

Service-Oriented Architecture and IT-Business Alignment

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Abstract

IT-Business strategic alignment has been one of the most important, persistent and interesting issues in both industry and academia. Not surprisingly, Service-Oriented Architecture (SOA) has attracted considerable attention among information technology (IT) practitioners due to its potential to address alignment of IT with business requirements. However, recent evidence indicates that many SOA initiatives have failed to enable this alignment in spite of rosy promises from vendors. This research examines the mechanism of IT-Business strategic alignment through dynamic capability-building processes to seek possible answers, and posits that IT infrastructure flexibility is a potential enabler of IT-Business strategic alignment under conditions of a dynamic external environment. First, the various facets of IT infrastructure flexibility within the context of SOA and IT-Business alignment are addressed. Then, the notion of environmental dynamism is introduced and the role of environmental dynamism in IT-Business alignment is identified. Finally, it is argued that IT infrastructure flexibility is a form of dynamic capability to help organizations achieve and maintain IT-Business alignment under higher degrees of environmental dynamism. We posit that the success of SOA in enabling alignment is contingent on environmental dynamism. Overall, this article contributes to both practice and research by shedding light on the largely ignored phenomenon, namely, of SOA failure and by exploring one fundamental factor affecting SOA initiatives' success.

Keywords

SOA success and failure, IT-Business Strategic Alignment, Service-Oriented Architecture, IT Infrastructure, Flexibility, Environmental Dynamism, Dynamic Capability

1. Introduction

IT-Business alignment has been consistently ranked at the top among other contemporary IT related top management concerns [18, 19]. Despite management's desire to better align business and IT for over two decades, this goal remains elusive. Recently, SOA has been proposed as a mechanism to facilitate alignment of IT with business requirements that are changing at an ever increasing rate because of its ability to engender a higher level of IT infrastructure flexibility [13]. This is especially true for firms in the manufacturing sector that have to contend with drastic changes in demand, functionality, design features, styling, etc. [16]. Although SOA has gained increasing popularity due to its ability to promote IT infrastructure flexibility¹ and, in turn, superior level of IT-Business alignment and, thereby, superior business value anecdotal evidence [13, 20] suggests that many SOA initiatives have failed to achieve these desired outcomes. While literature shows evidence of association between SOA and IT infrastructure flexibility the potential role of IT infrastructure flexibility in IT-Business alignment needs to be examined for empirical validity in order to investigate the missing link between SOA and desired IT-business alignment and associated contextual conditions. In addition, the relationship between IT-Business alignment and the business value of IT also needs to be investigated. Specifically, the primary objective of current research is to explore a key factor affecting the IT-Business alignment, namely, environmental dynamism which might moderate the relationship between IT infrastructure flexibility and IT-Business alignment. As such, this research seeks to

¹ For details relating to SOA, technology standards and the various components involved and its current state of evolution readers may want to refer to one or more of various available sources (e.g., [2, 3, 13, 22, 23]).

contribute to the knowledge of IT-Business alignment realization under different conditions of environmental dynamism for the given SOA initiative and IT infrastructure flexibility. We first introduce the fundamental domains underlying the research question: SOA, IT infrastructure, flexibility of IT infrastructure, and IT-Business alignment.

1.1 Service Oriented Architecture (SOA)

Although SOA is still in its infant stages [13] it has been advocated as an approach for building systems that enhances IT's ability to efficiently and effectively respond to the rapidly changing business environment and enable organizations to respond to these changes in a timely manner. It represents a core technology in the increasingly important discipline of service science. From a technical viewpoint, SOA is an application architecture wherein functions or services are defined using a description language with callable interfaces to support business processes. This research employs the definition provided by Arsanjani et al. [3], which adopts the view that "SOA is the architectural style that supports loosely coupled services to enable business flexibility in an interoperable, technology-agnostic manner. SOA consists of a composite set of business-aligned services that support a flexible and dynamically re-configurable end-to-end business processes realization using interface-based service descriptions." Implicit in this definition is the objective of employing SOA to enhance IS and business agility and to improve IT-business alignment in a rapidly changing business environment.

As is usual with any new IT initiative, however, the SOA implementation landscape is dotted with many failures. According to a 2008 InformationWeek Web Survey of 278 IT professionals, 32% of those using SOA indicated that those projects fell short of expectations [22]. IT professionals define SOA failure as a failure to realize grand claims made for SOA, i.e., better IT infrastructure flexibility and resulting improved IT-business alignment [20]. However, those able to successfully implement SOA were able to realize greater IT infrastructure flexibility. Accepting this empirical evidence of an association between the SOA and IT infrastructure flexibility as valid, our research focuses more on the factors affecting the relationship between IT infrastructure flexibility and IT-business alignment to investigate the reasons why many SOA initiatives do not realize claimed advantages.

1.2 IT Infrastructure

Literature suggests that IT infrastructure is the enabling foundation of shared IT capabilities upon which the entire business depends [11], the part of the organization's information processing capacity intended to be shared [26], a set of shared, tangible IT resources [9], and a key source for attaining long-term competitive advantage. Overall, IT infrastructure is viewed as the shared fundamental resources that need to exist to attain competitive advantage, and treated as a critical business capability as well as a foundation of IT capability.

IT infrastructure consists of both technical and human IT infrastructures [11, 12]. However, it is often the technical IT infrastructure that is referred to when practitioners discuss IT infrastructure [6]. Thus, IT infrastructure in the current study refers to its technical aspects.

1.3 IT Infrastructure Flexibility

IT infrastructure flexibility can be viewed as an organizational core competency [26]. Some of the key dimensions of IT infrastructure flexibility were proposed by Duncan [9]. Byrd and Turner [6] adapted Duncan's dimensions to further develop and propose three key constructs of IT infrastructure flexibility – connectivity, compatibility, modularity. *Connectivity* is the ability of any technology component to attach to any of the other technology components inside and outside the organizational environment. *Compatibility* refers to the ability to share any type of information across any technological components. *Modularity* addresses the ability to add, modify, and remove any software, hardware, or data components with ease and with no major overall effect. The current study employs the Byrd and Turner terminology for the three dimensions of IT infrastructure flexibility.

1.4 IT-Business Alignment

Since Henderson and Venkatraman [12] proposed four domains of strategic choice for alignment, many researchers have focused on different parts of this model partly due to the complex nature of overall IT-Business alignment. Recent research suggests that focusing on how individual components contribute to alignment may be more feasible and yield better results than tackling all the alignment challenges of the entire IS organization at once as embodied in the original model [7].

Although a number of researchers have studied IT-Business alignment, it is still unclear how an appropriate alignment can be accomplished and practitioners appear to continue to struggle to achieve alignment. Chan [7] argued that this is because alignment is not a straight forward management activity and that the process of achieving alignment is multifaceted and dynamic. The current study focuses primarily on the alignment of Business Strategy and IT strategy because strategic alignment is likely to contribute more to a firm's performance than structural alignment [7].

2. Literature Review and hypotheses

In this section, the theoretical arguments for hypotheses are presented by drawing mainly from literature on IT-Business alignment, Resource Based View (RBV), and the theory of dynamic capabilities. Following RBV, we point out that the core value of IT infrastructure lies, in fact, on IT-Business alignment. Next, drawing from the theory of dynamic capabilities, our research postulates that the core value of IT infrastructure (i.e. IT-Business alignment) under dynamic environment can be realized with the help of reconfigurability of IT resources (i.e. IT infrastructure flexibility). Finally, the mediating role of environmental dynamism is discussed.

2.1 IT Infrastructure as a Critical Resource: *Resource Based View*

Since Barney's [4] seminal paper, RBV has been widely adopted to define IT infrastructure in many studies [9, 26]. This literature stream suggests that IT infrastructure is the shared fundamental resources that need to exist to attain competitive advantage, and that it is a critical business capability. More recently, Wade and Hulland [24] proposed that IT resources (IT infrastructure was categorized as one of *inside-out* IT resources in their study) are emerging increasingly as sources of competitive advantage.

Because only valuable, rare, inimitable, and non-substitutable (VRIN) resources can lead to competitive advantages according to RBV, researchers have questioned what makes IT infrastructure (and IT resources generally) valuable, rare, inimitable, and non-substitutable. Lu and Ramamurthy [17] concluded from an extensive literature review of RBV-based IS studies that suitable blending of organization's various IT resources is the basis of developing competitive advantage. According to their study, suitable blending refers to the unique combination in which IT assets or resources are packaged and interwoven into business practices.

A compelling argument can be made from the noted RBV-based studies that IT infrastructure, which is not suitably aligned to business strategies and practices, cannot be considered as a critical source of superior IT capability and competitive advantage. IT-business alignment reflects a state of clear understanding of applying IT in an appropriate and timely way, in harmony and collaboration with business needs, goals, and strategies [18]. Such a state should lead to superior business value being exploited from IT. Thus, the importance of IT-Business alignment relies on the ability to make IT resources a critical source of IT capability that leads to competitive advantage and, in turn, superior firm performance. As such, the business value of SOA is mainly driven from its resulting IT-Business alignment.

The following section discusses environmental dynamism, a potential factor affecting the relationship between IT infrastructure flexibility (facilitated through the internal diffusion or infusion of SOA) and IT-Business alignment.

2.2 IT-Business Alignment and Dynamic Environment: *The Theory of Dynamic Capability*

The notion of dynamic capabilities emerged as a response to the criticism leveled against RBV, its inability to satisfactorily explain firm behavior and performance in dynamic environments. It is argued that RBV does not explain how and why certain firms have competitive advantages especially during rapid and unpredictable changes. Eisenhardt and Martin [10] defined dynamic capabilities as processes to integrate, reconfigure, gain and release resources to match and even create market change. Therefore, in order for IT infrastructure to qualify as a key resource from the perspective of dynamic capability, suitable blending at one point in time is not enough. Rather, it can be argued that suitable blending through continuous time frames is necessary. This is more pronounced in manufacturing industry [16, 25]. By itself, SOA supports a flexible and dynamically re-configurable end-to-end business processes realization, promoting modularity, a dimension of IT infrastructure flexibility. Modularity addresses the ability to add, modify, and remove any software, hardware, or data components with ease and with no major overall effect; this, in turn, provides the capability of continued suitable blending, i.e. the dynamic capability and resulting continuous IT-Business alignment. In sum, IT infrastructure flexibility, enabled by SOA initiatives, promotes dynamic IT-Business alignment.

Environmental dynamism refers to the degree of instability and turbulence of changes that occur in the organizations' operating environment [1, 8]. The current study adopts the notion of dynamism to refer to the relative rate of change to the various environmental factors and ability to predict those changes. In a more dynamic or turbulent environment, it may be difficult to achieve a suitable blending of IT infrastructure (i.e. the unique combination in which IT assets or resources are packaged and interwoven into business practices) because many changes may occur simultaneously and at an increasing rate; suitable blending at one point in time may not be suitable anymore even in a short time frame. Echoing this perspective, Lu and Ramamurthy [17] suggested that firms in such dynamic environments may be more pressed to constantly reconfigure their IT resources. Consistent with this line of thought, IT-Business alignment cannot be achieved without higher degree of IT infrastructure flexibility when facing dynamic environments.

Based on the foregoing brief discussions of two key theory bases (*Resource Based View* and *The Theory of Dynamic Capabilities*) and previous IT-Business alignment literature, the conceptual research model is shown in figure 1.

The research model depicts the four main constructs of this study: the infusion of SOA, IT infrastructure flexibility and IT-Business alignment, and environmental dynamism. Resource Based View and the theory of dynamic capabilities, as discussed, strongly suggest that environmental dynamism moderates the relationship between IT infrastructure flexibility and IT-Business alignment. It can be argued that suitable blending in a less dynamic environment does not require higher IT infrastructure flexibility whereas in a more dynamic environment these theories suggest that reconfigurable flexible IT infrastructure is essential and constantly affects realization of the right mix (IT-Business alignment). Hence, the following two hypotheses are proposed for examination.

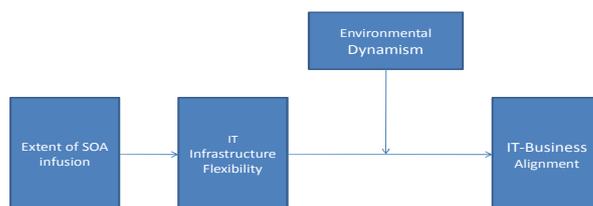


Figure 1: Research Model

Hypothesis 1: Under conditions of high environmental dynamism, the association between IT infrastructure flexibility and IT-Business alignment will be (relatively) strong.

Hypothesis 2: Under conditions of low environmental dynamism, the association between IT infrastructure flexibility and IT-Business alignment will be (relatively) weak.

Once the model and accompanying hypotheses are empirically validated, the results will provide a sound explanation of why some SOA initiatives do not enable the claimed IT-business alignment and associated value in spite of achieving higher IT infrastructure flexibility. In less dynamic environment, additional flexibility gained with SOA plays a less significant role in achieving IT-Business alignment, resulting in underutilization of the system capabilities. Furthermore, considering the fact that significant costs are to be expected to be incurred in the early phases of SOA adoption, we project that SOA initiative would not pay off even over the long run for firms faced with less dynamic environments. The opposite will be true for firms faced with highly dynamic environments.

3. Research Design and Operationalization

3.1 Research Design and Data Collection

As a control group, seven industries are randomly selected from a set of all industries that have been experiencing lower environmental dynamism while seven other industries are randomly selected with higher environmental dynamism to serve as a treatment group. From each industry within each group, using published secondary data [8], ten organizations are randomly selected. This procedure yields a total sample size of 140 that satisfactorily meets the threshold of statistical power of 0.80. The study uses survey methodology to measure the infusion of SOA, IT infrastructure flexibility and IT-Business alignment. As noted, published secondary data are used to measure environmental dynamism. IT infrastructure flexibility metrics are obtained from senior IT managers (e.g. CIO, Director of MIS, and database administrators) while senior business executives (e.g. VP of finance, operations, or marketing) are respondents for IT-Business alignment measurement and business value.

3.2 Operationalization

3.2.1 The Infusion of SOA

The level of servicization (also called servitization) is adopted to measure the level of SOA infusion. Servicization refers to the procedure of wrapping around different underlying business processes to fabricate services [21]. More specifically, the percentage of servicized business processes is utilized to measure the infusion/internal diffusion of SOA.

3.2.2 IT Infrastructure Flexibility

As noted, the dimensions of IT infrastructure flexibility were proposed by Duncan [9] and further refined by Byrd and Turner [6] who developed the measurements for three dimensions in their study. IT infrastructure flexibility measures are adapted from Byrd and Turner [6] reflecting connectivity, modularity, and compatibility.

3.2.3 IT-Business Alignment

IT-Business alignment is operationalized following Huang and Hu [14]'s approach. The balanced score card system is adopted for measurement.

3.2.4 Environmental Dynamism

Environmental dynamism measure is adapted from extant research [8, 15, 17]. Environmental dynamism is operationalized as the standard error of the regression coefficient of industry-level sales reported by all firms for each specific four-digit SIC code regressed over time. Following this approach, the standard error is then standardized for size by dividing it by the mean value of the industry-level sales. Specifically, the environmental dynamism of a certain industry in a given year is obtained by regressing industry level sales over the previous four years and the given year.

4. Conclusion

IT-Business alignment continues to be one of the most important IT management issues. Although SOA has been touted as the new evolution for dynamic IT-Business alignment, SOA initiatives increasingly fail and lose attraction and support. This study attempts to provide one explanation to such a phenomenon. The model presented here could provide a glimpse into how IT infrastructure flexibility enabled by SOA initiatives may serve as a key mechanism to help firms realize such alignment and eventual business value. Empirical validation of the proposed model would provide practitioners insights on when SOA initiatives fail and what can actions be taken in such occasions.

The study shows that it is particularly important to understand the impact of different levels of environmental dynamism on the success of SOA in achieving IT-business alignment by identifying the appropriate level of IT infrastructure flexibility. Many vendors and IT professionals of SOA initiatives assume all firms are in need of the same level of IT infrastructure flexibility (the highest possible level). In reality, however, the required level can vary depending upon the firm's environmental characteristics, e.g. environmental dynamism. In terms of limitations, although detailed in several respects, the model does present opportunity for further refinement and enhancement. For instance, factors other than environmental dynamism can be considered to explain the relationships among constructs. Another limitation is that the current study is research-in-progress to validate the model and is only a first step toward a more complete understanding of IT-Business strategic alignment mechanisms from the viewpoint

of SOA. However, we believe it provides a solid framework and sets the stage to build upon for further research investigations including other candidate factors affecting SOA initiatives.

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