In Search of Explanations: Conceptualizing the Relationship between Service-oriented Architecture and Organizational Agility

Completed Research Paper

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Abstract

Striving to survive in dynamic business environments, companies often aim to strengthen their organizational agility (OA) by making use of information systems (IS). While findings reported in pertinent literature regarding the relationship between IS and OA are inconclusive, many authors advocate service-oriented architecture (SOA) as a means to ultimately shape OA. However, research on this relationship lacks a systematic synthesis of explanatory results and theoretical contributions. To close this research gap, we synthesize literature in order to conceptualize the relationship between SOA and OA. The potential for establishing a definitive link between SOA and OA is limited because of the weak conceptualization of these two concepts in many studies and their merely association without providing any further explanation of their linkage. In addition to providing a conceptualization of the relationship between SOA and OA, we thus offer an agenda for future research to continue the search for explanations.

Keywords: Organizational Agility, Service-oriented Architecture (SOA), Literature Review, Conceptualization, Research Agenda, Information Systems

Introduction

One of the three main concerns for senior information technology (IT) executives (Luftman and Ben-Zvi 2011; Luftman and Derksen 2012) is the need to strengthen organizational agility (OA) (Overby et al. 2006; Trinh et al. 2012). OA pertains to organizations’ ability to quickly and adequately respond to continuous unanticipated changes, as well as survive unprecedented threats, embrace change, and take advantage of opportunities in the business environment (van Oosterhout et al. 2006). While information systems (IS) are alleged to strongly influence the strategic capability of OA (Sambamurthy et al. 2003), organizations struggle to ensure that IS attain the requisite agility to fully support OA.

Owing to this challenge, researchers have begun to investigate various antecedents of OA. With few exceptions, authors of most extant studies refer to broad notions like IT capabilities and digital options (e.g., Chakravarty et al. 2013; Chen et al. 2013; Lu and Ramamurthy 2011; Sambamurthy et al. 2003). Their findings indicate that IS represents both enabler and inhibitor of OA (Trinh et al. 2012). The inconclusiveness of the findings prompted researchers to explore specific technologies that might help to achieve OA (e.g., Trinh et al. 2012). Particularly, authors of extant studies repeatedly mention service-oriented architecture (SOA) and the related organizational mechanisms to represent a candidate for such
a specific technology that offers the opportunity to shape agile IS and ultimately OA (Bieberstein et al. 2005; Douglas 2003; Erl 2004; Erl 2005; Hagel and Brown 2001; Krafzig et al. 2004; Merrifield et al. 2008; Pulier and Taylor 2006). However, SOA research primarily focuses on technical topics, often combined with specific forms of SOA implementation technologies such as web services (McGovern et al. 2006; Umapathy and Purao 2007). While OA has been identified as the most frequently mentioned value potential of SOA (Becker et al. 2009), research on the alleged positive relationship between SOA and OA is divergent and lacks a systematic synthesis of explanatory results and theoretical contributions presented in pertinent literature (see Related Work).

Aiming to close this research gap, we pose the following research question: How can the relationship between service-oriented architecture and organizational agility be conceptualized based on pertinent literature?

We performed a literature review, as a part of which we identified and analyzed 26 studies relating SOA and OA. We analyzed arguments and explanations concerning the relationship between these two concepts. Most of the studies included in this review are limited to associations between the two concepts, while neglecting to provide an explanation for the linkage. Based on the insights obtained by analyzing the set of 26 articles, we identify links between SOA design principles and OA components. We use this synthesis to provide a conceptualization of the relationship between SOA and OA, and thus identify shortcomings in the pertinent literature, allowing us to propose an agenda for future research.

The remainder of this paper is organized as follows. In the next section, we present related work on SOA, OA, and the relationship between these two concepts. We then describe our research approach in Section 3 and present our results in Section 4. In Section 5, we discuss our results and provide an agenda for future research, before concluding our paper in Section 6.

Related Work

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 characterized by uncertainty and turbulence (Sharifi and Zhang 2001). In contrast to lean concepts associated with the efficient use of resources, agility pertains to the ability to quickly respond to ever-changing environments without compromising productivity (Dove 2002). Agility shares many similarities with the concept of flexibility, which allows organizations to successfully handle anticipated changes (van Oosterhout et al. 2006). Although the terms ‘agility’ and ‘flexibility’ have been used interchangeably in the literature (Conboy 2009), we emphasize their conceptual difference, since agility extends flexibility by allowing firms to manage not only foreseeable but also unanticipated changes (Overby et al. 2006; van Oosterhout et al. 2006).

There is evident lack of consensus regarding the definition of OA in the IS literature (Trinh et al. 2012; van Oosterhout et al. 2006). Various notions exist that emphasize different aspects of OA and define the concept at different levels of abstraction. Overby et al. (2006) define agility as the ability to sense environmental changes and readily respond to those. Furthermore, “agility is best viewed as applying to episodic events precipitated by environmental change” (Overby et al. 2006, p. 122). The two components of agility (i.e., sensing and responding) apply to both strategic and operational issues and are therefore established by sensing and responding capabilities of the entire organization (Overby et al. 2006). Consequently, two distinct types of agility, namely market capitalizing agility and operational adjustment agility, can be differentiated (Lu and Ramamurthy 2011). While the former focuses on an entrepreneurial mindset, the latter emphasizes speedy execution/implementation within the organization. In contrast to Overby et al. (2006), who see agility as an outcome provided through several organizational capabilities, Sambamurthy et al. (2003) consider agility as one of several significant organizational capabilities, which eventually affect the quality of organizations’ competitive actions.

A reoccurring theme in studies on agility is the need for adequately coping with continuous unanticipated changes in order to survive unprecedented threats, while embracing change and taking advantage of
opportunities in the business environment (van Oosterhout et al. 2006). Throughout our research, this notion of OA will be adopted, as it allows us to cover a likewise broad context of possible organizational implications related to agility. Considering means to enable OA, researchers rarely refer to specific technologies (see Trinh et al. 2012 for an exception), but rather explore broad notions such as IT capabilities and digital options (e.g., Chakravarty et al. 2013; Chen et al. 2013; Lu and Ramamurthy 2011; Sambamurthy et al. 2003). Since the topic of OA is broad, examining specific technologies might help reduce the complexity of the challenges firms face when attempting to achieve OA.

**Service-oriented Architecture**

Previous research emphasizes SOA—accompanied by its related organizational mechanisms—as an opportunity to ultimately shape OA (Bieberstein et al. 2005; Douglas 2003; Erl 2004; Erl 2005; Hagel and Brown 2001; Krafitz et al. 2004; Merrifield et al. 2008; Pulier and Taylor 2006). OA is identified as the most frequently mentioned value potential of SOA (Becker et al. 2009). Based on the IS paradigm of service-oriented computing (Papazoglou and Georgakopoulos 2003), SOA encapsulates elements of an IS architecture into interoperable services (Erl 2005). Such services “represent the fundamental element for developing applications” (Baskerville et al. 2005, p. 4) and are architectural elements encapsulating business or application functionality (Ren and Lytytinen 2008). Since SOA comprises several design principles and is not bound to any particular implementation technology (McGovern et al. 2003), it can be seen as an architectural style or paradigm (Erl 2005; Fielding 2000).

Several design principles evolve around the concept of SOA (Baskerville et al. 2005; Joachim 2011; Ren and Lytytinen 2008). An obvious principle is SOA’s service orientation that represents the view of basic architectural elements as services and stresses the separation of concerns in software (Erl 2005; Erl 2008). The design principle of loose coupling requires as few dependencies between services as possible and services to be ideally connected by a single well-defined interface (Brown et al. 2005; Krafitz et al. 2004). The degree of dependencies between services refers to the extent of their coupling. Consequently, modularity—also referred to as the principle of autonomy (Ren and Lytytinen 2008)—requires services to be autonomous, self-contained, and aggregated into an application by few well-known dependencies (Mueller et al. 2010). Adhering to this principle relates to the concepts of platform/implementation-independence and interoperability, which enable a service consumer to be independent from the actual implementation (e.g., hardware, programming language) of a used service (McGovern et al. 2003). This mandates that a service’s interface be defined in a neutral, standardized manner (Walker 2007). This is generally referred to as principle of using standards (e.g., open standards for interfaces or data representation). Interoperability and integration are particularly important in heterogeneous environments or in settings characterized by different implementation technologies (Jardim-Goncalves et al. 2006). However, extant literature is largely inconclusive on the exact set of principles, their emphasis, and level of abstraction (Viering et al. 2009).

In contrast to the theoretical view of applying SOA in a holistic way, practice rarely complies with all these principles, that is, SOA is usually fragmentated and selectively implemented (Hirschheim et al. 2010). This fragmentated 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). However, effective SOA implementations must also be business-oriented (Ren and Lytytinen 2008). Business-oriented services are expressed in business-related terms and can be incrementally modified as business processes change (Bieberstein 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 rather coarse-grained—ultimately holding the promise of enabling OA.

**Service-oriented Architecture and Organizational Agility**

The body of literature on the enabling role of SOA for OA comprises mainly (practitioner) monographs or edited books and is generally conceptual in nature (Antoniades 2014; Devos et al. 2013; Douglas 2003; Erl 2004; Erl 2005; Erol et al. 2014; Krafitz et al. 2004). Authors of empirical studies primarily investigate selected SOA themes and related benefits with the help of secondary data or industry cases (Krafitz et al.
Comprehensive overviews of research on SOA have focused on technical topics or general business implications (Joachim 2011; Viering et al. 2009). Quantitative research indicates that SOA governance mechanisms are required to achieve four specific agility-related benefits: modularity, scalability, integration, and service reuse (Joachim et al. 2013). In this context, modularity (see Byrd 2000 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 through governance mechanisms (Joachim et al. 2013). For instance, intensively accessed services can be distributed across multiple computing nodes. A common finding yielded by such studies points to an increased potential for integration (e.g., of internal resources like legacy-systems) by using SOA (e.g., Augusto et al. 2009; Baskerville et al. 2010; Fink and Neumann 2009; Luthria and Rabhi 2009). Service reuse is sought to accelerate development cycles and reduce time-to-market of change requests (Baskerville et al. 2010; Becker et al. 2009; Holmqvist and Pessi 2006). It can also be motivated by the need for an increased use of shared IT services to, for example, 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, such as the aim of building for/with reuse, using abstraction to control complexity, and incrementally extending functionality (Holmqvist and Pessi 2006). It can be argued that achieving these organizational capabilities at least to some degree represents a prerequisite for SOA adoption. Empirical evidence indicates that aforementioned organizational capabilities and SOA are positively related. However, the specific mechanisms through which they shape and influence each other remain unclear.

In conclusion, a variety of conceptual, qualitative, and quantitative studies referring to the relationship between SOA and OA have been conducted to date. However, the explanatory power and theoretical contribution of this stream of literature remains inconclusive. Additionally, extant studies differ with regard to the depth in which their authors describe the nature of the relationship between SOA and OA (e.g., Choi et al. 2010; Joachim et al. 2013). Most authors primarily describe the relation on an abstract level (e.g., Baskerville et al. 2005; Ren and Lyytinen 2008). A systematic synthesis of such studies is thus lacking, indicating that an extensive overview and analysis of these studies is needed to help the IS community improve the understanding of SOA’s role. The findings yielded will enable organizations to cope with unanticipated changes in their environments. For instance, insights into the research approaches applied in these studies provide guidance for future research. Additionally, we perceive the synthesis to be beneficial since it structures previous studies in a way that elucidates some important, yet under-researched, phenomena in this regard.

Research Approach

We conducted a concept-driven literature review (Okoli and Schabram 2010; Webster and Watson 2002) to establish how the relationship between SOA and OA can be conceptualized. We applied a two-phase approach to identify and analyze relevant literature in order to investigate the link between SOA and OA.

Phase 1: Identification and Selection of Literature

Our selection of articles followed a tollgate approach (see Figure 1; cf. Afzal et al. 2009). First, we identified an initial set of potentially relevant articles by conducting a systematic search of the following databases: ACM Digital Library, AIS Electronic Library, EBSCOhost, IEEEExplore, ProQuest, and ScienceDirect. We searched each database with the following query within the search fields title, abstract, and keywords: “organizational agility” AND “service-oriented architecture”. We included relevant
synonyms for the two terms of the query. We did not restrict the search period. For an assessment of the search process, we compared the identified articles with a small sample of known studies (i.e., Baskerville et al. 2005; Choi et al. 2010; Ren and Lyttinen 2008; Schelp and Aier 2009). All four articles known beforehand were found, indicating the effectiveness of our search process (Kitchenham et al. 2007).

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As an example, the search string for EBSCOhost was defined as follows: (TI ("web service" OR "webservice" OR "web services" OR "webservices" OR "service-oriented" OR "serviceoriented" OR "service oriented") OR AB ("web service" OR "webservice" OR "web services" OR "webservices" OR "service-oriented" OR "serviceoriented" OR "service oriented") OR SU ("web service" OR "webservice" OR "web services" OR "webservices" OR "service-oriented" OR "serviceoriented" OR "service oriented")) AND (TI ("flexibility" OR "agility" OR "agile" OR "flexible") OR AB ("flexibility" OR "agility" OR "agile" OR "flexible") OR SU ("flexibility" OR "agility" OR "agile" OR "flexible").
Our search approach yielded 1,525 results (692 articles published in journals and 833 included in conference proceedings; issued on March 3rd 2015). To reduce our results to the most relevant set, we only included articles published in journals from the MIS Journal Rankings of the AIS\(^2\) and selected IS conferences\(^3\) into further analysis. This resulted in a set of 213 articles relevant to our research context of information systems. We continued our selection of articles by excluding all articles that did not qualify as completed research. Then, we analyzed the remaining research articles according to their relevance to our research question. In other words, we assessed whether these articles address the central concepts of our study (SOA and OA). Articles with an exclusive focus on either SOA or OA were excluded from further analysis since they could not illuminate the relation between these two concepts. Furthermore, we removed several articles in which the term ‘agility’ was used only in a general-language sense. In other words, the authors of these articles do not seem to have a scientific concept in mind when using the term. We identified a core set of 23 research articles matching our criteria.

In addition to these 23 research articles, we iteratively extended our set of articles by searching forward and backward based on articles within the core set and on each added article, respectively (Webster and Watson 2002). For searching forward, we used Web of Science as recommended by Webster and Watson (2002), along with Google Scholar. We combined the results sourced from both databases and only added articles to our core set if they fulfilled the aforementioned criteria. This process resulted in our final set comprising 26 articles considered relevant to our research.

**Phase 2: Data Analysis**

We analyzed the set of core articles in detail by using a structured coding scheme (Flick 2009; Miles and Huberman 1994) (see Table 1). We independently coded each article in a team of two researchers and consolidated our respective coding results in the second step. The coding scheme consists of four code families. (1) SOA-related codes address the definition or measures of SOA the authors provided in the corresponding articles, aiming to ascertain whether authors value SOA as a business-oriented concept and identify SOA design principles explicitly mentioned. (2) The agility-related code family concerns the questions of conceptualization of OA in the corresponding articles and the manner in which the authors measured or operationalized OA in their study. (3) SOA–OA-related codes concern the link between SOA and OA. These codes pertain to the central question of how the relationship between SOA and OA is, in general, characterized and in particular how SOA influences OA. We evaluated the explanatory strength of this (causal) link for each study. Lastly, we considered (4) miscellaneous information included in each article, such as research method, research goal, and type of empirical data (if available). A detailed definition of each code can be found in Table 1. In order to enhance study validity and reliability, we independently coded each article. After coding sets of 3-4 articles, we compared our findings to merge complementary findings and discuss deviations. In case of refinement or extension of codes, we recoded the articles already completed. We iterated through this process until we reached agreement on all codings.

\(^2\) See https://aisnet.org/?JournalRankings.

\(^3\) We searched in the following conference proceedings: Americas Conference on Information Systems (AMCIS), European Conference on Information Systems (ECIS), Hawaii International Conference on System Sciences (HICSS), and International Conference on Information Systems (ICIS).
Table 1. Structured Coding Scheme

<table>
<thead>
<tr>
<th>Code Family</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOA</td>
<td>SOA Definition</td>
<td>Is the concept SOA explicitly defined? How do the authors define / conceptualize or operationalize / measure the concept SOA?</td>
</tr>
<tr>
<td></td>
<td>SOA Business Orientation</td>
<td>Does the study have a clear focus on business outcomes (rather than, for instance, a primarily technical approach)?</td>
</tr>
<tr>
<td></td>
<td>SOA Design Principles</td>
<td>Which SOA design principles do the authors mention?</td>
</tr>
<tr>
<td></td>
<td>SOA General Business Value</td>
<td>What business value do the authors mention that is generated through SOA? This code abstracts from OA-related business value (see code OA Business Value).</td>
</tr>
<tr>
<td>OA</td>
<td>OA Definition</td>
<td>How do the authors define / conceptualize or operationalize / measure the concept OA?</td>
</tr>
<tr>
<td></td>
<td>OA Business Value</td>
<td>What business value related to OA is mentioned in the study?</td>
</tr>
<tr>
<td>SOA–OA</td>
<td>Motivation for SOA–OA Research Gap</td>
<td>Do the authors provide motivation for the research gap between SOA and OA?</td>
</tr>
<tr>
<td></td>
<td>Existence of a link between SOA and OA</td>
<td>Do the authors address the link between SOA and OA?</td>
</tr>
<tr>
<td></td>
<td>Explanatory Strength of the SOA–OA Link</td>
<td>How strong is the link’s explanatory strength? We coded explanatory strength, ranging from association (merely mentioning the link) through argumentation or causal relationship (only providing an argument versus a detailed explanation for why A leads to B) to theory. We also considered whether arguments are supported by empirical data.</td>
</tr>
<tr>
<td></td>
<td>Real-world Examples Linking SOA and OA</td>
<td>Do the authors support the link between SOA and OA by providing real-world examples? On one hand, we coded abstract examples with fictional character that are not clearly based on empirical data. On the other hand, we differentiated between anecdotal examples with illustrative character and those clearly based on (rich) empirical data.</td>
</tr>
<tr>
<td>Misc.</td>
<td>Research Method</td>
<td>What research method do the authors employ (e.g., conceptual, literature review, case study research, survey)?</td>
</tr>
<tr>
<td></td>
<td>Empirical Data</td>
<td>Is the study based on empirical data? Is secondary data included?</td>
</tr>
<tr>
<td></td>
<td>Research Goal</td>
<td>What is the study’s research goal?</td>
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</tbody>
</table>
Results

In Table 2, we provide an overview of the 26 analyzed articles. The majority of articles (15) have been published in scientific journals, five of which are listed in the Senior Scholars’ Basket of Journals. The remaining 11 articles have been published in conference proceedings. We structure our results by referring to the definitions of concepts, the relationship between SOA and OA, and the research methods applied.

<table>
<thead>
<tr>
<th>Study</th>
<th>Focus of the Study</th>
<th>Research method</th>
<th>Empirical data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joachim et al. (2013)</td>
<td>Importance of SOA governance mechanisms for implementing an effective SOA that increases IT flexibility and leads to service reuse</td>
<td>Survey</td>
<td>Yes</td>
</tr>
<tr>
<td>Baskerville et al. (2005)</td>
<td>Strategic rewards and organizational impact of SOA adoption in the banking domain</td>
<td>Multiple case study</td>
<td>Yes</td>
</tr>
<tr>
<td>Baskerville et al. (2010)</td>
<td>Strategic rewards and organizational impact of SOA adoption in the banking domain (subsequent study of Baskerville et al. 2005).</td>
<td>Multiple case study</td>
<td>Yes</td>
</tr>
<tr>
<td>Bharadwaj et al. (2015)</td>
<td>Role of SOA in achieving business agility in organizations along the functions of the value chain</td>
<td>Conceptual</td>
<td>No</td>
</tr>
<tr>
<td>Becker et al. (2009)</td>
<td>Value potentials and challenges of the SOA paradigm for users and software vendors</td>
<td>Literature review, expert interviews</td>
<td>Yes</td>
</tr>
<tr>
<td>Beimborn et al. (2008)</td>
<td>Evaluation of SOA business value</td>
<td>Literature review, conceptual</td>
<td>No</td>
</tr>
<tr>
<td>Schelp and Aier (2009)</td>
<td>SOA and sustainable contributions to corporate agility</td>
<td>Multiple case study</td>
<td>Yes</td>
</tr>
<tr>
<td>Holmqvist and Pessi (2006)</td>
<td>Agility through scenario development at a car manufacturer</td>
<td>Single case study</td>
<td>Yes</td>
</tr>
<tr>
<td>Oh et al. (2007)</td>
<td>SOA as an IT asset in enabling organizational integration and impacts on sustained competitive advantages</td>
<td>Survey</td>
<td>Yes</td>
</tr>
<tr>
<td>Ren and Lyytinen (2008)</td>
<td>Review of the evolution of the SOA concept-related technologies</td>
<td>Literature review, conceptual</td>
<td>No</td>
</tr>
<tr>
<td>Vitharana et al. (2007)</td>
<td>State of the art of the service paradigm and service-centric supply chains aimed at achieving enterprise agility</td>
<td>Conceptual</td>
<td>No</td>
</tr>
<tr>
<td>Fink and Neumann (2009)</td>
<td>Ability of web services to facilitate IT flexibility, improve information management, and achieve competitive advantage according to the views of IT managers in Israel</td>
<td>Survey</td>
<td>Yes</td>
</tr>
<tr>
<td>Choi et al. (2013)</td>
<td>Enhancing OA through SOA and alignment between IT and business</td>
<td>Design science research, simulation</td>
<td>No</td>
</tr>
</tbody>
</table>

4 See https://aisnet.org/?SeniorScholarBasket.
<table>
<thead>
<tr>
<th>Authors</th>
<th>Title</th>
<th>Research Methods</th>
<th>Methodology</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demirkan et al. (2008)</td>
<td>State of the art service-oriented technologies and related management</td>
<td>Conceptual</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Bieberstein et al. (2005)</td>
<td>Governance, economic, and organizational structure challenges to SOA-based IT transformation</td>
<td>Conceptual</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Varadan et al. (2008)</td>
<td>Effective SOA governance framework for sustained and realized benefits</td>
<td>Conceptual</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Moitra and Ganesh (2005)</td>
<td>Influence of web services on business process flexibility and impact on organizational adoption</td>
<td>Interviews, joint application design</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Lee et al. (2010)</td>
<td>Critical success factors of SOA implementation for companies</td>
<td>Literature review, interviews</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>White et al. (2005)</td>
<td>Emergent information systems with the potential to enable deep integration, increase flexibility, and supply chain agility</td>
<td>Single case study</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Haines and Rothenberger (2010)</td>
<td>Best practices for implementing organizational change and the implications for software development</td>
<td>Multiple case study</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Bardhan et al. (2010)</td>
<td>State of the art and interdisciplinary perspective on IT service management and service science</td>
<td>Conceptual</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Mahadevan et al. (2009)</td>
<td>Three levels of SOA implementation maturity and their achievement</td>
<td>Conceptual</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Mueller et al. (2010)</td>
<td>Comprehensive framework on the economic value of SOA from an enterprise-wide perspective</td>
<td>Literature review, secondary case analysis</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Yoon and Carter (2007)</td>
<td>Key factors for successful SOA implementation</td>
<td>Secondary case analysis</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Choi et al. (2010)</td>
<td>SOA adoption and its impact on IS modification in the context of changing business requirements</td>
<td>Design science research, simulation</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Krishnan et al. (2007)</td>
<td>Impact of information sharing process complexity on supply chain performance</td>
<td>Survey</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

**Research Methods**

With respect to the research methods, we identified a broad range of approaches, ranging from pure conceptual studies to studies relying on case studies or survey-based research. While nine articles were purely conceptual and theoretical in nature (e.g., Demirkan et al. 2008; Varadan et al. 2008), authors of 13 studies collected empirical data firsthand. Case-based research is among the most popular research approaches, with eight analyzed studies based on this method (e.g., Baskerville et al. 2010; Schelp and Aier 2009). However, not all authors collected original empirical data for their case analyses; some relied on publicly available secondary data such as industry case reports (Mueller et al. 2010; Yoon and Carter 2007). In four studies included in our analysis, the authors adopted a survey-based approach (e.g., Fink and Neumann 2009; Oh et al. 2007). In further two, the authors opted for a research approach based on design science (Choi et al. 2010; Choi et al. 2013).

**Definition of Concepts**

The definitions of SOA adopted in the analyzed studies are largely inconsistent, which is surprising as this concept has been in use in IS and computer science literature for several decades (see Related Work). Nonetheless, authors of 15 articles at least explicitly define SOA. However, many of these authors provide several definitions within the same study, covering a broad range of views and notions. For instance, some
authors use a combination of the terms paradigm, architectural style, and metaphor in the same study (e.g., Beimborn et al. 2008; Bharadwaj et al. 2015; Bieberstein et al. 2005; Mueller et al. 2010). This issue reflects the aforementioned overall inconsistent conceptualization of SOA in literature (see Related Work). Some authors attempted to resolve this shortcoming by providing overarching and comprehensive definitions consolidated from literature. For example, according to Oh et al. (2007), SOA represents a new technology paradigm and a core IT asset that enables organizational integration. These authors counteract inconsistency prevalent in pertinent literature by defining SOA both in a broad sense (as an enterprise-wide IT architecture) and in a narrow sense (as a solution architecture that is based on web service technologies). Accordingly, they conceptualize their holistic concept of SOA by providing operationalized survey items derived from both definitions for their field study. Similarly, Ren and Lytinen (2008) assembled a comprehensive overview of definitions used for SOA in their conceptual study. They conclude that three streams of conceptualization exist in literature: (1) authors that “treat SOA only at the technical level”, (2) those who “define SOA from a managerial perspective”, and (3) definitions “where SOA is seen to provide a mechanism that matches needs of users with the capabilities provided by service providers” (Ren and Lytinen 2008, p. 76).

Since we excluded articles lacking a business view of SOA, we did not evaluate any articles that are limited to the technical perspective. Arguably, this makes sense for our given context because solely focusing on the technical level would potentially result in overlooking some benefits related to OA, which is located at the enterprise-wide business level. Concerning patterns of common SOA definitions, the authors of 18 studies refer to a paradigm in the context of SOA. Within this terminology, these authors either directly refer to SOA as an architectural paradigm (sometimes called the SOA paradigm, e.g., Demirkan et al. 2008; Mueller et al. 2010; Ren and Lytinen 2008) or refer to an overarching paradigm, on which SOA's ideas are based (e.g., the service-oriented computing paradigm or service paradigm; Baskerville et al. 2005; Fink and Neumann 2009; Vitharana et al. 2007). The former view is in line with the definition of the OASIS standard (MacKenzie et al. 2006). Yet, the latter is associated with a stream of literature that regards SOA in a broader perspective—as an instantiation in the form of software architecture (Bardhan et al. 2010). The authors of nine articles adopt the view put forth by He (2003) and define SOA as an architectural style (e.g., Choi et al. 2010; Haines and Rothenberger 2010; Yoon and Carter 2007): “SOA is an architectural style whose goal is to achieve loose coupling among interacting software agents” (He 2003, p. 1). However, He (2003) fails to address what an architectural style exactly is.

While general agreement exists that SOA involves a set of design principles, its content is inconclusive (see Related Work). Our analysis of articles corroborates this issue. Nevertheless, we identified a core set of principles regularly mentioned by authors. Loose coupling is the most frequently mentioned principle, followed by service orientation, standards, modularity, and platform independence. The authors of ten articles mention the core set of design principles in its entirety (e.g., Beimborn et al. 2008; Lee et al. 2010).

More than half of the articles in our sample have a weak focus on OA, and the respective authors do not define this concept in a rigorous manner. This reflects our observation that only few authors address the research gap between SOA and OA as a focal motivation for their study. In several articles, the authors refer to OA but do not provide a definition (e.g., Bieberstein et al. 2005; Lee et al. 2010; Varadan et al. 2008). Others only implicitly define the concept of OA, for example, by defining its sensing and responding components without referring to OA (Demirkan et al. 2008; Moitra and Ganesh 2005). However, in seven articles, the authors clearly define OA (e.g., Choi et al. 2013; Holmqvist and Pessi 2006; Schelp and Aier 2009). The majority of definitions is either based on the view originating from manufacturing (e.g., Bharadwaj et al. 2015; Schelp and Aier 2009), which is compatible with the definition of Overby et al. (2006), or authors refer to the widely cited seminal paper of Sambamurthy et al. (2003) (e.g., Baskerville et al. 2010; Choi et al. 2013).

**Relationship between SOA and OA**

General business value of SOA is attested in all articles included in our sample, since one of our inclusion criteria was a clear business focus. In addition to OA-related benefits, such as shorter time-to-market (Haines and Rothenberger 2010), enhanced quality (Vitharana et al. 2007), and gains in productivity (Choi et al. 2013), reduced costs are frequently mentioned (Mahadevan et al. 2009; Mueller et al. 2010; Yoon and Carter 2007).
Concerning the logical link between SOA and OA, our results are divergent. In the majority of analyzed studies (18), the authors merely associate the two concepts without providing any further explanation of the linkage, for example, by stating that “adoption of SOA provides potential for greater organizational agility” (Baskerville et al. 2005, p. 3). In a similar vein, some authors state that OA or related benefits have been achieved through SOA, but neglect to explain how these outcomes are generated (e.g., Yoon and Carter 2007). Furthermore, OA is generally seen as a central goal of SOA (e.g., Bieberstein et al. 2009; Krishnan et al. 2007; Ren and Lyytinen 2008). While not providing a complete argumentation for the relationship between the two concepts, we identified borderline studies that go beyond pure association including descriptions that could serve as cues for why these two concepts are linked. For example, according to Beimborn et al. (2008, p. 2), the main benefits of SOA contributing to OA 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)”. Similarly, Varadan et al. (2008, p. 486) argue on an abstract level that SOA confers greater OA among its benefits “because SOA makes it possible to locate and assemble the component parts of new products and applications rather than having to buy new, hardcoded solutions”.

Authors of only five studies provide a solid argumentation on why SOA is linked to OA (Bardhan et al. 2010; Choi et al. 2010; Choi et al. 2013; Mahadevan et al. 2009; Schelp and Aier 2009). In only three of these articles, researchers use real-world examples to augment their argumentation. For example, a multiple case study is used to report on realization of technical quality, flexibility, and reuse potentials (Schelp and Aier 2009). Two conceptual studies rely on anecdotal examples extracted from literature for illustration. This includes the case of the company eBay using its customers as product development teams (Bardhan et al. 2010) and case examples extracted from literature to illuminate each level of a SOA maturity model (Mahadevan et al. 2009). However, we did not identify any examples, in conceptual or empirical studies, illuminating the relationship between SOA and OA in a detailed and in-depth manner. Overall, there is a scarcity of empirical research in the set of articles providing arguments, as only the authors of one article back up their arguments concerning the linkage of SOA and OA with empirical data (Schelp and Aier 2009). Several articles could not be analyzed concerning their argumentation, as their authors failed to clearly link SOA to OA. For example, Moitra and Ganesh (2005) provide an argument why loose coupling is linked to organizational adaptability but do not discuss this relationship with respect to OA.

In general, if authors formulate arguments, they also provide a relatively strong conceptualization of central constructs, enabling them to describe the relationship in more detail. Accordingly, most of these authors commence with characteristics of SOA—in particular, its design principles—to build up an argument. The design principles concerning standardizing of interfaces and modularity of software are widely recognized to facilitate the combination of (existing) services and increase the flexibility of the overall system (Bardhan et al. 2010; Choi et al. 2010; Mahadevan et al. 2009; Schelp and Aier 2009). Development time can be reduced for new systems and changes to the existing ones expedited because, once enterprise services have been implemented in a standardized way, they can be reused or internally changed without any cascading effects on the dependent systems. Similarly, Choi et al. (2013, p. 2) argue that the “use of available services provides an organization with opportunities for lower cost, higher quality, and reduced maintenance through reuse”. The loose coupling design principle permits organizations to use an IT architecture that is integrated, while still subject to spontaneous changes (Bardhan et al. 2010). “This way, if business processes need to change to meet market changes, an organization only needs to alter its application service pattern to fit the new business logic. It will not need to develop a new application” (Bardhan et al. 2010, p. 23). While the aforementioned arguments only address responding capabilities, most authors do not provide explanations for how SOA enhances sensing capabilities, which is the equally critical second component of OA (see Related Work). Addressing the sensing component, Mahadevan et al. (2009, p. 14) note that “The ability to ‘sense’ the customer’s needs and configure a customized solution would give a company a crucial head start in the competitive race to be more heterogeneous while being in greater control”. While taking this business intelligence perspective, Mahadevan et al. (2009) argue that, through service differentiation in a business process, customer service usage can be analyzed to accurately determine customer priorities and offer personalized service, as well as identify bottlenecks via service monitoring.

None of the articles in our sample includes a theoretical explanation for the mechanisms that connect SOA and OA. When authors do provide arguments, they only partially address the relationship between
SOA and OA. For example, several authors focus on a fraction of available SOA design principles and link them to specific aspects of OA. Furthermore, we did not identify any study that provides an end-to-end causal argument, clearly building a cause-and-effect chain that starts with SOA characteristics and follows logical intermediate steps of value-creation to arrive at specific sub-components of OA. Authors of analyzed works provide extracts or abstractions of underlying mechanisms at most.

Only few authors address the research gap between SOA and OA as a focal motivation in their study. Visualizing the chains of explanation provided by authors on the relationship between SOA and OA (see Figure 2) elucidates the fragmented and unsystematic manner in which this relationship has been discussed in extant literature. Chains of explanation originate from the service orientation, loose coupling, standards, and modularity design principles. We could not identify a chain building on platform-independence. It can be argued that design principles are interrelated and dependent on each other (see Related Work) and that some chains rely on other principles as well. However, we could not identify explicit links in the analyzed literature. The sensing component of OA generally has weak support, because only one argument (resulting in two unique chains) links it with a design principle. Overall, the conceptualization appears fragmented and incomplete.

![Figure 2. Chains of Explanation for the Relationship between SOA and OA Identified in our Sample](image-url)
Apart from the consistent positive view of the impact of SOA on OA, we identified a rare example in our sample that provides a critical view on the positive relationship between SOA and OA (Schelp and Aier 2009). These authors observe an increase in system complexity with the introduction of SOA in all their cases and warn: “When considering the long term effects of increasing complexity the positive effects of introducing a SOA may show to be temporary” (Schelp and Aier 2009, p. 5). Sustainable contribution to OA is associated with “structures, processes, and instruments (i.e. policies, measures, and metrics), that are characteristic features of an explicit enterprise architecture management” (Schelp and Aier 2009, p. 6). This view complements SOA as an architectural design paradigm by transcending technical design principles and broadening the view on the enterprise level. Similarly, Choi et al. (2013) argue that, owing to its focus on architectural IT design and business-oriented services, SOA represents a vehicle to achieve IT-business alignment, which in turn enhances OA.

Research Agenda

In the previous section, we analyzed how authors conceptualized SOA and OA in their respective studies. On this basis, we extracted various chains of explanation from extant literature to conceptualize the relationship between SOA and OA. Chains originate from SOA’s design principles to OA’s subcomponents, namely sensing and responding.

Based on our results, we provide a research agenda in this section and discuss concrete avenues for future studies in the field. We present four themes that authors of future works should consider: critical distance, conceptualization and theoretical grounding of SOA and OA, strategic value, and theoretical linkage of SOA and OA. Although we carefully derived directions for future research from our observations grounded in the analyzed literature, the scope of our sample is limited, which is a general limitation of literature reviews. Furthermore, our research agenda is governed by our interpretation of the current situation.

Critical Distance

The majority of authors attest that SOA has a positive influence on OA. Yet, a critical position is rarely taken. While this holds especially true for publications from practice, such as edited books and monographs, this finding also applies to our analyzed set of scientific articles. The overly positive tone yields evidence for the assertion of the self-fulfilling prophecy of SOA; its industry as a whole is interested in SOA’s success and seeks to shape technological developments in a favorable way because large investments have been made in this area (Bardhan et al. 2010). Publications that did not undergo a rigorous scientific peer-review have to be considered with care. Future research needs to take this into account while building on prior knowledge. We would also like to encourage researchers to take a more critical perspective. For example, to strengthen future research that hypnotizes a positive relationship between SOA and OA, we recommend that authors support their line of argumentation with counterarguments. Furthermore, a meaningful approach to complement practitioners’ overly positive views, especially from vendors and consultants of SOA solutions, is to engage in empirical research with customers and users to verify the assertions made by SOA’s proponents. Our study provides researchers with a preliminary conceptualization of the relationship between SOA and OA, which could help to implement theory-testing research.

Conceptualization and Theoretical Grounding

SOA design principles vary in their strength in terms of contributing to OA. We identified modularity as the core principle most frequently mentioned by authors in chains of explanation. While several chains contain the modularity principle, platform independence could not be located in any chain of explanation. However, this principle is arguably closely related to standards, which are connected via reuse of services and flexibility of the system to the OA responding capability. Future research aimed at explaining the relationship between SOA and OA needs to address SOA’s design principles comprehensively.
Fragmentation of explanations relates to the generally weak conceptualization of the SOA and OA concepts. The divergent definitions and views of SOA hinder the structured and comparative analysis across literature concerning SOA’s role in influencing OA. The issue of SOA’s conceptualization is two-fold, as SOA must be placed in the broader perspective and the concept must be clearly defined as well. For the relationship between SOA and OA, it is essential to ascertain whether SOA is regarded as a pure technical design paradigm or as a software architecture instantiation of an overarching service paradigm deeply embracing organizational facets. In the first case, stemming from an engineering viewpoint, entanglements will be limited to technical aspects, whereas in the second case, organizational impacts will be unlocked. The decision concerning perspective influences the manner in which SOA is conceptualized (for example, from a set of design principles) and leveraged by organizations. Authors of future studies in this field need to be aware of and address ramifications concerning this decision. They also need to clearly position their research with the help of strong conceptualizations.

While investigating the SOA–OA relationship, thus far, researchers have failed to put OA in a perspective of strong theoretical grounding. This shortcoming is unfortunate as OA originates from a stream of literature with solid theorization. Conceptualized as dynamic capabilities, the resource-based view theoretically underpins OA (Bharadwaj 2000; Sambamurthy et al. 2003). Furthermore, strong empirical research exists that can serve as a basis for operationalizing and measuring this concept in organizational settings (e.g., Chakravarty et al. 2013; Lee et al. 2015; Lu and Ramamurthy 2011; Tallon and Pinsonneault 2011). It is noteworthy that authors of the analyzed studies mainly considered the notion of OA characterized by responsiveness and quickness while neglecting to address the component of sensing. A possible reason for this omission is the aforementioned insufficient theoretical grounding of OA; most authors simply fail to define this concept comprehensively. Another issue to keep in mind is the general-language meaning of the term ‘agility’, which may be associated with a stronger focus on responding, nimbleness, and reactivity, rather than being related specifically to sensing.5 Disregarding sensing is critical as it can be argued that sensing capabilities represent a prerequisite for successfully responding to changes in the organization’s environment (Roberts and Grover 2012a; Roberts and Grover 2012b). Authors stressing responding capabilities often do so at an expense of sensing capabilities, as they may implicitly subsume the former in the latter and regard both as a coherent entity (which is essentially the idea behind OA). However, if that is the case, authors of future research should explicitly discuss their conceptualizations and explain the roles sensing and responding capabilities play in their study’s context.

Researchers should be cautious not to use the term agility in a general-language sense, as this will inevitably lead to confusion in a scientific context. This is particularly critical for practitioner-oriented research outlets as these publish research at the intersection of science and praxis. Additionally, researchers aiming to pursue this line of study should recognize prior knowledge on the concept of OA and exploit readily available operationalizations while investigating the relationship between SOA and OA.

**Strategic value**

Researchers have already begun to position OA-related research in the context of IT strategy (e.g., Chakravarty et al. 2013; Galliers 2006; Weill et al. 2002), strategic alignment (e.g., Oosterhout et al. 2007; Tallon and Pinsonneault 2011), and strategic IS planning (e.g., Baskerville 2006; Holmqvist and Pessi 2006). Those aiming to investigate the relationship between SOA and OA could benefit from tapping into these streams of research and analyze SOA as an IT-based innovation (Rogers 2003) to provide strategic value. Related to the IT paradox (Morgan 2004), authors of future studies could attempt to establish whether top management considers SOA as an innovation to shape OA and how it is understood to essentially contribute to the business value. Quantitative research designs that measure strategic value are common in strategic research and could be applied to SOA innovation-diffusion and its strategic value (for a simulation-based approach from our sample of analyzed articles see Choi et al. 2010; Choi et al. 2013).

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Theoretical Linkage of SOA and OA

Acknowledging that theoretical grounding is generally weak, it is understandable that we identified few articles that provide arguments beyond merely associating SOA and OA. Detailed explanation with strong conceptualization, focus on causality, and theoretical propositions are required. Future research should systematically exploit strong conceptualizations of OA provided in the extant literature. Authors of future studies need to provide sharp conceptualization and detailed explanations at the same time.

Although we observed a variety of research methods in our sample, comprehensive and empirically underpinned theoretical knowledge on the relationship between SOA and OA is presently lacking. Therefore, we argue that data-driven, empirical approaches focusing on theory development—such as case study research with an in-depth character (Keutel et al. 2014) or based on a grounded theory approach (Eisenhardt 1989)—would be most beneficial for future research endeavors.

Conclusion

We reviewed and synthesized pertinent literature in order to conceptualize the relationship between SOA and OA. The weak conceptualization of the two concepts in many studies limits the potential for establishing a definitive link between SOA and OA. Moreover, authors of most of the analyzed studies only associate the two concepts without providing any further explanation of the linkage. Concerning the influence of the two sub-components of OA, namely responding and sensing, the latter is only weakly supported. While providing a conceptualization of the relationship between SOA and OA, we developed directions for future studies to continue our search for explanations, emphasizing the themes of critical distance, conceptualization and theoretical grounding, strategic value, and theoretical linkage.

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