An Instrument for Measuring SOA Maturity

Research-in-Progress

Nils Joachim
Department of Information Systems and Services, University of Bamberg
nils.joachim@uni-bamberg.de

Daniel Beimborn
Department of Information Systems and Services, University of Bamberg
daniel.beimborn@uni-bamberg.de

Tim Weitzel
Department of Information Systems and Services, University of Bamberg
tim.weitzel@uni-bamberg.de

Abstract

Existing empirical research on the business value of Service-Oriented Architectures (SOA) has only measured the extent of SOA adoption – but not maturity – to determine whether typical goals, like increased business agility or IT cost reduction, could be achieved. However, a widely implemented SOA might be less mature than an SOA adopted only in particular areas of the organization, which in turn can lead to mis-measurement and misinterpretation. On the other side, the few existing SOA maturity frameworks that have been specified by previous researchers lack valid operationalizations to make them applicable to empirical research. Ready to use items and scales for evaluating the particular maturity level of an organization are missing.

We propose to measure the degree of SOA maturity as a new variable for future empirical research especially in the context of SOA business value. Our analytical approach uses 21 items to classify the maturity of an organization’s SOA in seven maturity levels along seven maturity dimensions derived from The Open Group Service Integration Maturity Model (OSIMM). The applicability of this new instrument is shown using data from 121 organizations. The results show that the majority of the organizations has only reached SOA maturity levels two to four. Also, higher levels of SOA maturity highly and significantly increase the realized business value from SOA in terms of business agility, straight through processing (STP), and reduced IT costs. However, the marginal benefits are decreasing for higher levels of SOA maturity in cases of STP and business agility.

Keywords: Service-oriented Architecture; SOA; maturity model; SOA maturity; OSIMM; measurement model; operationalization; business value; empirical; PLS
Introduction

84% of the world’s largest organizations (i.e., 20,000 or more employees) are employing Service-Oriented Architectures (SOA), yet only 12% of those have realized all of their planned benefits (Heffner 2010). Among the remainder, 39% will expand their use of SOA even though it has delivered less benefits than expected, 16% will not expand the use until the issues which hamper realizing benefits from SOA are resolved, while 32% are in a too early stage to decide, and only 1% will cut back their use of SOA (Heffner 2010). While much of the discrepancy between SOA adoption and actually realized benefits results from lacking business perspectives (Joachim 2011; Joachim et al. 2011a) and SOA governance (Joachim et al. 2011b), there is also a substantial — and interesting — measurement challenge. On the one hand, some empirical studies investigate specific benefits of SOA (Kumar et al. 2007; Oh et al. 2007; Tafti et al. 2008). On the other hand, all of them only measure the extent of SOA adoption¹ but do not assess the maturity of an organization’s SOA. In addition, while various frameworks for assessing SOA maturity were developed in the last years (e.g., Arsanjani and Holley 2005; Hirschheim et al. 2010; Rathfelder and Groenda 2008; Söderström and Meier 2007) none of these have been operationalized to be used in empirical research. Ready to use items and scales for evaluating the particular maturity level of an organization are missing. According to a Gartner survey (Sholler and Schulte 2009, p. 1) “companies at higher levels of SOA maturity achieved payback faster, realized higher degrees of developer productivity, agility and innovation, and had higher degrees of asset reuse.” Thus, SOA is not just a technology fad, but can indeed deliver the promised benefits. However, organizations should focus more on increasing SOA maturity in order to realize the benefits, which they expect from adopting SOA.

In the following, we will develop an instrument allowing researchers to measure the level of SOA maturity — not simply adoption. Therefore, our goal is not to develop another SOA maturity framework, but to add an empirical instrument to existing ones. Concretely, we will operationalize The Open Group Service Integration Maturity Model (OSIMM) (The Open Group 2009)) to make it applicable to empirical survey-based research. Our research question is: How can the maturity of an organization’s SOA implementation be measured, classified and made comparable in empirical studies?

Next, we give an overview of SOA maturity models existing in the literature to then develop an instrument for measuring SOA maturity based on the OSIMM. Then, we demonstrate its empirical applicability in the context of SOA business value research using survey data from 121 firms.

Overview of SOA Maturity Models

One of the best-known generic maturity models is the Capability Maturity Model Integration (CMMI), which extends the previous CMM and defines five levels of process maturity: initial, managed, defined, quantitatively managed, and optimizing. Because of its wide applicability in the industry, the five CMMI-levels serve often as basis for other maturity models, such as the SOA maturity models which researchers² have developed for describing different levels of SOA maturity. The following overview briefly summarizes the most prominent ones:

Service Integration Maturity Model (SIMM), published by IBM (Arspanjani and Holley 2005), describes seven maturity levels: silo, integrated, componentized, simple services, composite services, virtualized services, and dynamic reconfigurable services. It has a rather technical focus but has the advantage of covering the earlier stages of service development which are often neglected by other models.

¹ For example, Kumar et al. (2007) measure SOA adoption with three dummy items whether a firm uses XML, Web Services technologies (SOAP etc.), and a companywide services based IT architecture.

² We limit our overview to SOA maturity models developed by researchers in contrast to vendor models (e.g., by Sonic Software, HP, or Oracle) to avoid their “dependency on the respective products” (Rathfelder and Groenda 2008, p. 2). However, we have included IBM’s maturity model as it is not only technology independent, but also explicitly includes the very early stages of services. Moreover, it serves as basis for other maturity models (cf. Hirschheim et al. 2010) and was handed over to The Open Group for further enhancements published as “The Open Group Service Integration Maturity Model (OSIMM)” (The Open Group 2009).
Combined SOA Maturity Model (CSOAMM), published by Söderström and Meier (2007), combines the SIMM and the industry-driven SOA MM (Sonic Software Corporation et al. 2005). It is not a separate maturity model but shows how SIMM, SOA MM, and CMMI are related. As each of the models has a different number of levels (SIMM (7), SOA MM (6), and CMMI (5)), the aim of CSOAMM is to facilitate “interpretation and comparison of SOA maturity models” (Söderström and Meier 2007, p. 398).

Independent SOA Maturity Model (iSOAMM): Motivated by their finding that many SOA maturity models are developed by “vendors of SOA products and often used to promote their products” (2008, p. 1) Rathfelder and Groenda propose an independent SOA Maturity Model. The iSOAMM consists of five levels: trial SOA, integrative SOA, administered SOA, cooperative SOA, and on-demand SOA. Moreover, it distinguishes five viewpoints for each maturity level: service architecture, infrastructure, enterprise structure, service development, and governance. Thus, the proposed model is very comprehensive and describes various necessary tasks within each viewpoint for each maturity level.

SOA Maturity Model: The SOA Maturity Model (Hirschheim et al. 2010) explicitly adds a business dimension to the SIMM and thereby addresses this shortcoming of the SIMM. However, the authors do not use SIMM’s seven maturity levels but limit them to five levels, named similarly to CMMI: initial stage, managed stage, defined stage, quantitatively managed stage, and optimized stage. The disadvantage of this change is that especially on the lower maturity levels the seven different levels of the SIMM can distinguish an organization’s SOA maturity level more precisely than the SOA Maturity Model with only five maturity levels. However, the SOA Maturity Model assesses each of its maturity levels more comprehensively than the SIMM, which is rather focused on technical aspects. Therefore, six dimensions are used to cover the business aspects as well: view of SOA, benefits & metrics, business involvement, methodology, sourcing of services, and governance.

The Open Group Service Integration Maturity Model (OSIMM), developed and approved by The Open Group (2009). IBM has handed over its SIMM to this consortium and stopped to continue development. In fact, the two authors of the original SIMM mapping have joined the development team of the OSIMM. The OSIMM draws on the same seven maturity levels as the SIMM, but adds seven maturity dimensions, which leads to the OSIMM maturity matrix. The maturity dimensions are: business view, governance & organization, methods, applications, architecture, information, and infrastructure & management. The model not only describes each maturity dimension and each maturity level, it also defines 87 questions, which are, with a very few exceptions, open questions and thus suited for assessing an organization’s maturity level with respect to each maturity dimension by using interviews.

As noted before, these maturity models have not been operationalized for surveys yet, and usable items and scales for evaluating the particular maturity level of an organization do not exist. In order to operationalize SOA maturity, we will draw on the OSIMM. The OSIMM has the advantage of being evolved from the popular SIMM, which is also the foundation for the CSOAMM and the SOA Maturity Model. Also, the OSIMM includes different maturity dimensions, as also suggested by the iSOAMM and the SOA Maturity Model, to overcome the shortcoming of the SIMM, which has a rather technical focus. Thus, using the OSIMM allows for the most complete and most detailed assessment of SOA maturity considering both business and IT aspects as well as comparing the maturity along different dimensions.

Operationalizing SOA Maturity for Empirical Research

For assessing which of OSIMM’s seven maturity levels has been reached by a firm, we adopt an approach used by Sabherwal and Chan (2001) for classifying companies into their corresponding business strategy type. For each organization, we calculate the squared statistical distance to each of the seven maturity levels using the characteristic values of 21 items, which capture the theoretical profiles of the seven maturity levels, in order to categorize an organization regarding its respective SOA maturity level to which it shows the lowest squared statistical distance. Overall, the development of our SOA maturity instrument follows three steps, which are summarized in Figure 1 and described in the following in greater detail.

---

3 We refrain from using cluster analysis as we want to determine the maturity level with respect to already given maturity models and not to cluster organizations into groups, which would not necessarily match with any maturity model levels.
Figure 1. Analytical Approach Used for Operationalizing SOA Maturity

**Step 1: Definition of characteristic SOA maturity profiles (for combined sample)**

1.1 **Development of items and appropriate scales for measuring SOA maturity**: The items presented in Table 2 are primarily derived from the definitions given regarding how each dimension’s maturity is assessed by the OSIMM (The Open Group 2009) (cf. Table 1) and in addition guided by further details available from The Open Group (2009) such as the OSIMM maturity matrix. As a result, three different items have been developed for each maturity dimension to measure the particular dimension, which led to a total of 21 items (3 items per dimension \( \times \) 7 dimensions) for measuring the overall SOA maturity.

1.2 **Definition of characteristic values**: For each item, the threshold values (based on a standardized scale from 0 to 1) determining the ideal profile for each maturity level must be defined. These characteristic values \( x_{li} \) for all maturity levels \( l \) and all items \( i \) are always increasing linearly and in equal distance (Level 1: \( x_{l1} = .00 \), Level 2: \( x_{l2} = .17 \), Level 3: \( x_{l3} = .33 \), Level 4: \( x_{l4} = .50 \), Level 5: \( x_{l5} = .67 \), Level 6: \( x_{l6} = .83 \), Level 7: \( x_{l7} = 1.00 \)). The only exception is the first item measuring the architecture dimension (“We solely use standard software.”), which is reverse coded (Level 1: \( x_{l1} = 1.00 \) to Level 7: \( x_{l7} = .00 \)) but uses the same linear steps. To simplify the measurement, we assume equidistant steps for an incremental implementation of all characteristics and consequently define lower characteristic values at the earlier maturity levels in order to reflect limited experiences and higher characteristic values at later maturity levels (and vice versa for the reverse coded item).

**Step 2: Classification of each organization’s SOA maturity (for each organization)**

2.1 **Recoding of answers**: The answers of every participating organization must be recoded to the standardized scale (0 to 1) with equidistant steps.

2.2 **Computation of distances to each maturity level**: In this step the distance between an organization’s SOA maturity and the defined characteristic values for each of the seven SOA maturity levels has to be computed. Therefore, the statistical distance between the answers given to the 21 items (recoded to range from 0 to 1, cf. step 2.1) and the defined characteristic values of each of the seven maturity levels (cf. step 1.2) is computed. We used the

**Step 3: Use of SOA maturity instrument in empirical research for hypotheses testing (for combined sample)**

(a) Using a single integer representing overall SOA maturity level of an organization (composite value of 21 items)

(b) Using 7 integers each representing the maturity level of one of the 7 maturity dimensions of an organization (7 composite values of 3 items each)

---

4 We had to make some minor decisions regarding ambiguous items. For example, the definition regarding the application dimension does not only cover those applications based on SOA principles, but also using service-enabled technologies (e.g., Web Services, service bus, service registries). As the OSIMM maturity matrix for example lists “project based SOA environment” and “common SOA environment” as characteristics of maturity level 4 and 5 of the infrastructure & management dimension, we decided to assign the use of supporting technologies to other dimensions, where the technologies fit better. Finally, we integrated another item (i.e., “extent of business processes supported by SOA”) to the application dimension to measure “process integration via service”, which characterizes level 6 of the application dimension.
statistical distance (Sharma 2008, p. 44) as “the euclidean distance must be adjusted to take into account the variance of the variable” (2008, p. 43). This takes into account that the distribution among variables may vary and that those variables with the same absolute difference are statistically closer, if their variance is larger. The squared statistical distance, $SSD_k^2(\text{Level } l)$, of a particular organization $k$ to a specific SOA maturity level $l$ is the sum of the differences between the answers of the organization to specific items $i$, $x_{ki}$, and the characteristic values for those items for the specific maturity level, $x_{li}$, weighted by the standard deviation of that item $s_i$:

$$SSD_k^2(\text{Level } l) = \sum_{i=1}^{21} \left( \frac{x_{ki} - x_{li}}{s_i} \right)^2$$

At the end, for each organization $k$ seven squared statistical distances have to be computed – one for each SOA maturity level $l$ with the respective characteristic maturity level values $x_{li}$.

2.3. Classification of organizations: Next, each organization can be classified according to one of the seven maturity levels. Comparing the seven values for the squared statistical distance, $SSD_k^2(\text{Level } l)$, for each organization $k$, the organization’s SOA maturity level will be classified conservatively as the one with the least statistical distance to the characteristic values for the particular maturity level as computed in step 2.2:

$$\text{SOA maturity level}_k = \min_{1 \leq l \leq 7}(SSD_k^2(\text{Level } l))$$

Step 3: Use of SOA maturity instrument in empirical research for hypotheses testing: Finally, this leads to the new composite value representing the level of SOA maturity of a particular organization $k$ as a single integer value ranging from 1 to 7.5

This new instrument can be used in empirical research which requires the level of an organization’s SOA maturity as part of the research model, for example in the area of SOA business value. The new variable can be used for group comparisons, but also as a single item for measuring a latent variable in regressions or structural equation modeling (SEM) and other statistics. The following section will give examples for using the derived variable (i.e., SOA maturity) in PLS and other statistics.

<table>
<thead>
<tr>
<th>Maturity Dimensions</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
<th>Level 6</th>
<th>Level 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business View</td>
<td>Silo</td>
<td>Integrated</td>
<td>Componentized</td>
<td>Services</td>
<td>Composite Services</td>
<td>Virtualized Services</td>
<td>Dynamically Re-Configurable Services</td>
</tr>
<tr>
<td>Governance &amp; Organization</td>
<td>&quot;... by identifying the formal definition and documentation of the organization’s business drivers and processes.&quot; (p. 16)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methods</td>
<td>&quot;... by identifying the formal use of SOA governance across the organization to develop, deploy, and manage business and IT services (SOA solutions).&quot; (p. 20)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Applications</td>
<td>&quot;... by identifying the application architectures that are designed and implemented using SOA principles and development practices and utilize constructs such as loose-coupling, separation of concerns, and employ the use of service-enabled technologies such as XML, web services, service bus, service registries, and virtualization.&quot; (p. 25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Architecture</td>
<td>&quot;... by identifying those service components that have been designed and are deployed using formal SOA methods, principles, patterns, frameworks, or techniques.&quot; (p. 30)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Information</td>
<td>&quot;... by identifying the information architecture that supports a master data model (federated data service) and implements a common business data vocabulary.&quot; (p. 40)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infrastructure &amp; Management</td>
<td>&quot;... by identifying the IT infrastructure that supports the non-functional and operational requirements and SLAs needed to operate an SOA environment.&quot; (p. 45)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1. How Each Dimension’s Maturity is Assessed Using the OSIMM
(The Open Group 2009)

5 Alternatively to the determination and classification of organizations with respect to their overall SOA maturity level in steps 2.2 and 2.3, one can conduct both steps iteratively using the three items of each of the maturity dimensions. This would not result in a single integer for the overall SOA maturity level, but in seven integer values representing the level of each maturity dimension of an organization for step 3.
Table 2. SOA Maturity Instrument

<table>
<thead>
<tr>
<th>Maturity Dimensions</th>
<th>Item</th>
<th>Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X  Services are the primary concept for structuring the non-technical level.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X  Redundant business activities have been consolidated.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X  Business units are collaboratively identifying business services.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X  We have clearly defined processes to pool the IT requirements of the different business units.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X  We follow a service-oriented perspective when modeling business activities.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X  For designing interfaces we use functional standards (process, functional, data models).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X  Exchanging or modifying single components does not affect our IT infrastructure.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X  All of our applications are integrated via service-oriented interfaces.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X  To what extent are the following business processes supported by SOA?</td>
<td>Likert scale from “no SOA” to “solely supported by SOA” (average of these five items used as a single item)</td>
</tr>
<tr>
<td></td>
<td>• production/operations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• procurement/B2B integration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• research &amp; development</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• marketing/sales/customer relations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• secondary processes (accounting, HR etc.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X  We solely use standard software.</td>
<td>Likert scale from completely disagree to fully agree</td>
</tr>
<tr>
<td></td>
<td>X  Our firm has realized its IT architecture in an SOA-oriented manner.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X  Service orientation is the primary design principle of our IT architecture.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X  We can easily create consolidated views about all data belonging to a customer.</td>
<td>Likert scale from completely disagree to fully agree</td>
</tr>
<tr>
<td></td>
<td>To what extent are the following technologies used in your organization?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X  Web Services (WSDL, SOAP)</td>
<td>6 steps (scale: not known or not applied, pilot usage, single projects, particular business area, multiple business areas, firm wide)</td>
</tr>
<tr>
<td></td>
<td>X  Enterprise service bus (ESB) or other service-related bus</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X  Registry / repository</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X  Business activity monitoring (BAM)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X  Business rules engines</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X  Service-orchestration (e.g., business process execution language (BPEL))</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X  XML</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X  Service component architecture (SCA) or service data objects (SDO)</td>
<td></td>
</tr>
</tbody>
</table>

Note: “X” indicates that the particular maturity dimension of the OSIMM is assessed by the respective item of the instrument.

Exemplary Empirical Application of the SOA Maturity Instrument

This section shows an exemplary empirical application of the new SOA maturity instrument, using data collected from 124 managers responsible for the IT architecture in their organization (chief IT architects, CIOs, or similar). All organizations represent firms operating in the German service industry. First, we conducted the two steps described in the previous section to achieve SOA maturity scores for each firm. In the following, we use this score in an empirical research model for assessing the business value (such as increased business agility or reduced IT costs) with respect to the different levels of SOA maturity.

Figure 2 gives an overview about the descriptive results of the second step (i.e., classification of each organization’s SOA maturity). None of the 124 organizations can be classified according to the highest maturity levels 6 or 7. This is not surprising given the fact that we investigate a relatively young concept. For example, early studies investigating the process maturity of software engineering practices according to CMM have had only organizations belonging to level 2 to 4 (Dekleva and Drehmer 1997) or 1 to 3 (Herbsleb et al. 1997). However, we can see a rather broad distribution across maturity levels 2 to 4. Second, we can observe that organizations operating in ICT or financial services tend to have more mature
SOAs than other service industries. For example, over 70% of the organizations belonging to these two industry types have an SOA classified at maturity level 3 or higher.

As exemplary application, we used the level of SOA maturity\(^6\) as exogenous single item construct in PLS\(^7\) in order to investigate the role of SOA maturity on the business value achieved from SOA. Therefore, we assessed the effect of an organization’s SOA maturity on three common benefits, which organizations try to achieve when introducing SOA (Baskerville et al. 2005; Yoon and Carter 2007): (1) *Increasing business agility* in terms of a “quick IT response to market change or customer demand” (Yoon and Carter 2007, p. 6), (2) *Improving straight through processing (STP)* as it is “easier to integrate systems” (Yoon and Carter 2007, p. 6), which reduces the discontinuities of business processes, and (3) *reduced IT costs* due to “lower application development costs/time” or “lower operational costs” (Yoon and Carter 2007, p. 6). Besides the new variable representing the maturity of an organization’s SOA, the other latent variables are measured using reflective multi-item instruments (cf. Table 3).

As only three organizations are classified as having an SOA maturity level 1 or 5, we only used the data from the 121 organizations belonging to SOA maturity levels 2 to 4.

\(^6\) As only three organizations are classified as having an SOA maturity level 1 or 5, we only used the data from the 121 organizations belonging to SOA maturity levels 2 to 4.

\(^7\) smartPLS 2 M3 (Ringle et al. 2007) was used.
Regarding construct reliability and convergent validity, we found that all composite reliabilities (C.R.) are higher than .841, which is well above the requested .7 (Nunnally 1978). The minimum AVE across all constructs is .632, which fulfills the demanded .5 by Chin (1998). Moreover, the square roots of the AVEs are in all cases larger than the correlations among the constructs (Gefen et al. 2000) and the cross-loadings of the indicators are lower than their loadings on their own construct (i.e., sufficient discriminant validity).

Applying the Kolmogorov-Smirnov test does not reveal any significant differences between the participants regarding non-response bias (Armstrong and Overton 1977). Further, using the marker variable approach for testing the effect of a possible common method bias (CMB) (Podsakoff et al. 2003) does not show any structural differences using a theoretically unrelated marker variable as proxy for a common method factor: all levels of significance (loadings and paths) remain the same and the largest absolute change in $R^2$ is .018, i.e., negligible.

The results of our exemplary application lead to the path coefficients, significance levels, and R-squares as shown in Figure 3. One can easily see that the level of SOA maturity has a very strong and highly significant effect on all three of the aspects of SOA business value. However, SOA maturity does not explain a major proportion of their variance (6.2% to 13.0%) as these aspects are also heavily influenced by many other IT-related and organizational factors.

As the scale of the independent latent variable can be directly interpreted such that increasing this variable by one unit represents an increase of SOA maturity by one level in the OSIMM, Figure 4 presents the average scores of the three latent business value variables for each level of SOA maturity. The figure shows that the three business dimensions (business agility, STP, and reduced IT costs) rise with increasing levels of SOA maturity. In addition, the figure also indicates decreasing marginal benefits of higher levels of SOA maturity for STP as well as stagnation for business agility from level 3 to 4.

---

8 “IT should facilitate access to new markets and regions.” (Rated on a 7-Likert scale from “no goal” to “most important goal”.

---
Conclusion and next steps

We have developed an analytical approach to classify organizations with respect to their achieved level of SOA maturity, which can be used in future empirical SOA research. For each of the seven maturity dimensions defined in the OSIMM we developed three items, which led to a total of 21 items as well as characteristic values representing ideal profiles for each of the seven SOA maturity levels. This SOA maturity measurement instrument can be easily used in future empirical studies. Moreover, in addition to assessing the overall SOA maturity, the presented measurement instrument can also be used to assess separately the maturity level of each of the seven maturity dimensions. Thus, we provide a first operationalization of SOA maturity and its dimensions for survey-based research.

One of the limitations is that the data used for the exemplary application of our instrument stems from a single key informant. Even though the tests for detecting common method bias do not indicate that CMB is a problem, gathering data from different respondents would be the better research. Another limitation is that we have derived the items primarily using the definitions of the seven maturity dimensions as presented in the documentation of the OSIMM (The Open Group 2009). However, one could also extent the operationalization of the measurement instrument for SOA maturity by assessing the entire OSIMM maturity matrix consisting of 49 different characteristics (7 maturity levels × 7 maturity dimensions). We have refrained from this approach as it would increase strongly the complexity of the instrument. If one wants to assess the 49 different characteristics with at least 3 items, as we did for each of the seven maturity dimensions, this would require 147 items. Thus, another, more practical alternative would be to derive the key characteristics not from the maturity dimensions but from the maturity levels (cf. Dekleva and Drehmer 1997). This would lead to the same complexity as our instrument has, but it would not allow determining different levels of maturity with respect to each maturity dimension. Finally, instead of assuming equidistant steps for each item from one level to another, one could adjust the size of the steps to reflect varying importance of the items for the different maturity levels.

In a next step, the developed instrument for measuring SOA maturity will be further validated. We will contact some of the 121 firms which have participated in the survey in order to conduct a second assessment of their SOA maturity level based on interviews. The questions for assessing their level of SOA maturity in interviews can be derived directly from the documentation of the OSIMM (The Open Group 2009). These 87 questions have been particularly defined for assessing an organization’s SOA maturity using interviews. Such a parallel, qualitative assessment of the participating firms will enable a comparison on whether and which differences between the results of the interviews and the survey data (21 items) occur. If there are, the results of the interviews will help to adjust the proposed measurement instrument to increase the fit of the two assessments. Another approach to avoid using self-reported data would be that a third party assesses the organizations to increase accuracy and accountability (Harter et al. 2000). Thereby, we hope that the developed instrument will give other researchers in the field of SOA a tool for comprehensively measuring the degree of SOA maturity in their research models.

In this paper, we also exhibited a first application of our instrument. In the future, we will investigate the identified decreasing marginal benefit of increasing SOA maturity in more depth. We will examine the effect of SOA maturity on all SOA business value dimensions as specified in Mueller et al. (2010) or Joachim et al. (2011a) as well as its effect with business process management (BPM) (cf. Beimborn and Joachim 2011) to get a more complete picture about these relationships. In a second step, we will also investigate the costs (for educating and training IT staff, implementing technical infrastructure, and adapting organizational and decision-making structures) and risks (performance risks, implementation risks) associated with SOA. By comparing the benefits with the increasing costs and risks an organization will face if implementing a more mature SOA, these results will serve as a framework to understand how the optimal level of SOA maturity can be determined for a particular organization. Conducting this comparison will allow us to analyze the relationships between the maturity levels and the benefits, costs, and risks of SOA. Such results can support managers’ decisions regarding their desired level of SOA maturity by making benefits, risks, and costs more transparent and to support balancing them when deciding about an SOA implementation.
Acknowledgments

This work was supported by the E-Finance Lab at Goethe University in Frankfurt, Germany. The authors gratefully acknowledge the financial support of the industry partners.

References


