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# A Literature Review of Research on Service-Oriented Architectures (SOA): Characteristics, Adoption Determinants, Governance Mechanisms, and Business Impact

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# A Literature Review of Research on Service-Oriented Architectures (SOA): Characteristics, Adoption Determinants, Governance Mechanisms, and Business Impact

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**ABSTRACT**

This literature review synthesizes existing research in the field of Service-Oriented Architectures (SOA) from a business perspective and integrates results from 40 works to offer researchers an overview about the existing body of knowledge in this research field as well as a research agenda, which unifies and extends previous efforts. While the literature regarding the technologies and design principles for SOA and even Service-Oriented Enterprises (SOE) converges, especially research regarding the identification of determinants influencing SOA adoption, governance mechanisms for effectively implementing SOA, and regarding SOA's actual business impact is needed. Previous empirical research indicated promising factors in each of these fields. However, future research should especially draw attention to holistically cover each of the research areas. Moreover, extending the use of empirical research methods will further improve our understanding regarding the importance of different adoption determinants, governance mechanisms, and the actual business value of SOA.

**Keywords**

Service-oriented Architecture, SOA, literature review, literature search, adoption, governance, practices, impact, business value, research agenda, IS journals, IS conferences.

## 1 INTRODUCTION

In recent years, Service-Oriented Architectures (SOA) attract more and more the interest of both organizations as well as research (Viering et al., 2009). According to Forrester Research, 84% of the biggest global 2,000 enterprises "say they are using SOA now or will be by the end of 2010" (Heffner, 2010). Initially, SOA research focused on technical aspects regarding the characteristics of SOA. However, after providing a solid technological base for implementing SOA, the business perspective on SOA gained increasing attention and research agendas as well as conceptual models for investigating SOA through the lens of the business appeared (e.g., Beimborn et al., 2008; Demirkan and Goul, 2006; Ren and Lyytinen, 2008; Vitharana et al., 2007; Zhao et al., 2008). Also, first results regarding governance mechanisms for implementing SOA effectively or indicating SOA's business impact were shown by case studies (e.g., Baskerville et al., 2005; Hirschheim et al., 2010; Yoon and Carter, 2007) or empirical evaluations of specific benefits, like SOA's impact on organizational integration (Oh et al., 2007), information sharing in supply chains (Kumar et al., 2007b), or the joint impact of SOA and business process management on process quality (Beimborn and Joachim, 2010). Besides this, existing research also extended the focus from SOA to the broader concept of Service-Oriented Enterprises (SOE) (Bieberstein et al., 2005b; Brown and Carpenter, 2004; Cherbakov et al., 2005; Janssen and Joha, 2008; Vitharana et al., 2007), which "as an emerging architecture-of-business takes the view that service-orientation helps to execute the business strategy of an enterprise with significant multi-dimensional benefits (flexibility to change, enhanced quality, effectiveness), in less time (time-to-value) and cost (efficiency) using IT" (Vitharana et al., 2007, p. 3).

Many researchers improved our understanding in the broad research field of SOA, including the emerging concept of SOE, determinants explaining the adoption of SOA and SOE, governance mechanisms for leveraging their potentials, as well as their possible impact on business value. However, as "in the majority of cases, literature reviews serve as *the* means to reveal open research gaps and are part of a larger research endeavor" (vom Brocke et al., 2009, p. 11), this paper conducts a review of the literature. Based on an analysis of 40 sources (17 journal articles, 20 conference papers, and three books) the literature

review synthesizes existing research and integrates previous results in order to offer an overview about the existing body of knowledge as well as proposing a research agenda, which unifies and extends previous efforts.

The remainder of the paper is organized as follows: The next section explains the underlying methodology (i.e., literature review) and gives a detailed overview about the literature search process as well as existing related research. The third section presents the results of analyzing the identified literature regarding SOA with respect to four areas: characteristics, adoption determinants, governance mechanisms, and business impact. The fourth section discusses the results and develops a research agenda for future SOA research from a business perspective. Last, the work is summarized and its limitations are discussed as well as possibilities for extending this literature review on SOA are given.

## 2 METHODOLOGY AND OVERVIEW

This literature review follows the framework for literature reviewing proposed by vom Brocke et al. (2009), which is based on a review of the review literature itself and especially highlights the need for comprehensibly documenting the process of literature search in a review article. The framework itself is structured into the following five phases, which are explained in the following: (1) definition of review scope, (2) conceptualization of topic, (3) literature search, (4) literature analysis and synthesis, (5) research agenda.

(1) The *definition of the review scope* of this literature review is summarized in Figure 1 (categories applicable to this review on SOA research are highlighted), which is based on the taxonomy proposed by Cooper (1988) and adapted by vom Brocke et al. (2009). This literature review on hand *focuses* on research outcomes of research applied in the domain of SOA. The *goal* is to integrate findings with respect to four areas of SOA research, i.e., characteristics, adoption determinants, governance mechanisms, and business impact. The four areas of research are based on the only existing literature review on SOA from a business perspective, conducted by Viering et al. (2009), classifying 175 articles covering SOA and Web Services published between 2000 and 2009 with respect to their research topic. For example, for the first group (characteristics), they reveal that 18 articles deal with "artifacts and standards", 10 with "definitions", and 3 with "products". In contrast to this pure topic-based classification of research articles, the literature review on hand analyzes the research outcomes. For example, this analysis identifies similarities regarding which design principles constitute SOA, or which business benefits are achieved or not achieved in practice, instead of only reporting that 10 articles have investigated the benefits of SOA. Thus, instead of focusing on rather technical issues, such as particular implementation or orchestration details (Abraham et al., 2008; Louridas, 2008) or investigating various methods for identifying services (Boerner and Goeken, 2009; Klose et al., 2007), this literature review investigates SOA from a business perspective. As indicated before, this review draws on the framework for analyzing SOA research, developed by Viering et al. (2009). Thus, this paper on hand is *organized* along a conceptual structure. No particular *perspective* is taken in order to guarantee a neutral representation of the review results. The *audience* addressed by this review are specialized scholars interested in SOA or SOE. According to the taxonomy of literature reviews, the *coverage* can be classified as representative as it is limited to samples of articles, which also stand for other articles, but does not explicitly consider the entirety of the literature.

| Characteristic | Categories | | | |
|---|---|---|---|---|
| focus | research outcomes | research methods | theories | applications |
| goal | integration | criticism | | central issues |
| organization | historical | conceptual | | methodological |
| perspective | neutral representation | | espousal of position | |
| audience | specialized scholars | general scholars | practitioners/politicians | general public |
| coverage | exhaustive | exhaustive and selective | representative | central/pivotal |

**Figure 1. Taxonomy of this literature review on SOA (following Cooper, 1988; and vom Brocke et al., 2009)**

The second step is (2) *conceptualization of the topic*. It addresses the point that "the author of a review article must begin with a topic in need of review and a broad conception of what is known about the topic and potential areas where new knowledge may be needed" (Torraco, 2005, p. 359). As indicated before, this review draws on the framework for analyzing SOA research, developed by Viering et al. (2009), and classifies SOA research with respect to the following areas: characteristics, adoption determinants, governance mechanisms, and business impact. (3) The *literature search* considered the sources presented in Table 1. These sources are selected based on the top 25 research journals according to the ranking developed by Lowry et al. (2004). In addition, the IBM Systems Journal which is listed as top global practitioner journal (Lowry et al., 2004) covering a significant part of SOA research was included. Also, four IS conferences (AMCIS, ECIS,

HICSS, ICIS) are considered to cover more recent SOA research. Finally, also three widely-cited SOA books (Erl, 2005; Keen et al., 2004; Krafzig et al., 2005) are considered in order to have a more complete picture.

Table 1 lists the investigated journals and conferences, the name of the database used for searching, the respective fields, which were searched (if possible: title or abstract or keywords), and the coverage (at least 2000 to 2009). Last, the hits resulting from a query using the keywords "*SOA"* or "*service-oriented"* or *"service oriented"* for the particular journal or conference as well as the number of articles used for the following analysis and synthesis are listed. The decision whether a retrieved article (i.e., a hit) will be analyzed in detail in this literature review was made based on the title. If the title sounded relevant to the focus of this review, the abstract was screened to make a final decision. In total, 40 sources including journal and conference articles as well as the three books have been screened. However, as one can see, the main sources were IS conferences (20 articles analyzed), and the only journals out of the top 25 research journals as well as the one practitioner journal publishing relevant SOA articles are the IBM Systems Journal (8), Wirtschaftsinformatik (6), and the Communications of the ACM (3).

| Journal | Database | Search fields | Coverage | Hits | Analyzed |
|---|---|---|---|---|---|
| MIS Quarterly | EBSCO Host - Business Source Premier | title \| abstract \| keywords | 1977-2009 | 0 | 0 |
| Information Systems Research | | | 1990-2009 | 2 | 0 |
| Journal of Management Information Systems | | | 1984-2009 | 0 | 0 |
| Management Science | | | 1954-2009 | 4 | 0 |
| Communications of the ACM | | | 1965-2009 | 10 | 3 |
| Decision Sciences | | | 1970-2009 | 1 | 0 |
| Information Systems Journal | | | 1998-2009 | 0 | 0 |
| Organization Science | | | 1990-2009 | 0 | 0 |
| Harvard Business Review | | | 1922-2009 | 2 | 0 |
| INFORMS Journal on Computing | | | 1989-2009 | 0 | 0 |
| Operations Research | | | 1952-2009 | 0 | 0 |
| Journal of Computer Information Systems | | | 2000-2009 | 1 | 0 |
| Decision Support Systems | ScienceDirect | all fields | 2000-2009 | 32 | 0 |
| Information and Organization | | | 2000-2009 | 2 | 0 |
| Information Systems | | | 2000-2009 | 21 | 0 |
| Information and Management | | | 2000-2009 | 17 | 0 |
| Journal of Strategic Information Systems | | | 2000-2009 | 5 | 0 |
| IEEE Transactions on Computers and Services Computing[1] | IEEE Computer Society | Exact Phrase | 2000-2009 | 41 | 0 |
| IEEE Transactions on Software Engineering[1] | | | 2000-2009 | 47 | 0 |
| IEEE Computer | | | 2000-2009 | 55 | 0 |
| ACM Transactions | ACM Digital Library | title \| abstract | 2000-2009 | 18 | 0 |
| Journal of Information Systems | American Accounting Association (AAA) Digital Library | title \| abstract \| keywords | 2000-2009 | 0 | 0 |
| Wirtschaftsinformatik | SpringerLink and journal website | *not explained* | 2000-2009 | 63[2] | 6 |
| IBM Systems Journal[3] | Journal Website | title \| subject \| abstract | 2000-2008 | 35 | 8 |
| European Journal of IS | Journal Website | full text | 1991-2009 | 12 | 0 |
| Journal of the Association for Information Systems | AIS Electonic Library (AISeL) | full text | 2000-2009 | 4 | 0 |
| International Conference on IS (ICIS) | | title \| abstract | 1994-2009 | 5 | 3 |
| Americas Conference on IS (AMCIS) | | title \| abstract | 1997-2009 | 44 | 6 |
| Hawaii International Conference on System Sciences (HICSS) | IEEE Xplore Digital Library | title \| abstract | 2000-2009 | 50 | 6 |
| European Conference on IS (ECIS) | IS and Innovation Group of the LSE and Political Science | title | 1993-2009 | 15 | 5 |

1 From the 13 IEEE Transactions journals only those three most suitable for SOA are investigated: computers, services computing, and software engineering
2 The 63 result from searching the period 2006-2009 using SpringerLink. 2000-2005 is not covered in SpringerLink. This period was investigated using the journal website leading to additional 64, 24, and 131 hits for service oriented, as searching for „service oriented" as phrase was not possible. Also, the results contain redundant hits.
3 The last issue of the IBM Systems Journal was published in 2008.

**Table 1. Considered sources**

The two last steps of the framework for literature reviewing (4) *literature analysis and synthesis* as well as developing a (5) *research agenda* are described in detail in sections 3 and 4 respectively, as these present the main contribution of the paper.

## 3 RESULTS OF THE LITERATURE REVIEW

This section summarizes the research outcomes of the previous research (*literature analysis and synthesis)* with respect to the four areas of SOA research. While the area of the *characteristics of SOA* is mainly based on articles following conceptual or

argumentative deductive research methods, the other three areas of SOA research (*adoption determinants, governance mechanisms, and business impact*) are primarily based on articles employing case studies or quantitative methods[1].

### 3.1 Characteristics of SOA

Table 2 presents the results of analyzing the articles covering SOA's characteristics. In total 38 of the 40 identified articles handle characteristics of SOA. Thus, this category has been very well-researched. In the following, the findings are grouped into three subcategories. The first category consists of technologies used for implementing an SOA. The second category presents common design principles applied in an service-oriented IS architecture. The last category shows principles used to establish an service-oriented enterprise (SOE) (Janssen and Joha, 2008; Vitharana et al., 2007). While it is also recognizable that previous research mainly described the first two subcategories, the principles associated with realizing an SOE architecture are quite often mentioned in the literature showing the close relationship of both concepts: SOA and SOE. Overall the extracted intersection of aspects can be interpreted as a common understanding regarding the characteristics of SOA. As the identified characteristics are often found in conceptual research papers, it would be particularly interesting to analyze concrete SOA implementations of organizations to reveal which approach to SOA they follow.

| Aspect | Examplary definition | References |
|---|---|---|
| Technologies used for implementing an SOA | | |
| Business process execution language (BPEL) | „Business process service: A service that orchestrates other services according to a business process. Implemented e.g. by using WS-BPEL." (Offermann and Bub, 2009, p. 1) | 1, 2, 4, 5, 6, 7, 8, 10, 14, 18, 26, 27, 30, 31, 36 |
| Service registry/ repository | "Critical to the success of initiatives was the use of a UDDI registry. The registry facilitates service and component reuse by providing the architecture with the ability to look up services that exist and reuse them." (Yoon and Carter, 2007, p. 7) | 2, 4, 6, 7, 8, 9, 11, 14, 15, 16, 19, 22, 23, 32, 34, 35 |
| Enterprise service bus (ESB) | "At the core is an Enterprise Service Bus (ESB) supplying connectivity among services." (Ferguson and Stockton, 2005, p. 754) | 4, 7, 10, 19, 26, 27, 32, 35, 37, 39 |
| Web Services (XML, WSDL, SOAP) | "Service provider, who provides service functionality in the form of web services that are published by the Service Broker." (Tewary et al., 2009, p. 8) | 1, 2, 3, 6, 10, 14, 16, 34, 35, 39, 40 |
| Design principles applied in an service-oriented IS architecture | | |
| Modularity/ loose coupling | "The idea of SOA is to create a world of services being loosely coupled which can be flexibly combined to create dynamic business processes, new applications." (Janssen, 2008, p. 2) | 1, 4, 5, 6, 8, 11, 13, 14, 16, 17, 20, 21, 22, 24, 25, 26, 27, 28, 29, 30, 32, 33, 35, 37 |
| Implementation independence | "Those independent services [...] can be accessed without any knowledge of their underlying implementation details." (Vitharana et al., 2007, p. 6) | 1, 4, 6, 7, 14, 19, 20, 27, 28, 29, 30, 32, 36, 37 |
| (Open) standards | "Services represent abstract software elements and/or interfaces […] using widely applied standards." (Legner and Heutschi, 2007, p. 1644) | 3, 5, 6, 11, 14, 20, 21, 23, 25, 29, 35, 36, 37 |
| Service description | "create services that are modular, accessible, well-described, implementation-independent, and interoperable" (Fremantle et al., 2002, p. 80) | 1, 2, 3, 5, 6, 9, 10, 23, 32, 34, 37 |
| Interoperability | "For all participants, enhancing interoperability between existing systems was a key aspect of the SOA effort." (Haines and Haseman, 2009, p. 7) | 1, 4, 16, 24, 28, 30, 35, 36 |
| Platform independence | "The interface is defined in a neutral manner that should be independent of the hardware platform, the operating system, and the programming language in which the service is implemented." (Walker, 2007, p. 651) | 6, 11, 14, 19, 20, 28, 37 |
| Service contract | "An SOA is a component model that interrelates the different functional units of an application, called 'services,' through well-defined interfaces and contracts between these services." (Walker, 2007, p. 651) | 7, 8, 11, 19, 25 |

[1] It would be possible to also consider more articles using conceptual or argumentative deductive research methods for the latter three research fields as well, but this would only add propositions regarding possible factors or benefits. In order to enhance the understanding of the actual realizable benefits and actual governance mechanisms only articles using case studies or quantitative methods were included, which can provide answers and are not limited to plausible propositions.

| Aspect | Examplary definition | References |
|---|---|---|
| Principles used to establish an service-oriented enterprise | | |
| Business process choreography | "Independent services with well-defined invokable interfaces which can be called in defined sequences to form business processes." (Vitharana et al., 2007, p. 1) | 1, 2, 5, 13, 24, 26, 27, 28, 29, 31, 32, 33, 35, 36, 39 |
| Encapsulate business function | "Those services are clearly capsulated, and loosely coupled entities, which deliver a defined business functionality." (Becker et al., 2009, p. 2087) | 4, 7, 8, 11, 13, 14, 21, 24, 27, 28, 29, 30, 37 |
| Align IT with business processes | "Service-orientation is not only about building IT systems using SOA but also encompasses the transformation of an enterprise through the alignment of business and IT to be efficient and effective." (Vitharana et al., 2007, p. 3) | 5, 14, 18, 27, 32 |
| Decouple business from IT | "SOA must decouple business applications from technical services and make the enterprise independent of a specific technical implementation or infrastructure." (Krafzig et al., 2005, p. 57) | 7, 8, 30 |
| Note: 1 Fremantle et al. (2002), 2 Papazoglou and Georgakopoulos (2003), 3 Tan et al. (2004), 4 Keen et al. (2004), 5 Cox and Kreger (2005), 6 Kano et al. (2005), 7 Krafzig et al. (2005), 8 Erl (2005), 9 Vetere and Lenzerini (2005), 10 Ferguson and Stockton (2005), 11 Baskerville et al. (2005), 12 Antikainen and Pekkola (2009), 13 Becker et al. (2009), 14 Eymann and Winter (2008), 15 Kumar et al. (2007b), 16 Oh et al. (2007), 17 Elfatatry (2007), 18 Pfeiffer and Winkelmann (2007), 19 Walker (2007), 20 Winkler and Buhl (2007), 21 Legner and Heutschi (2007), 22 Yoon and Carter (2007), 23 Kumar et al. (2007a), 24 Henningsson et al. (2007), 25 Müller et al. (2007), 26 Siedersleben (2007), 27 Vitharana et al. (2007), 28 Janssen (2008), 29 Hau et al. (2008), 30 Beverungen et al. (2008), 31 Lotz et al. (2008), 32 Arsanjani et al. (2008), 33 Eckert et al. (2009), 34 Tewary et al. (2009), 35 Haines and Haseman (2009), 36 Offermann and Bub (2009), 37 Luthria and Rabhi (2009), 38 Schelp and Aier (2009), 39 Bieberstein et al. (2005b), 40 Tafti et al. (2008) | | |

**Table 2. Identified characteristics of SOA**

### 3.2 Determinants Influencing SOA Adoption

Retrieving empirical articles regarding SOA adoption determinants shows sparse results. Only two papers explicitly investigate SOA adoption (Tewary et al., 2009; Yoon and Carter, 2007) and a third paper mainly focuses on SOA maturity/ readiness and thereby offers some insights into factors actually influencing an organization's decision to adopt SOA (Eckert et al., 2009). In addition, Schelp and Aier (2009) do not investigate SOA adoption, but SOA's contribution to agility. Interesting, they observed that the complexity, which is a usually a negative determinant in many adoption models, increased in all of the five SOA case studies. Another interesting finding is that none of the papers on SOA adoption applies an underlying theory or framework for developing their SOA adoption model. Instead, e.g., Yoon and Carter (2007) analyzed different business vs. IT motivations in their cases and Tewary et al. (2009) applied a process view on how a single organization adopted SOA in three stages: assessment, evangelization, and pilot.

| Aspect | Example | Finding | Source |
|---|---|---|---|
| Technology | | | |
| Compatibility | "This also means that OLM inherits a plethora of information systems from various time periods, developed on a variety of platforms." (Tewary et al., 2009, p. 3) | supported | 22, 34 |
| Relative advantage | "Along with standardization and automation SOA could now reduce operational costs, improve operational efficiency, and increase service reliability worldwide." (Tewary et al., 2009, p. 4) | supported | 22, 34 |
| Complexity | "Decoupling the systems has led to increased complexity, but the systems are more flexible and integration is easier now." (Schelp and Aier, 2009, p. 6) | supported | 34, 38 |
| Costs | "The SOA adoption project involved four external consultants and eight resources from OLM for the period of nine months." (Tewary et al., 2009, p. 7) | supported | 22, 34 |
| Organization | | | |
| Organization size | "OLM Inc. is a multi-billion dollar company and one of the largest OEMs […] in the Oil industry." (Tewary et al., 2009, p. 3) | supported | 34 |
| Top management support | "The 'CEO strongly supported building end-to-end, service-oriented development and delivery platform,' said Wachovia's Susan Certoma." (Yoon and Carter, 2007, p. 7) | supported | 22 |
| | "SOA is almost always driven by IT and receives only moderate management support." (Eckert et al., 2009, p. 7) | partly | 33 |
| IT experience | "These workshops addressed the IT staff as well as the business division staff. [...] They needed to get a look and feel of what it means to use SOA." (Tewary et al., 2009, p. 7) | supported | 22, 34 |
| Environment | | | |
| Management fashion | "The SOA adoption [...] is triggered by the bank and not by external consultants." (Eckert et al., 2009, p. 7) | not supported | 33 |

**Table 3. Identified determinants influencing SOA adoption**

### 3.3 Governance Mechanisms for Implementing SOA

For investigating the field of SOA governance again primarily empirical articles have been found. However, very generic SOA governance frameworks, such as Niemann et al. (2008) or Kohnke et al. (2008), which develop an entire SOA governance framework based on the existing literature instead of evaluating single governance mechanisms in practice with respect to their relevance, are excluded[2]. In total, six papers on SOA governance mechanisms could be found. Interestingly, these works are less fragmented than the previous research on SOA adoption. For example, four of the articles comprehensively and consistently investigate nearly every aspect which could be identified in the body of the literature (Bieberstein et al., 2005a; Tewary et al., 2009; Walker, 2007; Yoon and Carter, 2007). Thus, research in this area mainly investigates the eight aspects presented in the following figure. Service management thereby comprises sub-aspects such as the funding for SOA, which is seen as the most challenging task according to the results of expert interviews (Becker et al., 2009). However, as the existing literature does not explicitly use any of the existing SOA governance frameworks to structure its research regarding SOA governance, in this literature review the identified governance aspects are group into three areas following Kohnke et al. (2008): structures, processes, and employees.

| Aspect | Example | Source |
|---|---|---|
| Structures | | |
| Decision-making Body | „The internal SOA Center of Excellence (CoE) is represented as a virtual organization that consists of several internal organizations devoted to the advancement of SOA." (Walker, 2007, p. 652) | 19, 22, 34, 39 |
| Standards | "Internal service standards and SOA design criteria were published and enforced with existing enterprise architecture governance practices." (Walker, 2007, p. 660) | 19, 34, 39 |
| Processes | | |
| Service management | "First, coordinate the integration of SOA into the enterprise by defining a set of enterprise policies and agreements for service ownership, funding, charging, and usage mandates and publishing SOA compliance criteria to promote a consistent SOA infusion into information and application designs." (Walker, 2007, p. 660) | 13, 19, 22, 34, 39 |
| Service development | "SOA enables reuse through the 'build once and leverage' approach (e.g., by using already existing functions instead of building new ones, thus eliminating redundant development and support costs)." (Walker, 2007, p. 653) | 13, 19, 22, 34 |
| Employees | | |
| Qualification | "Education programs and classroom sessions are critical to disseminating emerging concepts and bridging skill gaps." (Bieberstein et al., 2005b, p. 694) | 19, 22, 34, 39 |
| Incentives | "Perhaps the biggest failure in most organizations that have attempted transformations is the lack of incentives for the desired behaviors. […]Although formal performance measures related to rewards serve as powerful incentives for reuse, there are others as well." (Bieberstein et al., 2005b, p. 706) | 19, 22, 39 |
| Collaborative work of business units | "Some of the organizations purposely strengthened trust between business units. For example, Con-Way's Maja Tibbling said that 'establishing trust between business units is very important." (Yoon and Carter, 2007, p. 7) | 19, 22, 39 |
| Business/IT alignment | "... because business and IT units must work together in designing, building, deploying, and operating services, to achieve a high level of alignment between business requirements and IT capabilities, which is required to create quality services." (Yoon and Carter, 2007, p. 8) | 12, 22, 39 |

**Table 4. Identified governance mechanisms for implementing SOA**

### 3.4 SOA's Business Impact

For assessing the business impact of adopting SOA, conceptual models such as Beimborn et al. (2008) are explicitly discarded, as they argument – based on other articles, such as empirical articles – why certain benefits should be achievable by SOA, but do not deliver findings whether this is the case in practice. Thus, SOA's impact on an organization is only investigated by the results of empirical research in this literature review. Overall 12 articles could be identified, which applied empirical methods in order to investigate the business value of SOA. From these 12 articles, just one used a mixed method approach (literature review and expert interviews, i.e., Becker et al., 2009)[3], only 4 applied a quantitative research design (Kumar et al., 2007a; Kumar et al., 2007b; Oh et al., 2007; Tafti et al., 2008), while the remaining 7 articles investigated the business value of SOA using case studies. Only the results of the expert interviews (Becker et al., 2009) as

[2] Otherwise one could more or less add these two to every single aspect identified in this research field as further sources, which propose that these mechanisms are useful.

[3] Only the benefits identified in the expert interviews – and not the results of the literature review, which also includes conceptual papers, – have been used for assessing the actual business impact of SOA in this literature review.

well as two of the case study articles (Baskerville et al., 2005; Yoon and Carter, 2007) reflect a rather complete view on the actual benefits achieved by adopting SOA in organizations. The other identified papers focus on particular types of benefits, for example, the impact of SOA in mergers and acquisitions (Henningsson et al., 2007) or the impact of SOA on joint venture value (Tafti et al., 2008). Similar to the SOA adoption determinants, this research field lacks an overarching categorization of the identified benefits, as well. Broadly, the different evaluated benefits can be distinguished into IT benefits and business benefits; Table 5 provides a more detailed sub-categorization.

| Aspect | Example | Finding | Source |
|---|---|---|---|
| IT benefits | | | |
| Integration | "As shown by the study all respondents agreed to SOA making the integration easier than when using centralized system solutions" (Henningsson et al., 2007, p. 7) | supported | 11, 16, 22, 24, 35, 37, 38 |
| | | partly | 13 |
| Reuse | "better reuse" (Becker et al., 2009, p. 6; Schelp and Aier, 2009, p. 6; Yoon and Carter, 2007, p. 5) | supported | 13, 22 |
| | | partly | 11, 37, 38 |
| Scalability | "Tony Bishop, vice president and director of product management at Wachovia, pointed out that their IT needed to be flexible, adaptable, and scalable." (Yoon and Carter, 2007, p. 4) | supported | 22 |
| Business benefits | | | |
| Business agility | "shorter time-to-market" (Becker et al., 2009, p. 6; Haines and Haseman, 2009, p. 5-6; Janssen, 2008, p. 8; Schelp and Aier, 2009, p. 6) | supported | 11, 13, 22, 24, 28, 35, 37, 38 |
| B2B integration | "We provide empirical evidence from recent data that service-oriented architecture can indeed enhance organizational integration." (Oh et al., 2007, p. 13) | supported | 11, 13, 15, 16, 23, 24, 40 |
| | "Our findings indicate that integrating partners using SOA could prove challenging because of the lack of industry standards and mature tool." (Luthria and Rabhi, 2009, p. 6) | partly | 37 |
| Cost reduction | 8 of 8 cases, IT cost reduction (Haines and Haseman, 2009, p. 5-6) | supported | 11, 22, 28, 35 |
| | | partly | 13, 38 |
| Data quality | "improved information quality and availability" (Becker et al., 2009, p. 6) | partly | 13, 22, 35, 38 |
| Business/IT alignment | "in some cases it appeared to have improved relationship with the business units" (Haines and Haseman, 2009, p. 8) | supported | 22 |
| | | partly | 13, 24, 35 |
| | | not supported | 11 |
| Straight through processing (STP) | "One of the primary sources of strategic value for SOA is its role of enabling technology for application integration." (Baskerville et al., 2005, p. 4) | supported | 11, 13, 24, 35 |
| | | partly | 22 |
| Process monitoring | "automation and management of processes" (Becker et al., 2009, p. 6) | partly | 13, 35 |
| Outsourcing | "simplified outsourcing" (Becker et al., 2009, p. 7) | supported | 13 |

**Table 5. Identified business impact of SOA**

## 4 DISCUSSION

This section presents the last step of the framework for literature reviewing (vom Brocke et al., 2009): developing a (5) *research agenda*. As Table 2 shows, a consensus regarding the characteristics of SOA in terms of technologies used for implementation, design principles applied in an service-oriented IS architecture, and also regarding design principles used for establishing an service-oriented enterprise (SOE) is achieved in the literature.

However, as the results also show, only very limited empirical research regarding the identification of adoption determinants, governance mechanisms, and evaluating the actual business value of adopting SOA has been conducted. As the proposed research agenda for future business-oriented research in the field of SOA shows (cf. Figure 2), a clear and concise understanding of SOA characteristics is crucial in order to investigate these three other areas, which depend on the concept of SOA. Thus, as a multi-dimensional measurement instrument comprising the three identified aspects of SOA has not been applied in the four existing quantitative studies, the research question (RQ1) "*How should SOA be conceptualized in empirical research?*" has to be answered first in order to use this measurement instrument for the remainder of the identified research questions in the other areas of SOA research from a business perspective. Also, such an measurement instrument can be used to investigate different approaches to SOA implementation. For example, whether organizations concentrate on technologies, IS, business aspects, or which balance between these extreme approaches they apply when implementing SOA in their organization. Second, the SOA concept with its three main characteristics (cf. Table 2) is the main *dependent* variable in research investigating determinants influencing the adoption of SOA (cf. Table 3), which leads to research answering

RQ2: *What are the factors influencing SOA adoption?*. This research could be grounded on the technology-organization-environment (TOE) framework (DePietro et al., 1990) , which is often applied for investigating adoption at the organizational level (Chau and Tam, 1997; Mishra et al., 2007; Zhu and Kraemer, 2005). Thereby especially management fad and fashion as largely neglected potential determinants of adopting SOA should be investigated (Abrahamson, 1991; Abrahamson, 1996). Third, for investigating SOA's business impact (cf. Table 5) the concept of SOA is the main *independent* variable, where the identified IT and business benefits are the dependent variables dealing with research regarding RQ3: *What is the business value of SOA?*. Thereby, future research should investigate the holistic picture of achievable SOA benefits, which is extracted mainly from case studies, applying quantitative methods to justify and quantify the benefits on a broad empirical basis. Fourth, for further insights why in certain cases specific business benefits could be achieved or not (cf. Table 5), investigating governance mechanisms (cf. Table 4) could provide further insights regarding RQ4: *Which SOA governance mechanisms are important in order to implement an effective SOA?*. As previous research does not apply a common SOA governance framework to structure their findings, a suggestion for future research is the use of common governance frameworks, such as the one proposed by Kohnke et al. (2008), which suggests the following three categories of SOA governance mechanisms: structures, processes, and employees. This type of research needs to incorporate both the adoption of SOA in terms of its characteristics as well as aspects of its business impact since the effectiveness of governance mechanisms can only be judged with respect to its influence on IT and/or business benefits. The overall research agenda is visualized by the following figure:

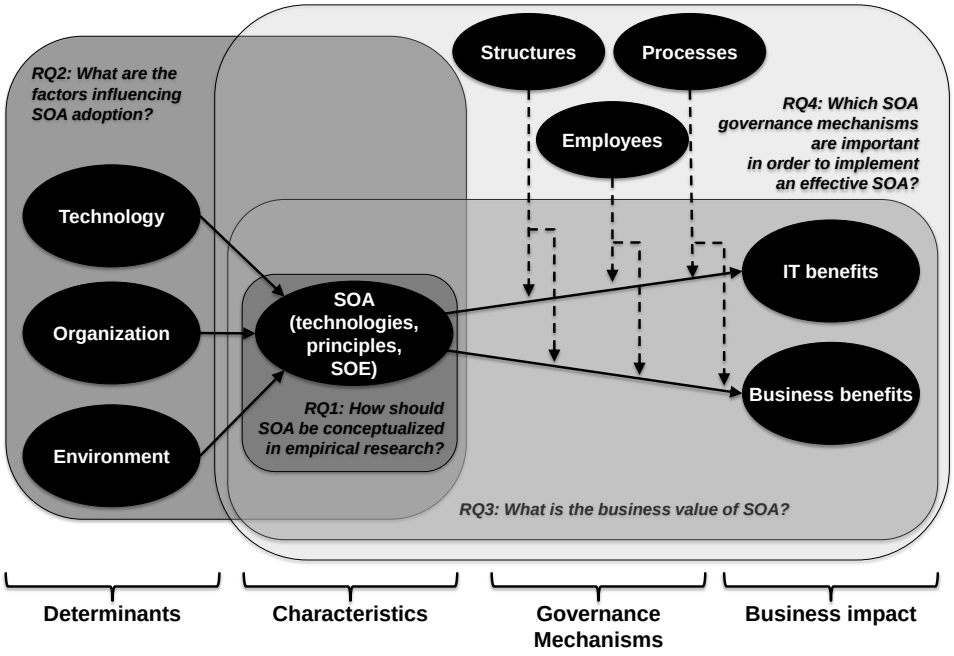


**Figure 2. Proposed research agenda for future business-oriented research on SOA**

Overall, the results show that the first articles applying empirical research methods enhanced the knowledge regarding what adoption determinants and governance mechanisms should be further investigated in order to understand the concept of SOA and its achievable business impacts by adopting SOA holistically. However, while in each of the four research fields only a very few case studies exist that aim at covering the field completely, most of previous research is fragmented. Particularly, quantitative studies are very seldom. Thus, future research should try to investigate each of the fields consistently and holistically, covering all of the identified aspects in a single research field as well as including the concept of SOA in an integrated way including both IT and business aspects. Thus, applying case studies and quantitative approaches to each of the SOA research fields allows to compare the relative importance of each of the aspects extracted from diverse articles.

## 5 CONCLUSION

This literature review synthesized the existing research on SOA from a business perspective by analyzing 40 sources and integrated their results in order to offer an overview about the existing body of knowledge as well as proposing a research agenda, which unifies and extends previous efforts.

Previous research regarding SOA has moved on from a pure focus on technical aspects to business aspects surrounding SOA, which in particular leads to the emerging concept of the service-oriented enterprise (SOE) (Vitharana et al., 2007). While the literature regarding technologies and design principles for SOA and even SOE converges, especially the research fields regarding the identification of determinants influencing SOA adoption, governance mechanisms for effectively implementing SOA, and SOA's actual business impact, are in rather early and fragmented stages.

This literature review regarding SOA research faces some limitations itself. First, this literature review mainly covers the years 2000-2009. Of course additional articles were published in the meantime, which should be included in a future version. Second, this review concentrated only on a selection of top journals, four conferences, and three books, without using backward and forward search (Levy and Ellis, 2006). However, the identified articles, the detailed and transparent documentation of the literature search process, the proposed categorization of the aspects in each of the research fields, and the proposed research agenda can serve as a good starting point for further literature reviews and future research in the SOA research field.

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