriented services are expressed in business-related terms and can be incrementally modified as business processes change (Bieberstein et al., 2006). The business context determines the appropriate level of granularity; that is, the domain scope that a specific service implements. Aligning services to the business context relates to the task of achieving a high potential for service reuse and concurrently keeping services relatively coarse-grained.

Relationship between Service-oriented Architectures and Organizational Agility

Contrary to the wide body of conceptual literature proposing SOA as a major driver for organizational agility, few empirical studies validate this proposition (Joachim, 2011). Joachim (2011) conducted a literature review in major IS research outlets identifying only eight SOA-related studies that empirically investigate agility as a business benefit. Henceforth, we focus on empirical findings regarding the relationship between SOA and organizational agility to shed light on propositions with stronger validation compared to pure conceptual propositions.

Joachim et al. (2013) ascertained in a quantitative study that SOA governance mechanisms are required to achieve four specific agility-related benefits: modularity, scalability, integration, and service reuse. In this context, modularity (cf. Byrd and Turner, 2000, p. 171 for a definition) refers to the ease of managing and changing modular architectures by separating dynamic logic (process) from static logic (service implementation) where “dynamic logic is more likely to be subject to changes and can be adapted more easily” (Becker et al., 2009, p. 7). Scalability is primarily achieved by the technical layers of SOA and less by governance mechanisms (Joachim et al., 2013). For instance, intensively accessed services can be distributed across multiple computing nodes. A common finding is an increased potential for integration (e.g., of internal resources like legacy-systems) by using SOA (e.g., Baskerville et al., 2005; Fink and Neumann, 2009; Luthria and Rabbi, 2009). Service reuse is sought to accelerate development cycles and reduce time-to-market of change requests (Baskerville et al., 2005; Becker et al., 2009; Holmqvist and Pessi, 2006) and for an increased use of shared IT services, for instance, to extend organizational capabilities (Fink and Neumann, 2009). Similar to the previous argument of broadening the use of shared IT services, SOA facilitates the flexibility of information access and usage within organizations (Fink and Neumann, 2009). SOA invokes affinities within organizations to develop capabilities for recognized principles of software development like the aim of building for/with reuse, using abstraction to control complexity, and incrementally extending functionality (Baskerville et al., 2005; Holmqvist and Pessi, 2006). It is arguable that achieving these organizational capabilities at least to some degree represents a prerequisite to the adoption of SOA. However, empirical evidence indicates that a positive feedback mechanism exists between organizational capabilities and SOA.

Critical voices emphasize that SOA results in a more complex system landscape and, while temporarily providing agility, positive effects will not sustain without solutions beyond technical design principles (Schelp and Aier, 2009). Sustainable agility needs to be achieved by explicit enterprise architecture management in form of structures, processes, and instruments to measure and enforce policies.
Summarizing, the relationship between SOA and organizational agility is characterized by the elusive character of agility. The term agility can be seen as an “overarching term for several aspects” incorporating and sometimes equaling flexibility and speed (Becker et al., 2009, p. 7). Derived value potentials of agility are interrelated, mediating each other, and need to be intensively studied in according contexts to identify underlying mechanisms. An in-depth and holistic investigation is needed. Therefore, we choose case study research as a form of empirical research which is especially useful when the investigated phenomenon is broad and complex and boundaries to its context are not clearly evident (Benbasat, Goldstein and Mead, 1987; Dubé and Paré, 2003; Yin, 2009).

RESEARCH APPROACH

This research-in-progress is based on two systematic literature reviews on SOA (cf. Joachim, 2011; Viering and Legner, 2009) and our own review of literature that focuses on the intersection of organizational agility and SOA. Identified propositions on the relationship between SOA and organizational agility form vague, a priori theoretical constructs, which provide a scaffold for our research design (cf. Walsham, 1995). These theoretical constructs do not yet have the character of testable hypotheses and need to be enhanced with further insights. The selected research approach therefore comprises a case-based method to study the phenomenon of agility intensively as opposed to extensively (Mingers, 2001). That means, we consider a particular case to gain in-depth insights in contrast to including a large set of investigated scenarios from which we generalize. Seeking a detailed picture and in-depth insights, we apply a qualitative case study that is exploratory in nature in the sense that prior theory represents only a starting point for our research and guideline for our study design (Paré, 2004). During our study, we maintain a degree of flexibility to readjust our study’s focus if necessary, for instance, due to new insights during data collection or analysis. This reflexive approach contains a continuous reconsideration of the underlying research strategy and goals (cf. Mcakova and Whitley, 2004 for an example of a reflexive approach). Our research approach therefore focuses on a rich case description in contrast to broad generalizable implications and theoretical saturation (Darke, Shanks and Broadbent, 1998; Eisenhardt, 1989; Walsham, 1995).

Case Selection

Case selection will not be limited to a single case. However, to ensure the necessary depth of insights conducting a large-N study is not preferable (Ragin, 1997; Walsham, 1995). Henceforth, we will refer to our study as a single case study for the sake of linguistic simplicity.

We confine our relevant population to large enterprises (LEs) in service sectors like communications, logistics, trade, and related fields as such companies rely on highly digitalized business processes and operate in rather rapidly changing and dynamic market environments. Therefore, these companies can potentially improve performance more than others through IS innovations. Furthermore, substantial boundaries of our case are the active usage of SOA to provide business processes and past as well as future SOA initiatives. Past SOA projects are interesting to reflect on the history of SOA adoption the company has undergone, helping to establish the historical context of the case. Our three substantial boundaries (i.e., LEs, service sector, and SOA adoptions) are depicted on the left side in Figure 1.

The case constitutes the usage of SOA and its impact on organizational agility. Since organizational benefits of agility are strongly interrelated (cf. section Theoretical Background) an embedded case design is difficult to establish and not useful for
this study. To avoid missing important factors we choose a holistic case design (Yin, 2009). Many studies assert that most companies have adopted SOA only in small parts (e.g., only in selected business units) or have limited their adoption to some promising aspects of SOA (e.g., Hau et al., 2008). LEs, due to their available budget, are more likely to invest into large enterprise architecture projects as they can realize benefits on a larger scale when adopting strategies like company-wide SOA implementation. This involves the opportunity to observe SOA in a more exhaustive form of adoption than in small or medium enterprises. Summarizing, we select a most-likely case for identifying a connection between SOA and organizational agility as the aim of our research is the explanation of how SOA establishes organizational agility.

We are currently negotiating a research collaboration with one of the largest German telecommunication providers. Recent feedback has been overall positive and first steps have been accomplished to gain access to the enterprise and conduct the study on-site. The company has adopted SOA on a global basis, providing a common service infrastructure for all its business units. Thus, SOA is critical to its operations and practitioners’ interest into researching this topic is high.

**Data Sources**

Our study can be characterized as cross-sectional field study (Orlikowski and Baroudi, 1991) as it mainly builds on a detailed picture of the current situation and retrospective data in the respective case. We aim to combine real-time and retrospective data as both are mutually informing and help to validate the other. Data is drawn from various sources including semi-structured interviews, informal conversations, observations, articles from press, and internal documents like reports and key figures (cf. Figure 1). We aim to triangulate these data sources (Yin, 2009) to gain a diverse and holistic picture (Stake, 2005) by identifying various kinds of stakeholders and collecting diverse opinions. This can be achieved, among others, by interviewing experts but also staff members at lower hierarchy levels that are involved in and affected by past and future SOA initiatives.

**Data Analysis**

Our data collection and analysis overlap to establish a reflexive and flexible research approach and to enable readjustments of research goals and underlying research design. All data is organized in a case study database and a chain of evidence is established (Yin, 2009). Interviews are recorded and transcribed for further analysis. Qualitative data analysis comprises coding methods combined with congruence analysis to find explanations that fit the observed evidence best (Kvale, 2008; Myers, 2013). We iteratively analyze data in a team of researchers to ensure inter-coder reliability. Results from qualitative analyses are discussed with researchers not engaged in field research and experts to increase transparency of the analysis process and comprehensibility of drawn conclusions.

**EXPECTED CONTRIBUTIONS**

Providing insights on how SOA influences organizational agility fills crucial gaps in empirical research related to SOA and organizational agility. Empirical examples show that SOA introduces mechanisms to improve agility-related benefits (cf. section *Introduction*). However, few studies addressed the question of how these two concepts interact. IS research so far lacks an in-depth understanding of this relationship. Filling this gap will result in more robust theory in general as our study aims for explanatory theory, which can also be utilized to improve recent theory focusing on prediction.

An in-depth understanding on this relationship represents the foundation for robust theory in the future. Furthermore, derived benefits of organizational agility are interrelated, mediating each other, and need to be intensively studied in according contexts to identify underlying mechanisms. Thus, we conduct an in-depth, holistic case study to avoid missing important factors (cf. section *Research Approach*) as the investigated phenomenon is broad and complex and cannot be studied outside of its natural context.

The research fields SOA and organizational agility are strongly connected as organizational agility is alleged to be the main business benefit of adopting SOA (cf. Becker et al., 2009 and section *Theoretical Background*). Our findings will highly contribute to both research fields. Identifying causal mechanisms at work in the context of a specific case provides the opportunity to refine the concept of organizational agility in terms of explaining how it can be achieved. These explanations can guide future research on organizational agility when studying SOA or related technologies. So far, the research field of SOA lacks empirical research with regard to organizational impacts (Viering and Legner, 2009). Most studies in this field contribute to technical themes or elaborate on organizational impacts only in argumentative form. Our study addresses this gap by investigating the relationship between SOA and organizational agility and by putting SOA in the broader context of enterprise architecture.
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