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Service-Oriented Architecture: Technology Selection and Strategic IT Management

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INTRODUCTION

This paper examines the strategic decision making process of managing IT infrastructures. In particular, this paper proposes a methodology that can be employed in making a company's decision to implement a Service Oriented Architecture (SOA). SOA forces us, for the first time, to analyze and truly examine our IT operations through business—not technical—perspectives (Datz, 2004). Accordingly, the decision to embrace or not to embrace SOA and in what capacity, combines quantitative and qualitative factors from both business and technical perspectives. Therefore, it is not possible to provide a purely objective measure by which the decision to embrace SOA can be resolved. This paper proposes a methodology through which this decision can be analyzed and evaluated and describes the insight provided.

BACKGROUND

SOA is a step in an evolutionary chain of advancements in information systems architecture: Distributed Computing (Ganti & Brayman, 1995), Business Pressures for Integration: (Hopke & Woolf, 2003) and Cost Containment and Outsourcing (Bissonnette, 2005). At its most basic level, SOA is a collection of services that communicate with one another (Datz, 2004), (Wikipeida, 2005). Business applications are constructed by linking together the appropriate services. This service focus provides a better way to expose discrete business functions and is therefore an excellent way to develop applications that support business processes (Brown & Johnston, 2002).

A Web Service is an application or business logic that is accessible using standard Internet protocols such as HTTP and SOAP and standard data formats like XML (Hagel & Brown, 2001). Although the concepts behind SOA were developed well before the emergence of Web Services technology, Web Services play a vital role in modern SOA (Hashimi, 2003) and for the purposes of this paper we assume that a current SOA implementation includes Web Services.

SOA offers substantial technical benefits that make development, maintenance, and integration significantly less burdensome for an organization, while simultaneously improving over-all performance. SOA provides a variety of benefits related to support for heterogeneous environments and legacy systems by simplifying replacement and in some cases, extending the lives of these systems (Datz, 2004).

The business-oriented benefits of SOA are not as well characterized, but these benefits can make SOA very attractive to organizations aspiring to control IT costs and maximize the value of their existing investments. The improved integration capabilities of SOA can lead to bottom-line savings by making IT costs more predicable, and easier to manage. Additionally, SOA makes it easier to share information with business partners across company firewalls, simplifying the implementation of business relationships (Datz, 2004).

ANALYSIS METHODOLOGY

Because this decision making process involves both technical and business considerations, we must draw from both of these arenas to develop a methodology. Furthermore, in order to analyze the different contributing factors, both quantitative and qualitative methodologies must be employed. We can first approach this decision using the Analytic Hierarchic Process (AHP) as demonstrated by Braglia & Petroni (1999) and Yuntsai, Chiwei, & Jianru (2004). When used for technology selection, AHP is a powerful process because it enables us to mathematically transform conceptually subjective factors into quantitative variables, allowing us to effectively evaluate alternatives (Yuntsai, Chiwei, & Jianru, 2004).

Factor Identification

The first step in the AHP process is identification of decision factors. A company considering SOA must weigh the investment costs in technology and skills against the presumed benefits to their organization. While every company's situation is different, we have identified a group of representative decision factors by combining and consolidating factors from research conducted on IT and on business strategy decision making (Bacon, 1992, Kambil, Kamis, Koufaris, & Lucus, 2000, and Marsh, 2005). For clarity, we have defined these factors in a way that is common to many businesses. In addition to those listed, factors such as cost and technology maturity are typically critical to IT decision making.

- **Growth Rate:** Growth Rate is defined as increased operating capacity, e.g. how fast are operations expanding. We assume that growth in capacity reflects growth in demand and consequentially growth in revenue.
- **Market Volatility:** Market Volatility is a subjective measure of the dynamics of the company's target markets and industry, resulting in changes in business processes, rather than to changes in market prices. To subjectively measure market volatility companies must consider how often business requirements change as a result of changing market conditions and changes to customer requirements.
- **Existing Environment:** The existing IT Environment determines the challenge of intra-organizational integration and is largely a measure of whether an organization's systems are primarily heterogeneous or homogeneous. Because homogenous systems are substantially easier to integrate than heterogeneous systems, the recognized benefits of SOA may be diminished when utilized in a very homogeneous organization.
- **Inter-Organizational Integration Demands:** Inter-Organizational Integration demands determine the degree to which a company will need to integrate with business partners. Ultimately, this measures how vertically integrated the business's value network must be.

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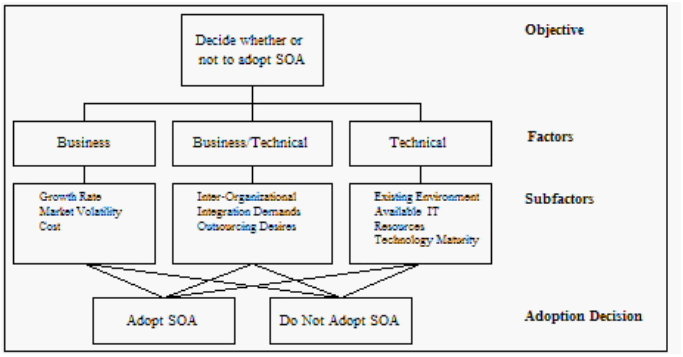
Figure 1. Representative AHP decision tree for SOA



- **Outsourcing Desires:** Outsourcing desires are an indication of the company's long term IT strategy and impacts how the company plans to focus its IT assets and initiatives.
- **Available IT Resources:** By Available IT Resources include both IT personnel and tangible IT assets and technology. The Available IT Resources have a sizable bearing on the organization's execution capability to implement an SOA solution.

Classification and Prioritization

The next steps are prioritization and classification of the decision factors; this is usually performed by constructing a decision tree. For the factors identified above, the decision tree is shown in Figure 1. We categorized factors based on whether they were primarily from the business side or the technical side of our organization. Once the AHP decision tree has been constructed, we evaluate whether each factor supports SOA and score each according to its relative importance.

While AHP has proven to be effective in prioritizing and simplifying the complexity of such decisions, this methodology has several weaknesses. These weaknesses are particularly apparent when AHP is used to analyze a technology such as SOA that has strong ties to a variety of business factors. First, it is prone to cause time-consuming disputes regarding which values are most important (Harfield, Driver, Beukman, 2001). Second, some factors are inherently qualitative and it may be difficult to assign them a quantitative value. Finally, it does not address the possibility of interdependence between the factors involved in the decision to adopt SOA decision. To address these weaknesses we turn to the realm of competitive strategy and marketing.

2 x 2 Matrix Analysis

To address the weaknesses of AHP analysis, we use the "2 x 2 matrix" format demonstrated by Porter in his analysis of competitive strategy (1998) and the Boston Consulting Group's model of the Product Portfolio Matrix (2003). The 2 x 2 matrix allows us to subjectively analyze and understand two factors and the relationship between them. It can be especially effective when used to analyze factors on the same branch of the AHP factor tree.

Figure 3. 2 x 2 Matrix (single dominant factor)

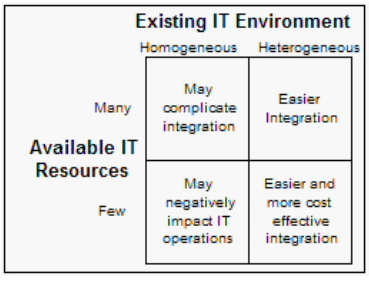
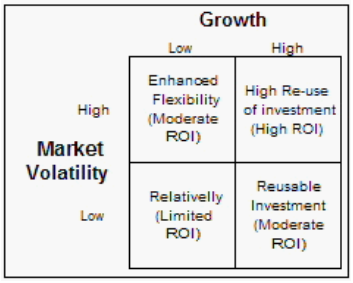


Figure 2. 2 x 2 matrix (balanced factors)



To show the application of the 2 x 2 Matrix in this situation, we present two examples. The relationship between growth rate and market volatility are analyzed in terms of perceived return on investment (ROI) of SOA implementation in Figure 2. As market volatility increases, a company will gain flexibility and responsiveness through SOA. If market growth is high but volatility is low, however, the main benefits of SOA relate to reusability and are more moderate. This analysis indicates that these two factors are balanced in that they require us to choose between the flexibility or reusability aspects of SOA.

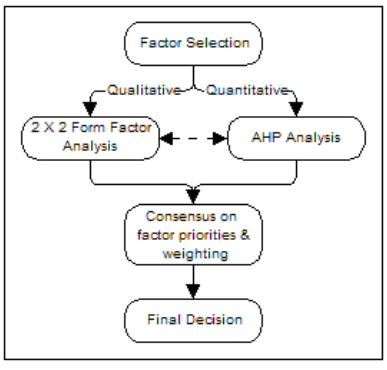
The relationship between the Existing IT environment and the availability of IT resources is examined in Figure 3. If the existing environment is primarily homogeneous, implementing SOA may have adverse effects regardless of the available IT resources. Whereas, if the existing IT environment is heterogeneous, organizations will be able to improve the ease and efficiency with which they can integrate their IT systems. This single dominant factor indicates that the dynamics of the existing environment are more critical to consider than the availability of IT resources.

CONCLUSIONS

We have demonstrated in the above analysis a methodology that can be used to facilitate a company's SOA decision. First businesses need to identify the factors most important to their company's situation. While these factors may differ from those identified in our example, the analysis methodology should be the same. The AHP methodology can be used in conjunction with the 2 x 2 matrixes as an aid to making the SOA decision. Because the decision to adopt SOA is influenced by both business and technical considerations, it is necessary to use both business and technical methodologies in making the decision. We have proposed integrating AHP with 2 x 2 matrixes in order to address the weaknesses that the AHP methodology exhibits with regard to the SOA decision process (see figure 4 below).

The central benefit of SOA, as advocated by the IT community, is that it can help businesses use their existing IT resources to do more with less

Figure 4. Proposed methodology



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and ultimately improve the efficiency of the entire company, making it more competitive.

At a strategic level, however, SOA is a powerful tool for facilitating alignment between IT and business operations. The methodology, coupled with SOA, gives insight into the role of markets, value chains and IT assets as factors in the decision and the dominance / balancing aspects of the factors. Further research will provide more detailed insight.

We believe that the proposed methodology will help businesses make technology selection decisions that not only result in technologies more suited for their IT departments, but also the right business decisions in terms of market and industry dynamics. Given the need for alignment between IT and line-of-business operations, methodologies such as this will become increasingly necessary.

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