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Building the Business Case for SOA: A Study of the Business Drivers for Technology Infrastructure Supporting Financial Service Institutions

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Abstract. Financial service institutions are pursuing organizational agility in the face of an increasingly competitive marketplace, and are consequently looking infrastructure technologies that enable process and infrastructure agility. Service-oriented computing (SOC) appears to to provide flexibility and agility, not just in systems development but also in business process management. This paper empirically examines the decision to adopt SOC as an enterprise strategy across fifteen firms, and investigates the business drivers that influence the enterprise adoption of SOA. In doing so, this paper adds crucial empirical evidence to the formal academic literature about the business case for SOA as an enterprise strategy, and lays the groundwork for future work on SOA alignment with business strategy.

Keywords: Service Oriented, SOA, SOC, Business Drivers, Technology Adoption.

1 Introduction

In response to dynamically changing market conditions, financial institutions are increasingly looking for avenues of organizational agility [1]. By virtue of being the underlying enabler of the core business processes, information technology is very critical to achieving this agility [17]. Technology infrastructures built on service oriented computing principles appear to facilitate business process and, subsequently, organizational agility [21]. The paradigm of Service Oriented Computing (SOC) views whole business functions as modular, standards-based software services. The associated Service Oriented Architecture (SOA) establishes a defined relationship between such services offering discrete business functions and the consumers of these services, independently of the underlying technology implementation [28].

There is a great deal of enthusiasm in the industry about this concept but the adoption of SOA by end-user organizations is still in a relatively early stage [32]. Therefore, there is a scarcity of critical research addressing the ability of organizations to realize business value from the adoption of SOA. From a pragmatic perspective, there is widespread recognition of the fact that various organizational

issues need to be addressed for the successful implementation of any information technology [19]. What is needed beyond the current research on the technology implementations of SOA, is a focus on the study of the real-world adoption of SOA across the enterprise and the factors that aid or impede such adoptions. This understanding becomes even more critical in the context of financial services institutions since the strategic impact of information technology is very high for financial institutions, and the industry sector is at the leading edge of the adoption curve for innovative technology solutions [25].

This paper empirically examines the use of SOA across fifteen firms – a mix of banks, insurance firms, and service providers - and as part of a broader study, specifically investigates the business drivers for choosing to adopt SOA as the technology infrastructure. Having identified the business requirements that drive organizations to choose SOA as the enterprise infrastructure, the paper then examines the value proposition of SOA that could fulfill these business requirements. In doing this, the paper helps build a business case for the adoption of SOA by financial institutions. The results of the empirical study also provide valuable insights into the factors that influence the real-world adoption of SOA, thus filling a crucial gap in academic literature.

Section 2 provides some background on the concept of service orientation. Section 3 describes the empirical study of SOA adoption across fifteen firms including the data collection and analysis processes. Section 4 describes the results of the empirical study, while Section 5 examines the value proposition of SOA along each of the business requirements identified by the study and articulates the business case for SOA. Section 6 identifies related work in this area, and the final section, Section 7, concludes the paper with a discussion of the contributions and possibilities for future research.

2 Service Oriented Computing

As organizations have evolved with ever-changing technology, and natural organic and acquisition-based growth, the complexity of their infrastructures has increased dramatically, requiring more innovative distributed computing techniques to address their needs [7]. With the increasing diversity of platforms, protocols, and development environments, the need for a higher level of abstraction was recognized as being imperative for the efficient use of existing heterogeneous and/or geographically distributed resources [6]. This need was compounded by the growing business need for communications across diverse domains – for example, across partner or customer systems - for increased business value through strategic partnerships [8]. This gave rise to the concept of services, functional entities whose location and implementation are abstracted from the client or user, to allow the integration and communication of diverse and distributed technology domains.

2.1 What Constitutes a Service?

A service is a business function implemented in software, wrapped with a formal, documented interface that is well known, does not depend on the internal workings of other services, and can be located and accessed by any software agent using standards-based communication mechanisms [28]. These services could be simple services performing basic granular functions such as order tracking or composite services that assemble simple or other composite services to accomplish a broader modular business task such as a specialized product billing application. As an example, a business flow, such as an online book retail service, could be built using services across multiple service providers pulling together, say, billing services from a partner, and warehousing services from another partner. At a lower level, this could also potentially work for an individual business application say, the ordering of a book being built from tying together simple services such as a book search feature and customer verification.

2.2. Service Oriented Architecture (SOA)

While services manifest business functionality in the service-based computing model, a Service-Oriented Architecture (SOA) provides a framework for the infrastructure to facilitate the interactions and communications between services [28]. An SOA is as an interconnected set of services which in its basic form is a message-based interaction between software agents, each accessible through standard interfaces and messaging protocols. These agents can be service providers or service requesters (clients) interacting with service discovery agencies, and the services in the SOA should be technology neutral, loosely coupled (not tightly integrated into the requester's process), and support location transparency.

SOAs can be thought of as both an architecture and a programming model, more a way of thinking about building software than a software development technique [7]. According to widely accepted definitions of services [11], [28], [36], SOA-compliant architectures exhibit the following four properties:

- Modularity. The services in the architecture are developed as independent modules of functionality, offering well-defined interfaces to their users. The services represent a logical view of discrete business level operations (e.g., customer verification) and are relatively granular or coarse-grained in scope.
- Loose Coupling. This is facilitated by encapsulation of the underlying functionality so that the implementation is logically decoupled from the invoking entity. Services may encapsulate functionality at various levels – from components within an application to components or sub-systems communicating across enterprises – as long as they represent discrete meaningful business functions. This facilitates the composition of these services into complex services and applications.
- Technology neutrality. Services are universally usable by any requester, and communication between services is message based, with the message format being standards-based and platform-neutral.

- Location transparency. The services are self-describing in that they have formal documented interfaces that are well known, and they are easily locatable and accessible over a network. According to [28], the service interface is “known where to be found not only by agents who designed the services but also by agents who do not know about how the service has been designed and yet want to access and use it”.

In the business world, SOAs may be viewed as application architectures “within which all functions are defined as independent services with well-defined invokable interfaces, which can be called in defined sequences to form business processes” [7]. Decomposing this definition, services can represent simple business capabilities (e.g., address validation), complex business transactions built from simple business capabilities (e.g., placing purchase orders), or broader system functions (e.g., user authentication). In addition to this essential attribute of granularity, services are “independent” in that they meet the requested need but their internal implementations are irrelevant to the business process. Services are “invokable” in that they can be used from within or across enterprise boundaries by users across diverse platforms.

Service consumers can, ostensibly, weave together business services, with no knowledge of the underlying technical service implementations, changing existing business models where the business process are invariably tightly tied to specific technology solutions [34] . The pulling together of simple, basic, core services to form a complex business process in the SOA world is called service composition [29]. To achieve this seemingly easy equilibrium of the composition of services into higher level applications, however, the underlying technical infrastructure needs to provide stateless or context independent technical services with relevant metadata that describes what the service does and how to interact with it. These stateless technical services can then be bound together on demand to form business services, using generic communications infrastructure and the contextual metadata [26], [35].

2.3. Technology Implementations of SOA

SOAs may be implemented using any appropriate technology as long as the services in the SOA framework support the basic principles of service-oriented computing - modularity, loose coupling, technology neutrality, and location transparency.

Hub-centric message driven systems used by enterprises today are widely viewed as precursors to what is now called SOA [12]. Message oriented middleware (MOM) allowed systems to build modules that communicated over a messaging infrastructure, forming a loosely coupled system and allowing for a level of abstraction. Component based software programming models, such as DCOM, CORBA, and Enterprise Java Beans (EJB), are also earlier attempts at building loosely-coupled object-based systems [20]. These system models that were precursors to the service concept continue to be viable options of implementing SOA in certain situations [2]. When it comes to wider use across organizational boundaries, however, the use of these models are hampered by the lack of uniform standards and support from major software vendors [5].

The next step on the implementation chain was made possible by the ubiquitous information channel - the Internet. Web services are essentially the deployment of a

service-based computing model over the Internet, and unlike other earlier technology implementations, leverage open Internet standards to facilitate diverse inter-enterprise communication [28], garnering relatively unanimous industry vendor support [20].

2.4. Current State of Industry Adoption

There are a variety of statistics available from various trade magazines and technology analysts relating to the adoption of SOA in the industry, all generally indicating the widespread acceptance of SOA. As early as 2003, Gartner [27] had predicted that over time lack of SOA would become a competitive disadvantage for most enterprises. When it comes to adoption of SOA in the industry today, there are a variety of statistics available from various trade magazines and technology analysts, all generally indicating the adoption of SOA as widespread. Surveys of professionals worldwide [9], [31], [32], indicate that knowledge and awareness of SOA amongst the IT professional community is "significant", with most companies "doing something related to SOA". The associated reports conclude that the spread of SOA is "almost inevitable". This mirrors the general optimism in trade journals and magazines, indicating that SOA, and specifically Web Services, is the popular choice for businesses looking for flexible systems development.

The major technology vendors appear to have invested significant effort in promoting SOA, building supporting products and tools, and even publishing related research, with IBM seemingly in the forefront. Its research initiative (Service Science, Engineering, and Management or SSME for short) is a collaborative effort with various universities worldwide to promote multi-disciplinary research in service-oriented computing. HP has recently introduced the Business Technology Optimization (BTO) for SOA, a set of software and services for service management. Microsoft and BEA are also updating their product suites and infrastructures to include service-oriented concepts. In addition to specific products and solutions, software vendors, large and small, have thrown their support behind SOA, working on various cross-vendor initiatives to promote the growth of SOA adoption. The efforts are too numerous to list here, but industry trade journals have an abundance of information on vendor products, and ongoing collaboration efforts across various vendors to promote standards and interoperability for enterprise service infrastructures.

3 The Empirical Study

A case study approach was chosen as the research methodology to study the alignment and adoption of SOA across the enterprise because, according to Benbasat *et al* [3], case studies are "well-suited to capturing the knowledge of practitioners and developing theories from it".

Fifteen firms – a mix of both financial service institutions in the banking and insurance sectors, and software service providers that had a significant number of clients in the financial services industry - were approached to understand their position on SOA. Most of these firms were chosen based on their involvement in

industry conferences on SOA which was an indication of their interest in adopting SOA. A few, however, were chosen on an opportunistic basis leveraging a network of contacts. Table 1 describes the industry sector and profile of the firms interviewed as well as the designation of the interviewees.

Table 1 - Summary of Firms Interviewed

Firm	Sector	Interviewee	Profile
1	Bank	Head of Strategy	Large Australasian private bank
2	Bank	Business development executive; Technical Architect	Large U.K. based bank
3	Bank	Business development executive	Large Europe based bank
4	Bank	CIO	India's second largest private bank
5	Bank	Enterprise Architect	Mid-sized Australasian public-sector bank
6	Bank	Enterprise Architect	Large Australasian private bank
7	Insurance	2 x Technology manager / Architect	Mid-sized Indian private general insurance firm
8	Insurance	CTO	Large Indian public sector general insurance firm
9	Insurance	CIO	Large Australasian insurance firm
10	Insurance	Enterprise Architect	Large Australasian public sector insurance firm
11	Product & Services	CTO; VP of Strategic Accounts	Small India-based ERP solutions firm
12	Product & Services	Technical architect	Large European ERP solutions firm
13	Product & Services	Technical architect	Large U.S. based software and services firm
14	Services	2 x Technical architect; Product manager	Large India-based software services and consulting firm
15	Services	Principal	Large US-based multi-national consulting firm

Semi-structured interviews were conducted with business managers, enterprise architects, and CIOs/CTOs of 13 (thirteen) of these firms. A broad set of questions addressing specific areas of discussion (technology strategy, business drivers for the technology infrastructure, implementation details, challenges and concerns, benefits realized, and lessons learned) was used to guide the interviews. Wherever possible, the interview data was augmented by documents provided by the interviewees. Each of the individual interviews lasted an hour with the exception of the interview with Firm 5, which lasted 30 minutes.

Communications with Firms 10 and 15 were limited to electronic communication. Firm 10 indicated that their firm did not have an explicit SOA strategy, but they were

pursuing SOA practices at a technical level by "following reasonable SOA practices in terms of trying to keep things abstracted through the use of messaging middleware and a messaging portal". Firm 15 was able to supply documents describing its SOA strategy at the business and technical levels, and provide specifics of a case study of a large financial services firm. Both these firms are included in the analysis not as primary data but more as an emphasis to the findings from the data gathered in the interviews with the other firms.

Fourteen of the firms interviewed were in various stages of implementing SOA, either for themselves or their clients, most of them already having migrated targeted business functions to a service based deployment. The firms were able to provide some insight into the anticipated and observed benefits of the migration to a service-oriented approach. Firm 6 did not have an SOA strategy and had tried unsuccessfully to migrate to a service based infrastructure. The interview provided a valuable insight into the challenges of building a business case for SOA adoption. The product and software service providers were able to provide an insight not only into the business drivers for their product offerings but also their perception of the business drivers for their clients.

Transcripts of the individual interview data were analyzed using a two-pass method. The first pass of the analysis used thematic coding to identify broad categories of organizational issues. The second pass of analysis was performed using axial coding and major factors were identified using meta-codes. The meta-codes were then used to identify similar patterns across the data from the multiple firms interviewed. The following section details the results of the data analysis identifying the major themes of suggested best practices and organizational factors affecting the implementation, and the cross-firm patterns observed within these themes.

4 Understanding the Business Drivers for SOA

From a strategic perspective, a business requirement that was common across most of the firms (Firms 2-8, 12, 14) interviewed was the delivery of a standardized set of products, both internal and those provided by strategic partners, over a unified *service delivery platform*. Firms envisage a seamless customer experience across all of their offerings and are consequently looking to implement a single service delivery platform for their customers.

The tactical business drivers according to Firms 2, 4, and 6-10 appear to be the need for process and infrastructure *agility*. Firms are looking for the ability to integrate new products and third-party services into their product offerings for increased customer value – a flexible plug-and-play approach to facilitate the use of best-of-breed products transparently over their service delivery platform. At a tactical level, businesses recognize the need for process and infrastructure *agility* according to Firms 2-6, 8, 9, and 11-14. Firms are looking for the ability to integrate new products and third-party services into their product offerings for increased customer value – a flexible plug-and-play approach to facilitate the use of best-of-breed products transparently over their service delivery platform.

Finally, at an operational level, firms are pursuing opportunities for *efficiency gains*, looking to optimize their business processes and reduce costs, as indicated by Firms 1, 2, 3, 6, 9, 11, 13, and 14. These business drivers, it appears from the cross-firm data, are pushing the supporting IT teams to implement services based solutions that allow the seamless integration of internal and external resources, promise infrastructure agility to support business process agility, and provide process and development efficiencies [21].

These findings are summarized in Table 2 along with a few typical quotes from the interview transcripts.

Table 2 - Summary of Business Drivers for SOA

Business Driver	Firms	Typical Quotes
Service Delivery Platform	2, 3, 4, 5, 6, 7, 8, 12, 14	[We are] looking for one solid plug-and-play platform…for seamless user interface and back-end integration. Drivers for consumer banking [are] a service platform to provide a single view of back-end systems in Phase 1. Phase 2 will provide a single customer view to agents. Business drivers for SOA [is] to be able to give consistency and standardization across systems.
Process and Infrastructure Flexibility	2, 3, 4, 5, 6, 8, 9, 11, 12, 13, 14	Flexibility is a core requirement. This is achieved purely by the technical infrastructure. Flexibility is paramount, to be able to change the business process. We have services…If someone comes along and says I want to do this we can.
Efficiency Gains	1, 2, 3, 4, 9, 11, 13, 14	What matters to us is process optimization. [Our infrastructure] addresses operational and efficiency problems. We didn't realize this is SOA, but looking at it, it has evolved into SOA. Using SOA increases IT value by making it reusable and extensible.

5 Articulating the Business Case for SOA

Existing literature indicates that SOAs can potentially offer corporations increased business value. This literature is now examined to understand how SOA may satisfy the strategic, tactical, and operational business drivers identified from the analysis of the cross-firm data.

5.1 Strategic Value Proposition

The ability to seamlessly integrate external resources from strategic partners and internal resources, including legacy systems, enables a single *service delivery platform*, while the reuse of existing assets promotes standardization [14], [21]. Firms can take advantage of this seamless integration of internal and external resources and pull together disparate best-of-breed products and services to create a single service delivery platform, independent of the physical implementations of each individual component.

Moving to a service based approach also allows existing and proven legacy system functions on a diverse set of hardware and software platforms to be encapsulated as services on a new standards-based integration platform [7], [8], [10] and delivered to a broader customer base. The reuse of existing components, while enabling rapid product development and cost efficiencies, allows for a standardized implementation of business functionality and consequently, a more consistent customer experience across product offerings [14].

The location transparency and technology neutrality of services allows businesses to include services from third-party providers or business partners into their own processes as value-added service offerings [21]. This opens up new avenues of strategic partnerships with suppliers, partners, and customers beyond traditional organizational boundaries [30], allowing a new business model – a re-bundling of intra- and inter-enterprise business processes as seamless services [13].

5.2 Tactical Value Proposition

Service-oriented systems enable *agility* in business processes by virtue of modularity and loose coupling, and allow for a flexible plug-and-play approach to business and infrastructure functions by abstracting the underlying service implementations [21].

Effective SOAs tend to be well-defined process-centric architectures facilitating better process visibility and process knowledge resulting in easier design, automation, monitoring, and most significantly, modification of business processes – i.e., resulting in improved process flexibility [7], [14], [27].

In addition, as the service paradigm permeates organizations, the services themselves can be virtualized from the underlying hardware platform. The underlying technology platform can be potentially substituted with ease, allowing for the best choice of platform for the services. This allows the business to focus on the core services while the infrastructure used to run the services become more of a commodity, to be leased or purchased from the provider of choice [7], [13], [33]. Organizations can focus on the efficient orchestration of services to form a product and shed the burden of owning resources [7].

From an implementation perspective, SOA's modular approach also means that companies need not plan to take on a high-risk all-or-nothing approach to its rollout [13]. They can adopt a phased migration to service-orientation, and leverage this approach to focus initially on opportunities that meet immediate customer requirements.

5.3 Operational Value Proposition

SOAs can potentially offer corporations the opportunity to realize process and development *efficiency gains* while mitigating the overall change and technology related risks of the corporation.

Existing architecture frameworks tend to be program-centric with business flow or process knowledge often spread across individual system components. This hampers the consolidation of information relevant to clearly understanding business flows. Well-designed service architectures allow for better process knowledge and facilitate the potential for continuous process improvement [7], [14], [27], [33].

Service orientation enables monitoring of services from a business perspective rather than systems perspective, allowing for better process visibility [7], [14], [27], [33]. Business services that are the core competence of the organization can be clearly identified, and the non-core services can then be candidates for substitution by those provided by vendors with the relevant expertise [13].

In addition to improving the existing business models, service based architectures provide a framework for corporations to offer their core competencies as services to other companies [13], [14], [21], focusing on areas of comparative advantage while buying or leasing services in which they lack superior expertise from other service providers [8]. SOA, thus, potentially allows for the creation of new products generating additional revenue streams.

The reuse of existing components, while providing potential savings in operational costs could also reduce risk in more ways than one [7], [10]. The enhanced business process incurs no new potential points of failure, and the maintenance of the supporting infrastructure continues to remain unaltered. In addition to the reduction in development and testing costs brought about by modularity and re-usability of service modules [15], the learning curve of the development or assembly team could potentially reduce over time due to familiarity with existing services [7], [14], [15], [21], [27], [38]. Gains may also be realized in terms of development and maintenance cost savings by purchasing services from reliable providers with a comparative advantage in developing the services [13].

Over time, the developed services become a core asset of the organization – a library of tested, ready to use, compatible components [7]. This promotes rapid product development, reducing the time to pull together well-design tested functionality to meet new and changing market needs [14], [21].

Table 3 - Summary of how SOA meets the identified business drivers

Business Driver	Business Case for SOA
Service Delivery Platform	1. Seamless integration, facilitates the leveraging of internal legacy systems and enabling strategic partnerships 2. Reuse of services enables consistent customer experience
Process and Infrastructure Flexibility	1. Process centric architecture enables process flexibility. 2. Virtualization facilitates portability across infrastructures. 3. Modular architecture enables phased rollout across the enterprise.
Efficiency Gains	1. Increased business process visibility allows for process improvement. 2. Process visibility also enables the identification of services that the firm has a comparative advantage in, allowing: a. Firms to outsource non-core services and b. Firms to offer core services as new products 3. Reuse could result in reduced development and testing costs. 4. Reuse also allows for rapid product development.

6 Related Work

Of the studies that evaluate the strategic value proposition of SOA, three studies stand out as stage-setters for future research and are discussed in the following paragraphs. The first two examine the potential value of Web Services specifically, while the third looks at SOA in general.

The first of these studies, an analytical study by Huang and Hu [14], investigates the link between Web services and competitive strategy using a popular strategic management tool, the Balanced Score Card [18]. The authors use the scorecard's four dimensions to establish propositions about how Web services could support or improve the following perspectives - learning and innovation, internal business process, customer, and financial. The cases to support the validity of these propositions are drawn from existing literature, industry reports, and vendor analyses from IBM and Microsoft.

The second study [16] argues the advantages of Web Services, a popular technology implementation of SOA, as an enabler of dynamic business networks using a popular stakeholder model for IS architecture [37]. The authors extend Zachman's architecture model to build a stakeholder model for Web Services along the dimensions of the owner, architect, builder, and end-user, and argue the benefits of Web Services along these dimensions to be ease of sourcing the IS implementation, modularity, IS integration, and ease of access respectively.

The last of these studies links SOA to the concept of dynamic capabilities, a concept in strategic management that research scholars indicate may help firms gain competitive advantage in rapidly changing market environments [23]. The concept of dynamic capabilities is a widely accepted approach to understanding the competitiveness of organizations. The authors explain the attributes of SOA that may make it amenable to creating these dynamic capabilities – i.e., integration of internal resources, integration of external resources, rapid product development, learning, and the creation of technological assets.

These frameworks offer possible means to study the business drivers and the real-world benefits of SOA implementations across the business and technology domains, but the real-world business drivers for SOA remain largely unexplored. The examination of the real-world drivers in the financial services domain is crucial given the rapid adoption of SOA by financial service firms.

7 Contribution and Future Research

Research in the area of information technology diffusion indicates that the successful adoption of new technology requires organizations to take an integrated approach to organizational and technical changes effected by the technology [24]. There is a growing understanding of the organizational processes and characteristics that influence the adoption and implementation of technology [4], [19], but there is little understanding of the business drivers that influence the organizational adoption of SOA [22].

This study adds to current knowledge by empirically investigating the business drivers for SOA adoption using data gathered from semi-structured interviews across multiple firms with a fairly broad representation within the financial services industry – banks and insurance firms, which researchers have identified as having high dependence on technology [17], [25], and service providers with clients in the financial services industry. The interview data was thematically coded to glean what challenges the firms faced in the process of implementing SOA, and our findings were fairly consistent across the firms interviewed. Having identified the business drivers for the technology infrastructure in financial service institutions, this study then examines the value proposition of SOA vis-à-vis these business drivers and builds a business case for the use of SOA by financial service institutions.

In investigating the business drivers influencing the adoption of service-orientation, this study

(i) fills a crucial knowledge gap because there is little empirical evidence of the practical enterprise business drivers for the adoption of SOA,

(ii) builds the business case for the adoption of SOA by examining the value propositions of SOA that fulfill the identified business drivers, and

(iii) lays the groundwork for future research for understanding the actual business value that may be realized from the adoption of SOA.

The findings of this paper are part of a larger research effort to leverage the data from the fifteen firms interviewed to understand how the enterprise SOA strategy can

be aligned with the organizational strategy. The next phase in this research effort involves a continued analysis of the data to develop a framework for SOA implementations.

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