

SOA Adoption Phases

A Case Study

The approach to SOA within an individual company follows a typical hype cycle. By reviewing the main findings and challenges of each phase of the hype cycle, the paper identifies the main pitfalls of SOA implementation efforts. The biggest problems are a lack of skills, expertise, and viable business models. Case study findings show that companies at various phases of SOA implementation should also focus on a simultaneous increase in business process maturity. The interconnection of business process maturity and SOA that is examined here is vital for understanding the likely path towards higher maturity and consequently greater benefits being reaped from SOA implementation.

DOI 10.1007/s12599-011-0168-2

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Received: 2009-09-23
 Accepted: 2011-01-04
 Accepted after three revisions by Prof. Dr. Buhl.
 Published online: 2011-07-09

This article is also available in German in print and via <http://www.wirtschaftsinformatik.de>: Trkman P, Kovačič A, Popovič A (2011) Phasen der SOA-Einführung. Eine Fallstudie. WIRTSCHAFTSINFORMATIK. doi: 10.1007/s11576-011-0281-3.

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1 Introduction

In theory, service oriented architecture (SOA) means the loose coupling of software components so that interoperability across programming languages and platforms along with a dynamic choreography of business processes can be achieved (Demirkan et al. 2008). This is intended to improve the fit between business needs and IT capabilities. In practice, it often results in a company left with thousands of services, a couple of expensive software tools, and few business benefits (Bradley 2008).

Given the lack of consensus on what SOA is (Bell 2008; Erickson and Siau 2008; Kaczmarek and Węcel 2008), it is not surprising that estimations of the proper approach to and potential outcomes of adopting SOA vary considerably (Bell 2008). However, none of this has stopped companies from initiating many “SOA implementation” projects at astounding rates (Erickson and Siau 2008). Nevertheless, most of the initially reported case studies were “vendor commercials”; out of approximately 800 papers reviewed by Erickson and Siau (2008) only 25 appeared in research journals. Recent studies show a more balanced view of SOA (Lee et al. 2010; Varadan et al. 2008), although many companies are still overenthusiastic and subsequently disappointed after introducing SOA.

For the purpose of our paper SOA is defined as an application architecture within which all functions are defined as independent services with well

defined invocable interfaces which can be called in defined sequences to form business processes (Griffin and Pesch 2007). SOA is thus an IT architectural paradigm while Business Process Management (BPM) is a managerial approach towards the improvement of business processes (Ko 2009).

Our paper’s main contribution is a rigorous analysis of a case study suggesting that SOA follows a typical hype cycle (Bradley 2008; Kaczmarek and Węcel 2008) not only in the general public’s view, but also in individual companies. The proposed general framework for attaining business/IT alignment emphasizes the double role of SOA; namely, to improve coherence of IT assets and to assure the fit between business, processes, and IT. The analysis of how the changes in business process maturity (BPMA) and SOA occur in various phases of the hype cycle shows that it is important to increase BPMA to obtain SOA-related benefits.

The structure of the paper is as follows: First, the challenges of each of the phases in the SOA hype cycle are reviewed. Then the methodology of the case study is presented. After this, both the main characteristics and potential dangers of each phase of the cycle and the situation in the company studied are analyzed. Then two frameworks are proposed with recommendations for companies on their longitudinal journey towards achieving SOA-related benefits. Finally, the main implications, limitations, and future research topics are discussed in the conclusion.

2 The SOA Hype Cycle

The Gartner Hype Cycle is a well-known concept for describing the attitude towards new technological solutions. We argue that it is very likely that companies internally follow a path through the hype cycle. This review of the challenges in each phase of this cycle allows companies to more clearly identify the challenges of SOA in their constant struggle to ensure that their IT systems meet their dynamic business needs.

2.1 The Technology Trigger

Traditionally, software systems had a pre-defined, static, monolithic, and centralized architecture with rigid infrastructure for linking individual operations. On the other hand, software applications were demanding increasingly flexible and dynamic means to integrate heterogeneous components (Baresi et al. 2007; Ghezzi and Guinea 2007).

SOA emerged as a response to these challenges because it allows applications to be dynamically composed of individual services and their combinations (Winkler and Buhl 2007). Its aim was to meet business demand for IT flexibility by shortening process lifecycle times (Demirkan et al. 2008). Specifically, in an SOA environment, all of an organization's IT systems can be viewed as services providing particular business functions (Pasley 2005). It was believed that SOA could offer unprecedented opportunities for business/IT alignment, a top concern for the past two decades (Chen 2008). The main idea is to link process activities (defined as business structures needed to execute processes) with realized services (Aier and Winter 2009), thus theoretically achieving a seamless business/IT alignment (Rippert 2006).

2.2 The Peak of Inflated Expectations

The technological advantages listed above led to an almost unanimous belief that SOA enables never-before-seen advances in enterprise architecture (Woodley and Gagnon 2005). SOA was believed to facilitate the alignment of existing IT infrastructure and systems to achieve end-to-end enterprise connectivity by removing redundancies, generating unified collaboration tools, and streamlining IT processes (Bieberstein et al. 2005), while providing greater flexibility and quicker implementation of future requirements

(Heinrich et al. 2009). With SOA, an information system (IS) was thus believed to be more flexible and agile for alignment with a dynamic business environment (Li et al. 2007).

SOA theoretically provides a mechanism for integrating applications that seamlessly support cross-enterprise (business-to-business) and intra-enterprise application integration (Curbera et al. 2003). If services are shared, not only the number of redundant services but also the costs of their operation, administration, and development could be reduced (Heinrich et al. 2009).

To summarize the above claims: SOA has been marketed as an ultimate answer to the eternal challenges of IS development; namely, to enable the flexible alignment of business needs and IT capabilities. Not surprisingly, such “commercials” have quickly encouraged software vendors, consultants, and companies to jump on the bandwagon.

2.3 SOA is Dead (the Trough of Disillusionment)

The realization that neither a decrease in costs nor an increase in business/IT alignment is bound to happen any time soon after implementing SOA quickly set in. Following SOA hype can in fact have negative impacts on companies' application architectures without capitalizing on some SOA benefits (Bell 2008). The naive and often published assumption that new business process applications can be developed immediately by linking business process models with services is far from reality (Adam and Doerr 2008).

Another typical (and truthful) stance of critics is that the current discussion of services is merely a revival of discussions that have been occurring for quite a while. On the technical side, the encapsulation of functionality in software and its adaptation for other components has been used for several years (Demirkan et al. 2008). On the business side, the separation of business rules from application codes has often been attempted previously, with varied success at best (Kovac 2004).

Furthermore, the business side is becoming inherently more complex with companies struggling to become more customer-oriented – meaning that increasingly more exceptions are added to their processes. Often the solution model only considers the “main” course of the

process while ignoring a large number of exceptions (Brahe 2007). Thus, SOA was often unable to solve a well-known problem of such approaches: they do not cope well with unforeseen situations (Cugola 1998).

The general opinion was summarized well by Manes (2009): SOA was once thought to be the savior of IT, but it has turned into a great failed experiment. It was supposed to reduce costs and increase agility on a massive scale but, except in rare situations, it has failed to deliver its promised benefits. After investing millions, IT systems were no better (and often worse) than before.

2.4 The Slope of Enlightenment

Although the acronym SOA has acquired a bad reputation, the requirement for service-oriented architecture remains stronger than ever (Manes 2009). The initial difficulties that started the SOA slide into the Trough of Disillusionment raised questions of how much value SOA could really deliver. It was realized that SOA is an approach and not a solution or technology (Bradley 2008; Erickson and Siau 2008). The true challenge for companies is to provide a process for successfully implementing the service orientation (Demirkan et al. 2008). The main question is not whether SOA will be introduced, but how to efficiently realize the long-term benefits (Kohnke et al. 2008).

In response to the challenges outlined in the previous section, organizations need to make structural, operational, and cultural changes to become more service-oriented (Demirkan et al. 2008). In the last few years, both practical experience and previous research have shown that the key propositions for improving business SOA implementation are:

- **Governance:** The introduction of SOA increases the complexity of service management and hence the need for effective governance (Bernhardt and Seese 2009; Kohnke et al. 2008; LaJeunesse and Tzur 2008; Mueller et al. 2009; Parejo et al. 2009; Schepers et al. 2008; Varadan et al. 2008), which is defined as specifying the decision rights and accountability framework to encourage desirable behavior in the use of IT (Weill and Ross 2004). The potential composition of services into business processes across organizational boundaries can only function properly if the services are effectively governed for compliance with

quality-of-service and policy requirements (Boerner and Goeken 2009; Papazoglou et al. 2007; Varadan et al. 2008). Each service should have an owner that should be responsible for gathering the requirements, development, deployment, and management of services (Bieberstein et al. 2005). These services must be properly documented – not only their current state, but also any change/update to the service (Bernhardt and Seese 2009). Last, but certainly not least, the approach to programming should assure a suitable structure of the service in terms of both reusability and potential changes (Erl 2005). The usual consequence of improper governance is reported in Brahe (2007): Thousands of service operations exist in the enterprise, and so it has been immensely difficult to locate a required service. They are not properly documented and some services require up to 100 input parameters, making it very difficult to invoke the service.

- *Training*: The employees need new skills such as expertise in component-based development, business analysis, business process reengineering, and complex service orchestration (Bieberstein et al. 2005; Demirkan et al. 2008; Erickson and Siau 2008; Erl 2005; Kohnke et al. 2008). Applying the principle of reuse leads to a shift of necessary competencies of software designers from domain-specific knowledge towards method-specific knowledge (vom Brocke and Buddendick 2006).
- *Business processes SOA connection*: SOA is closely connected to the management and maturity of organizational processes. The main challenges in developing process-driven and service-oriented systems are the refinement and, finally, mapping of business processes to the existing service infrastructure (Adam and Doerr 2008; Harmon and Wolf 2007; Kamoun 2007; Leymann et al. 2002; Papazoglou et al. 2007; Ravichandran et al. 2007). This issue is explored in depth in the last section.
- *Organizational structure and culture*: The transition to SOA requires a loosely coupled organization. Although the relationships within each unit may remain hierarchical, the relationships between units should be based on the provision and consumption of services (Cherbakov et al. 2005;

Ravichandran et al. 2007). If the functional structures remained unchanged, SOA in larger companies cannot be efficient because centralized control introduces multilayered bureaucracies, impedes agile decision-making, and fosters disruptive inter-functional rivalry (Bieberstein et al. 2005; Lawler et al. 2009). In fact, practical experience has shown that SOA implementation is most successful in companies that have previously applied service orientation (Herr et al. 2004; Krafzig et al. 2004). Therefore, a possible option is to first support the needed changes in organizational structures or increase in business process maturity, and only then to start SOA implementation.

2.5 The Plateau of Productivity

Even “the best SOA” will hardly deliver the entire scope of initially marketed benefits. Although SOA provides certain techniques and tools for IT integration and an ever-elusive challenge of bringing the business and IT together, it does not eliminate these challenges:

- As noted earlier, the *complexity of business processes* is such that, regardless of the approach used, it is virtually impossible to develop IT support for every possible exception. Even if this were possible, it is likely that the costs of full-scale IT support would outweigh the benefits.
- *Service reusability* is limited by service granularity. Atomic services are hardly reusable, whereas the use of molecular services often results in a mismatch between business process models and the available services; that is, the existing services do not immediately fit the requirements of business processes (Adam and Doerr 2008).
- The assurance of an *alignment between IT and the business world* is a continuous struggle because IT professionals and business users have different goals (Kohnke et al. 2008) and may also often search for local, instantaneous optima instead of long-term global ones. Even if SOA may provide a “common language” for IT and business people, they still speak in “different dialects”.
- Because SOA enables the inclusion of *services from external providers*, the access to these services should be properly managed by the process owner, not a programmer (Woodley and Gagnon 2005). Nevertheless, several risks are

inherent due to potential providers’ inability to continuously enhance the service to match the changing needs of a company’s processes.

2.6 Business Process Maturity and Its Role in the Hype Cycle

However, it is unclear which main factors influence the pace of the transition between the phases and the organizational way out of the Trough of Disillusionment. We propose the BPMA concept as the missing “component”. The notion of “maturity” has been proposed as a way to evaluate “the state of being complete, perfect, or ready” and the “fullness or perfection of growth or development” (Rosemann et al. 2006). A process-mature organization emphasizes processes, a process-oriented way of thinking, outcomes and customers as opposed to hierarchies (McCormack 2007). A mature process includes interactions among the employee skills, tools and methods used in all the tasks, and clearly defined metrics and methods (adapted from Harter et al. 2000). Moreover, in a process-mature organization the focus is on the entire processes of the organization, not just on one or a number of functions (Kumar et al. 2010).

BPMA is the stages through which an organizational process is becoming more process-oriented, ultimately realizing an end goal of being fully process integrated (McCormack 2007). The concept of BPMA suggests business processes have developmental stages (McCormack 2007) and is characterized by the extent, to which the processes are explicitly defined, managed, measured and controlled (Lockamy and McCormack 2004). Because it makes processes within an organization transparent it shapes the environment in terms of improving operations (Reijers 2006). A higher BPMA will be reflected in higher levels of success in the BPM initiative (Rosemann et al. 2006).

A BPMA assessment gives insights into the current BPMA level and indications concerning what to do to raise it to better support the business/IT alignment. It shows the required effort to move to the higher level the company needs to support the process capabilities identified in the business/IT alignment assessment (Catts and Clair 2009). The BPMA assessment also helps by providing guidelines to introduce further changes to the

current process to make improvements (Ahmed and Capretz 2010).

We argue that SOA can be used to assure the coherence of IT assets without much increase in the BPMA. The reason is that SOA may enable application building with less development effort even at lower levels of BPMA (Harter et al. 2000). However, after initial results in infrastructural improvement BPMA significantly reduces the challenges of IT implementation. Namely, the level of process maturity has diverse effects on different aspects of IT implementation (Kumar et al. 2010). A higher BPMA is therefore associated with differing IT implementation strategies and improved software quality (Subramanian et al. 2007). To achieve synergy between BPMA and SOA implementation organizations need to understand their position regarding BPMA (Ahmed and Capretz 2010), which represents information often limited to organizations with higher BPMA levels where processes are actively managed and improved.

Thus, in order to generate the business-related benefits and to improve business/IT alignment, the increase in BPMA should go hand-in-hand with the implementation of SOA. When properly implemented, SOA enables an incremental and manageable positive change throughout the organization. This allows for the utilization of processes to achieve higher levels of maturity. Similarly, this information also helps organizations introduce changes in the current process to make improvements because a well-established and measurable process contributes markedly to the success of an organization (Ahmed and Capretz 2010). Higher levels of process maturity are associated with better software quality and project performance (Subramanian et al. 2007).

An increase in BPMA critically influences both the outcome and the transition between the phases in the hype cycle. Further, achieving higher levels of process maturity requires a long-term commitment to continuous process improvement. It may take organizations years to achieve the next level of maturity and to realize the benefits (Jiang et al. 2004). Therefore, an organization needs a roadmap to monitor its progress, the inter-relation between SOA and BPMA and further actions to improve both.

In this context, we propose the following research hypothesis: *An organization's success with implementing SOA depends*

on its ability to match the SOA implementation with an increase in BPMA.

3 Case Study

3.1 Methodology

Main research questions were how does the attitude towards SOA change in a single company in various phases of the hype cycle, and how SOA implementation cycle and increase in BPMA are interconnected and which factors influence the transition between hype cycle phases.

A case study was used because it is suitable when “how” or “why” questions are asked about a contemporary set of events over which the investigator has little or no control (Yin 2003). Given the scarcity of studies investigating SOA and its role in business/IT alignment and our particular interest in the attitude toward SOA through different phases of the hype cycle, this qualitative approach was deemed suitable to enable contextualization and vivid description (Eisenhardt and Graebner 2007). Case study research is also a recommended way to research an emerging area (Yin 2003); this is certainly the case of SOA implementation. Finally, case study research is most relevant in the phases of Peak of Inflated Expectations or the Trough of Disillusionment of the hype cycle because the lack of successful examples precludes the use of quantitative techniques (O’Leary 2008).

Several reasons led to the selection of a large Slovenian service company (henceforth called Trencu). First, Trencu operates in a particularly dynamic environment, seeking to provide its clients with highly innovative solutions that require flexible IT support. Second, this industry resembles others that rely on knowledge workers, such as high-tech and knowledge-intensive industries. Third, several awards received by Trencu for their IT development/SOA efforts make this a “least likely” case – if they experienced problems in various hype cycle phases, it is likely that similar problems will also be experienced by others. Finally, previous contacts enabled excellent access to various (including confidential) sources.

Our data collection process extended over more than eighteen months. It also included a retrospective aspect as we learned about the development in the last 10 years through the interviewees’ retrospective account (Leonard-Barton 1990).

Informant interviews were our primary source of data; archival materials, internal documents, observations, business process models, and so on were also used.

We conducted about 30 semi-structured interviews with individuals directly involved in the various processes (e.g., senior executives, directors, and employees). We asked senior managers to nominate participating employees across levels and units to enable representative sampling. We also used a “snowballing technique” (Eisenhardt and Bourgeois 1988) by asking initial informants to recommend others that could offer further insight.

All interviews involved two researchers and were tape-recorded and transcribed verbatim to ensure reliability. An interview protocol was designed with the attitude to SOA and its role in supporting business operations in mind. Then, as data collection and analysis unfolded, our interviews became increasingly focused. We continued recruiting informants until additional interviews failed to dispute existing knowledge or reveal new knowledge – that is, until we achieved theoretical saturation (Strauss and Corbin 1998).

Internal documents and procedures were reviewed, and the content and flow of documents used in the process were carefully analyzed (from their creation to archiving). Before each visit, we analyzed the material related to individual processes. During the visit, we also collected documents created in the processes. The business processes from both back and front offices were modeled following a well-established methodological approach (Trkman 2010). Furthermore, a process map for the entire company was prepared to enable an overview of all current processes.

Our data analysis process followed Miles and Huberman’s (1994) recommendations. Systematic, iterative comparisons of data and existing literature aided the development of an integrative, theoretical framework. Analysis started by examining all interview transcripts, internal documents, and procedures. We looked for similar themes, which served as the basis of our proposed framework. In the final stage, we drew on past studies of BPM and SOA to refine our labels and understandings. The findings and developed frameworks were validated by Trencu’s employees (the CIO and selected key business users).

To our knowledge, this is one of the first rigorous holistic cases of SOA implementation (see Ordanini and Pasini 2008

as one of the few exceptions). Previous cases have mainly dealt with certain aspects of SOA implementation such as system architecture (e.g. Yuan and Lu 2009) or application reengineering (Umar and Zordan 2009). All of the information presented herein is real; however, some data (e.g., the name, size, and industry of the company, and exact dates when the case was conducted) are not revealed due to a confidentiality agreement.

3.2 Case Analysis

3.2.1 Promised Flexibility as a Technology Trigger

Trenco grew from a start-up company to a market and technology leader in less than two decades. Currently it services more than half of the Slovenian population. On the one hand, its IT infrastructure is state-of-the-art with the company being a technology leader in its region. On the other hand, it involves a complex interplay of applications developed in-house (mainly for internal users) and off-the-shelf applications (for financial and international services). This caused problems with interoperability (e.g., the re-entering of data from the front to back office system and multiple scanning of the same documents) and high costs/workload with maintenance. Further, no special attention was paid to the management of business processes which were unstructured and not documented, meaning that Trenco was at the first level of BPMA.

Due to company's growth and software inflexibility, SOA was identified as early as 2006 as an attractive option to both integrate existing applications and increase their flexibility to enable the continuous adaptation of IS to ever-changing business needs. The lack of a business/IT alignment can be less crucial in small companies because they are known for their ability to innovate, respond rapidly to changing environments, and satisfy customers' evolving requirements (Ferneley and Bell 2006). In contrast, effective governance is needed in larger companies to achieve and maintain a business/IT alignment (Weill and Ross 2004). In the words of Trenco's CIO: "SOA is the right solution for large companies technology-wise; however, it's too complex for small companies where business/IT alignment happens automatically."

3.2.2 Improvement in Infrastructure Leading to Excessive Expectations (the Peak of Inflated Expectations)

Following this impulse, Trenco invested considerable internal and external resources in the development and implementation of SOA. Several achievements were visible (e.g., identification of initial services to be supported and improvement in IT infrastructure): "SOA increases our efficiency; it brings a kind of organized distributed modularity into our network. Previously, we had many, many modules that were programmed in Java and C++. We've saved a lot of the optimization of our infrastructure."

Different approaches (both bottom-up and top-down; see, for example, Aier and Winter (2009) for an analysis of the benefits and problems of each) and modeling tools were used for business process modeling. As a consequence BPMA increased to level 2 as most of the basic processes were defined, documented and portrayed in flow charts. However, the company did not adopt a systematic approach, but instead initiated various projects without a clear goal in mind. Consequently, a clear connection between SOA efforts and business processes was not established ("however, now we are struggling with a much more difficult task: the connection with business processes"). Trenco expected that this would somehow gradually happen and would lead to the promised flexible and easily adaptable business processes. SOA was thus seen as a replacement for effective governance.

3.2.3 Many Projects, Few Results (the Trough of Disillusionment)

The results of different projects therefore did not create synergies to achieve the further increase in BPMA and consequently the desired business/IT alignment. Specifically, Trenco did not conduct a top-down analysis, which is one of the core activities of SOA governance (Mueller et al. 2009). Although several business process models were developed at Trenco, insufficient attention was paid to their suitability for the development of services/IT application. Specifically, the models developed were not prepared with sufficient details (e.g., exact business rules, all possible execution scenarios). Trenco invested relatively large sums in obtaining the licenses for the new "SOA tools" and some effort was made to train

the software developers in the use of the new development tools.

However, the BPMA did not make it to the third level which is often characterized as a breakthrough level (McCormack 2007). Managers did not employ process management with strategic intent, and results and jobs remained primarily functionally oriented. The training of business users was still lacking and thus little progress was made in achieving the business-process-SOA services connection. The business users namely need to know "which services are available for which business purpose, how these services can be connected, which services have to be replaced when a business process has to be changed or whether new services are needed in order to adapt to new requirements" (Paoli et al. 2009). Accordingly, business users were losing interest because the long-running project had yielded no visible results. A general impression arising at Trenco is that "the company is just not that far yet".

Certain efforts were also made to resolve the problems of a lack of governance (often the responsibilities were not properly defined) coupled with an organizational culture that values confirmation-seeking and a functional orientation or silo mentality (report to the boss, not to the process owner) thus remaining on the second level of BPMA. Consequently, there was limited support of middle management for projects targeted at an increase of end-to-end process and their support with a proper IT. A typical quote from a business user demonstrating the lack of governance: "this e-mail was forwarded 10 times – nobody wants to take responsibility and make a decision." Ultimately, there was a large gap between expected results and what was delivered, resulting in both users and managers losing interest.

3.2.4 Need and Opportunity to Optimize Business Processes (the Slope of Enlightenment)

The main impulse leading out of the Trough of Disillusionment was the recent economic crisis that led to a considerable decrease in revenue ("the economic crisis induced the managers to think differently"). Coupled with this was an upcoming merger with another company that enables a more thorough redesign of business processes and consequently their support with IT. Thus it was necessary to deploy process changes to put

broad process jobs and structures outside of traditional functions in place leading to the third BPMA level. Because SOA at Trencos was at a relatively advanced level technology-wise, it was seen as an opportunity to not only improve the IT side but also the business processes (e.g., the sales process; the CIO commented: “better IT support for sales process will reduce the number of employees needed; just tell me how many you want to fire”).

3.2.5 The Plateau of Productivity

Trencos has not yet reached the plateau of productivity. A set of continuous problems impeding early progress to this stage is expected, such as the attitude of managers and power users to process change (e.g., some are active in achieving process changes, whereas others like the status quo), the complexity of IT employed, and the many exceptions needed due to the required flexibility. In order to reach the fourth BPMA level to enable the full benefits of SOA Trencos should be putting processes first, i.e. basing organizational structures and jobs on processes, and making traditional functions equal or even subordinate to business process. This would enable the process owner to change the business processes simultaneously with a change in SOA-enabled IT support.

To summarize, Trencos has accomplished progress in IS integration, especially in providing suitable IT infrastructure, which in turn has improved efficiency. The company partly managed to connect the business and IT components for achieving higher organizational performance. Some efforts have been put into integrating existing applications, but little work has been put into the development and management of software services. Moreover, different business areas, such as sales and customer support, are still highly influenced by a silo mentality.

4 Interconnection of Business Process Maturity and SOA

The Trencos case shows that, without a clear roadmap, SOA efforts may stay in the Trough of Disillusionment (as also found by Sinz 2008). We thus argue (similar to Grant 2002) that IT, business processes and business concepts need to be aligned to assure the benefits of SOA implementation. In line with the design science principles, something that demon-

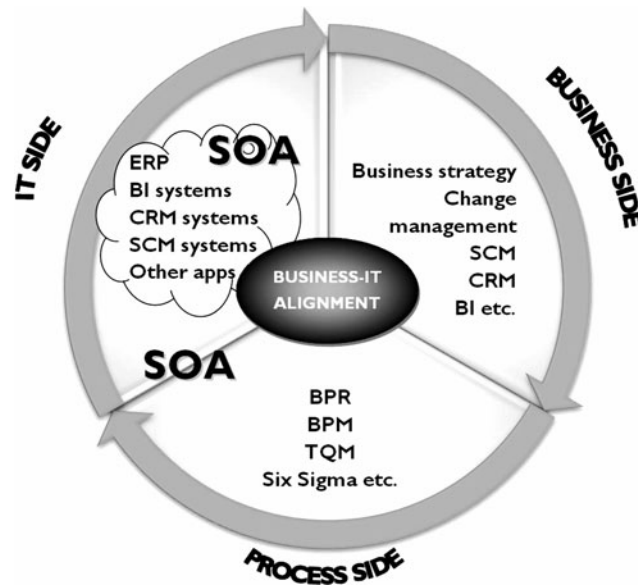


Fig. 1 The business/IT alignment and the role of SOA

strates utility needs to be proposed (Winter 2009). Knowledge and understanding of a problem domain and its solution need to be harnessed in the building and application of the designed artifact (Hevner et al. 2004). Available experience creates the basis for the artifact’s requirements’ analysis. Moreover, empirical research methods can support the evaluation of developed artifacts by testing their feasibility in a real-world application context (Houy et al. 2010). The analysis of the literature and the case study of Trencos suggest the development of the following two frameworks; the first one should serve as a general vision of the final goal of SOA implementation efforts, while the second is an overview of the phases a company may go through and can assist with the identification of the current state and the potential gap between SOA and BPMA.

In the proposed framework (Fig. 1), the business side mainly includes the formulation of a business strategy and a proper change management approach. Various concepts such as customer relationship management (CRM), supply chain management (SCM), and business intelligence (BI) belong to this side because they often require a complex shift in how the business is organized and managed. Our framework emphasizes the need to ensure a greater business contribution from IT assets with business processes and their change as the “missing link” (Stein et al. 2008). This linkage should be achieved not only at one point of time but over a longer time horizon,

thereby yielding effective change management of the business strategy, processes, and IT side.

BPMA can help in several activities necessary to obtain this, such as to better understand the business-IT linkage, analyze and prioritize gaps, and sustain alignment (Luftman and Brier 1999). Proper SOA planning helps close the gap between business users’ needs and SOA deliverables. To close this gap, companies need ongoing collaboration between business and IT to clearly identify business needs from IT and IT potential in that respect (Cherbakov et al. 2005). Such a dialogue helps IT professionals determine which SOA services to offer and how to effectively allocate IT resources.

The double challenge of SOA is thus to ensure:

- The coherence of the “IT assets” tripartite circle: this is mainly to ensure the proper integration of the legacy system and newly developed applications to assure coherent and flexible IT “assets” that include not only software, hardware, and telecommunications, but also processes, work routines, organizational knowledge, and responsibility structures. Furthermore, SOA has been identified as a possible solution for an enterprise information system to retain its old legacy systems (Li et al. 2007). The SOA concept should integrate legacy systems such as ERP, various SCM, CRM, BI systems, custom-developed applications, and services offered by external providers.

- The coherence of the entire framework: this is mainly to ensure a fit between business goals, business processes, and IT. The challenge is still the same as a decade ago: how to assure business/IT alignment – applying IT in an appropriate and timely manner in harmony with business strategies, goals, and needs (Luftman and Brier 1999). Currently, little has been accomplished in terms of research specifically connecting SOA with changes needed in organizations (Erickson and Siau 2008).

This dual challenge presents a partial answer to the wide gap seen between the expected benefits (hype) and practical experiences. Although SOA presents a new approach for dealing with the first challenge, it does not necessarily contribute to solving the second one. Namely, many organizations are still not fully aware of the need to base SOA on a comprehensive business model of the enterprise and to integrate business processes with business services (Schwarz and Hirschheim 2006).

However, the first framework does not enable a longitudinal analysis of the SOA implementation efforts but rather a general overview of the final goal to achieve full business/IT alignment. Therefore another framework is proposed (Fig. 2) that further explores the interconnection of BPMa increase and SOA success. While the axes do not have a direct semantic value the distance on x axis shows the gap/misalignment between the process and IT side (thus the lack of business/IT alignment). The y axis shows the expected evolution of this alignment over time.

The framework follows the claim that the organization can move from SOA Level 1 to Level 2 (as defined by Harmon and Wolf 2007) without much emphasis on processes. This corresponds to the first two phases of the hype cycle where the initial achievement of SOA-related improvements leads to the peak of inflated expectations. The literature review and our case study showed the company falls to the Trough of Disillusionment since only partial benefits were obtained.

In this phase, an organization's success with SOA depends on its ability to define its processes and the relationships between them; thus, on the improvement of BPMa (Harmon and Wolf 2007). The identification of services should be preceded by the optimization of a process because otherwise it will end up in

the “electronification” of inefficient processes (Grozniak et al. 2008; Heinrich et al. 2009). Namely, an often-cited reason for SOA failure is the non-existence of quality process models that can be used to identify business services (Heinrich et al. 2009). The company should thus not focus solely on business process modeling and redesign, but also on other aspects of BPMa. Only predictable and controlled processes can be efficiently supported with SOA-based services.

In order to reach the fourth level, BPMa structures and jobs need to be based on processes, and traditional business functions have to be equal or even subordinate to processes (McCormack and Johnson 2001). It is only in such a mature organization that IT applications can really be developed as a sequence of services. The fifth level shows the hypothetical situation of a full business/IT alignment in which business processes and SOA in fact merge into one. However, due to inherent limitations this cannot be reached, and a new hype cycle will start promising attainment of the fifth level of BPMa and full business/IT alignment.

The Trencos case can be analyzed with the proposed framework. Following a technology trigger, Trencos started to implement SOA at a low level of BPMa without any mapped or organized processes. It thus achieved the technical functionality of SOA (Level 1). It has started to model the business processes in the scope of the document-management system implementation project. This technology-oriented project slightly increased BPMa. In such a way, the initial benefits of SOA were realized with an improvement in the IT infrastructure leading to an improvement in the coherence of the “IT assets” with the achievement of Level 2 of SOA and BPMa.

Quick wins led to the Peak of Inflated Expectation. Several activities were started in an attempt to realize these expectations. For example, further business processes were modeled. However, the selection was not made after a careful analysis of how to raise BPMa and which processes were the most important, but was based on the attitude of middle managers to the modeling; the most co-operative ones were chosen (a project leader at Trencos said: “do not model the back office processes; their manager does not want anyone to get involved with his processes”). A clear goal for these efforts was not established. Such an approach led to

the development of a vast quantity of business process models (altogether 85 models and 580 pages of documentation were prepared) that hold little value for IT support. Finally, the improvement in the SOA technical capabilities was undermined by business users who did not realize what SOA truly offers because they did not have a clear view of the entire process. Thus, after the initial efforts yielded considerable benefits, these further activities mainly created costs.

Therefore, Trencos stumbled into the Trough of Disillusionment. The CIO of Trencos noted that “*something in between is missing*” with SOA being more advanced than BPMa. In the Trencos case, the economic crisis was the decisive turning point. Due to the company's decrease in revenues the top management was forced to cut costs; an increase in BPMa was seen as the most suitable option to achieve process optimization. Eventually Trencos managed to organize business processes at the company level so as to be able to start managing the SOA lifecycle (Level 3 of both SOA and BPMa). At that level, business processes are properly defined and process models can therefore also be used for IT support (McCormack and Johnson 2001). Above all, the business processes should ensure defined business rules are used in process activities; a description of the business rules should also be included in the models (van der Aalst et al. 2003). The business process models developed earlier were namely insufficiently detailed to be used for IT support. The Trencos CIO commented on this by saying: “the process models gave us an overview of our business but weren't really useful for IT support.” They were, however, a useful starting point for defining and mapping business rules to business process activities, thus making the models more suitable for IT support.

As stated, Trencos has not yet achieved Level 4, with human-related factors still being an impediment. A further increase in BPMa and the full management of processes are needed. The main characteristic of that level is that processes are actively managed; only at such a level of BPMa is it possible to move closer to the use of SOA to support business processes.

5 Conclusion

This paper showed how business processes and their maturity can be impor-

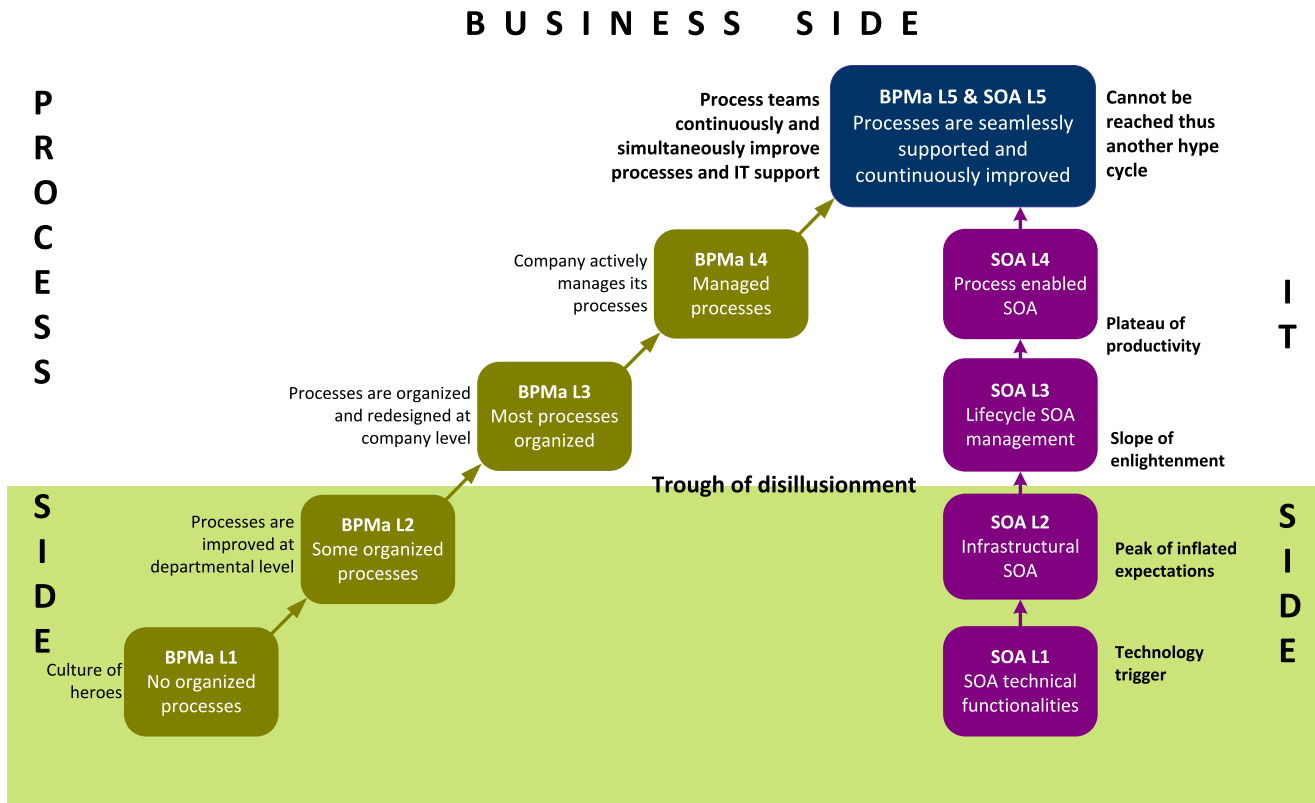


Fig. 2 Interrelationship between SOA and BPMa (adapted from Harmon and Wolf 2007)

tant in the quest for successful SOA implementation; this has rarely been studied before (Tallon 2007). On the one hand, companies should strive for coherent IT “assets” through the introduction of SOA. This provides a better “single version of the truth” with the decrease of problems relating to representation of data, data integration, and repetition. On the other hand, the framework emphasizes the need to look holistically at all three parts; it is especially important to connect BPM with SOA services.

The case indicated the importance of simultaneous improvement of BPMa and SOA technological capabilities. In the case of Trengo, the technological capabilities (IT side) were developing quicker than BPMa, leading to the initial Hype of Expectations and the consequent tumble into the Trough of Disillusionment. This shows that immature business processes hinder the business/IT alignment as the company does not have either a clear oversight of its business processes or a capability for their improvement/support with SOA-based IT. Thus the quest of IT to align with poorly defined process side is bound to bring sub-optimal results. Initial efforts increased BPMa only to a certain level; after that

outside events (the economic crisis and planned merger) speeded the needed increase in BPMa that enabled an exit from the Trough of Disillusionment.

This paper has some implications for practice. A company starting with (or in the middle of) SOA implementation should carefully analyze its current state of BPMa which can be measured with previously validated questionnaires (McCormack 2001). After that, the plan for a simultaneous increase in SOA implementation and BPMa should be carefully prepared, including both IT and business side.

This paper has several limitations. The case study analyzed could not cover all phases of the hype cycle because the company studied has not yet completed the cycle. While the proposed frameworks demonstrate some usefulness in the analysis of the Trengo case and could be used as guidelines for other companies attempting the SOA implementation it should be emphasized that a single case study cannot serve as a validation of the generalizability of the results. Several specifics of the studied case (e.g. the company’s merger) may reduce the generalizability of the case and it is possible that other companies will follow a different

path through the hype cycle and that triggers leading from one phase to another will be different. For companies with a high initial level of BPMa it is even possible that they will skip the initial phases of the hype cycle. Further longitudinal case studies are needed to validate the usefulness of the proposed frameworks in guiding SOA implementation efforts.

A statistical analysis of a sample of companies would help confirm the causal relationship between BPMa and SOA outcome. More research is also called for on how to actually measure the benefits of SOA; measurement of the benefits at the process level currently seems to be the most promising approach to estimating the impact of IT investments (Davamanirajan et al. 2006). Further, a rigorous bibliographical analysis of the growing body of research paper on SOA would help to identify the critical success factors of SOA implementation.

Perhaps most importantly, detailed, practical recommendations for companies dealing with SOA implementation were not provided. Both of our proposed frameworks are conceptual in nature and further research is therefore needed to provide more detailed guidelines to assure successful implementation. SOA is

currently more of a vision than a practical methodology for IS design (Sinz 2008).

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Abstract

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SOA Adoption Phases

A Case Study

The paper argues that attitudes to SOA follow a typical hype cycle from Technological Trigger, Peak of Inflated Expectations, and a Trough of Disillusionment to the more recent realization that SOA is a concept that may offer certain benefits but has several limitations. The main research question studies how the attitude to SOA changes in various phases of the hype cycle, how the SOA implementation cycle and an increase in business process maturity (BPMA) are interconnected and which factors influence the transition between the hype cycle phases. The paper shows that an organization's success with implementing SOA depends on its ability to match the SOA implementation with an increase in BPMA. The dual purpose of implementing SOA is shown in the first framework: to assure the coherence of IT assets and to assure business/IT alignment. In the second framework, the interconnection of SOA and BPMA and its role in transiting through the hype cycle phases is outlined. The findings are analyzed using a longitudinal case study of a large Slovenian company.

Keywords: Service-oriented architecture, Business/IT alignment, Business process management, Business process maturity, Hype cycle, Case study

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