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# Attaining Competitive Advantage Through Web Services: A Theoretical Perspective

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# Attaining Competitive Advantage Through Web Services:
# A Theoretical Perspective

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**ABSTRACT**

There is growing debate in the research literature on the competitive advantage offered by information technology. This has been further noted after the publication of an article in Harvard Business Review provocatively titled "IT Does Not Matter". Researchers have looked into different aspects such as; IS alignment, a firms IT capability etc. to support the perspective that IT does have an impact on a firm's performance. Similarly literature exists supporting the counter claim – IT does not matter. These researchers claim that IT investments do not improve company performance; that the cost-benefit analysis of IT investment does not justify the IT investment; and more importantly that IT does not give any competitive advantage as it is easily imitable.

We argue that a revolutionary emerging technology, Web Services can give an organization competitive advantage through a series of limited time competitive advantage. We argue this by using a multi-theoretic lens and look mainly into the literature of strategic alignment and dynamic capabilities.

**KEYWORDS**

Web Services, IS Strategy, Strategic Agility, Strategic Alignment, Dynamic Capabilities, Resource-Based View

**INTRODUCTION**

The emergence of digital networks and service oriented computing has given rise to Web Services. The impact of Web services on software development has even been compared to that of the assembly line in manufacturing (Ulrich, 2001). Presently, the World Wide Web is being used more and more for application-to-application communication. The programmatic interfaces made available for this communication to take place are referred to as Web Services. (W3C - www.w3.org). The idea behind Web services is that software solutions can be delivered as discrete services remotely over the Web, using a common means of understanding what each service does and how to integrate with it. For example, companies may develop their own application services such as credit card processing, production management etc. and choose to sell them on a subscription basis to others, thereby creating a source of revenue.
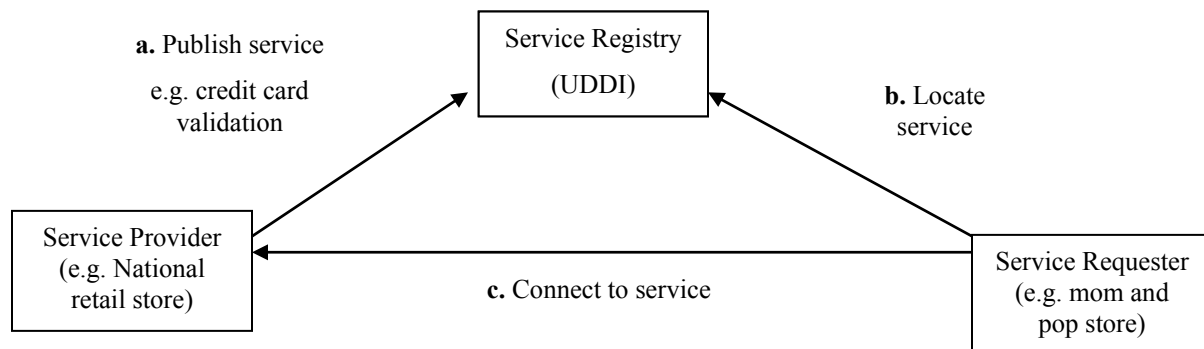
Figure 1: Registry, lookup and consumption of web services

Figure 1 illustrates an example of the concept of web services. In this scenario a "mom and pop" store is looking for a credit card validation application (locate service) and searches the service registry (UDDI) for this application and finds that a national store has offered their credit card validation application (publish service). The "mom and pop" store can now access the credit card validation application by paying a monthly subscription fee. This to an extent has already been done Microsoft Passport for instance offers its authentication function to other companies through web services on subscription basis and also few other companies, mainly financial institutions are using web services to share some common applications (for details see Bielski, 2003; Lim and Wen, 2003). One of the important features of web services is its interoperability. "Interoperability" means that the application is suitable for and capable of being implemented in a neutral manner on multiple operating systems and in multiple programming languages.

We are of the opinion that web services could allow companies to improve their performance on three fronts. First, by offering them flexibility through interoperability. Secondly, by enabling them to retain competitive advantage for a limited time and in some cases sustaining the competitive advantage for a longer period through a series of temporary competitive advantage. Finally, by generating revenues through web services. The specific contribution of this paper will be to highlight how companies can utilize the flexibility offered by web services to attain strategic alignment between Information Systems (IS) and business, gain competitive advantage over competitors through a series of limited time competitive advantage, and finally create a preliminary revenue generating framework in order for this web services model to work. In the following sections we will develop our support for limited time competitive advantage through web services.

## THEORETICAL PERSPECTIVES

In this section we will look at literature related to attaining competitive advantage and superior business performance through strategic use of IS. We will start by reviewing the literature on strategic alignment, then look into the literature of dynamic capabilities and finally into the resource based view literature. At each stage we will use the existing literature to show how it is applicable to web services

### Strategic Alignment

The importance of alignment for effective organizational performance is well known (e.g. Delery and Doty, 1996). IS strategy is directly concerned with business applications, and there have been previous suggestions that it should be aligned with the business strategy (Das et al., 1991; King, 1978; Zviran, 1990). The importance of linking the IS planning process with business planning has also been emphasized several times (Boynton and Zmud, 1987; Henderson and Venkatraman, 1992; King, 1978; King and Zmud, 1981) and researchers have responded by examining the necessity and benefits of aligning IS with the rest of the business (Chan et al., 1997; Henderson and Venkatraman, 1992; King and Teo, 1997; Luftman et al., 1999; Reich and Benbasat, 1996; Sabherwal and Chan, 2001; Sambamurthy and Zmud, 1999). These researchers suggest that alignment between business and IS strategies enhances business success and imply that greater alignment between an organization's business strategy and IS strategy indicates that the systems are targeted on areas that are critical to its success (Sabherwal and Chan, 2001). Organizations with greater alignment between business strategy and IS strategy are also more likely to utilize IS for competitive advantage (Johnston and Carrico, 1988; Wiseman, 1988).

However, despite the intuitive appeal of the argument for aligning IS strategy with business strategy, the dynamics of alignment has been little studied. A few exceptions to this are the Brown and Magill (1998) and Shabherwal et al. (2001). We feel that it is important to look at alignment from dynamic perspective and therefore we will take this approach in our paper. The reason for taking the dynamic approach is based on the argument of D'Aveni (1994), he states that although the static view presents invaluable tools for analyzing the competitive environment and position of the firm at any point in its evolution, they fail to recognize competitive advantage as a fluid and dynamic process. We tend to agree with the opinion of D'Aveni and feel that unless we take the dynamic perspective we will miss the interactions between environment, business and IS strategies.

### Dynamic Capabilities

The dynamic capabilities perspective refers to the ability of an organization to achieve new forms of competitive advantage by renewing its competencies in order to achieve congruence with the changing business environment (Eisenhardt and Martin, 2000; Teece et al., 1997). This capability is dynamic because organizations must continuously build, adapt and reconfigure both the internal and external competencies to achieve congruence with the changing business environment when time-to-market and product timing are critical, the rate of technological change is rapid, and the nature of future competition and markets are difficult to determine (Teece et. al. 1997). Specifically, dynamic capabilities can be defined as:

*[organizational] processes that use resources – specifically the processes to integrate, reconfigure, gain, and release resources – to match and even create market change* (Eisenhardt and Martin 2000 p. 1107).

From the existing literature (e.g. Eisenhardt and Martin, 2000) one gets an understanding that dynamic capabilities are behaviors that are largely repetitive and typically involve long term commitments to specialized resources. Zahra and George (2002) state that there is some creative tension in the argument that dynamic capabilities, per se, would not allow firms to sustain a competitive advantage (Eisenhardt and Martin, 2000). The assumption is that path dependency in the adoption of strategies and technologies that allow firms to differentiate themselves and deliver customer value in the short run can be imitated and substituted in the long run, thereby eroding the firm's ability to sustain supra-normal profits from such IT-related strategies.  However, other researchers believe that the ability to foresee technological change and adopt the appropriate strategies may, in fact, create a trajectory of growth that would create and sustain a competitive advantage (Cockburn and Henderson, 2000). Hence, both the timing and cost of the change-oriented strategy would influence a firm's ability to create and sustain a competitive advantage.

Sabherwal et al (2001) present a very interesting perspective to the dynamic alignment argument by using the punctuated equilibrium model. In their study they argue that companies go through periods of gradual evolutions, which are "punctuated" by sudden revolutionary periods of rapid changes (Van de Ven and Poole, 1995). The punctuated equilibrium model unlike the contingency theory, which implicitly assumes stability, recognizes that long periods of relative stability are divided by short bursts of considerable instability. Sabherwal et al (2001) state that "IS Management profile", which reflects the organization's basic choices in terms of strategy and structural arrangements in business and IS domain is a "deep structure". From the punctuated equilibrium model perspective the "deep structure" undergoes very little change for a long period of time separated by short period of revolutionary change. This means that under evolutionary changes, any alignment conflict can be resolved through the reinterpretation of the contingency factor (meaning resolution of alignment conflict without redesign). If the changes are revolutionary in nature, contingency factors are significantly changed and in order to resolve alignment conflict, the organization has to redesign its "deep structure" (IS management profile). If one takes a closer look at the case analyses presented by Sabherwal et. al (2001) we see some contradiction between the evolutionary and the revolutionary stages that they described in their case studies 1 and 3  and the strategic alignment literature discussed earlier (for details see Sabherwal et. al, 2001 p.186 and p.191). Gist of cases is explained briefly below.

### Case 1: Equipment sales company – Lease (Sabherwal et. al, 2001 p.186)

The researchers analyzed a ten year period and divided it into three segments of evolutionary changes separated by two periods of revolutionary changes. What is interesting is that in this ten year period, first there was an approximate four-year period of evolutionary changes followed by a one-year period of revolutionary change which was then followed by another three-year period of what they considered evolutionary change and finally two-year of revolutionary changes. If we follow the description of punctuated equilibrium model put forth by Sabherwal et. al (2001), we can infer that there are two periods of redesign in this ten year period i.e. changes to "deep structure."

From the above strategic alignment literature discussion we argue that in order for this company to improve its performance it had to align its business and IS strategy. Changing IS strategy to align it with the business strategy is not an easy task as it would take considerable amount of capital to make this change and doing it twice is a ten year period makes things even harder.

### Case 3: Energy (Sabherwal et. al 2001 p.191)

In the approximate seven-year period that the researchers analyzed, they divided it into two segments of evolutionary changes separated by a two year period of revolutionary change. In the short seven-year period it seems from the description that the company first followed the Defender strategy, then a Prospector/Analyzer strategy and finally an Analyzer strategy.

From the discussions on strategic alignment, dynamic capabilities and punctuated equilibrium model we can conclude that aligning IS and business strategy in a dynamic environment is extremely hard and costly affair. At the same time it is important to that these strategies are aligned in order to be an innovative and agile organization (Goldman, Nagel and Preiss, 1995). This seemingly paradox of a situation can potentially be resolved by the emerging technologies, namely Web Services. The concept of web services which stresses on interoperability makes it relatively easier to align the IS strategy with the business strategy than in the past. How this can be done is explained later in this paper.

**Web Services and Alignment**

From the above literature review we get an understanding that companies need to align its IS and business strategies in order to achieve superior business performance. Through the dynamic perspective we get an impression that every few years an organization's business and/or IS strategy changes because of the interaction between environment, business and IS strategies. Hence, we can conclude that these interactions prevent an organization from having cookie cutter approach. When the environment changes it forces the company to reconfigure its business strategy to adapt to the environment in order to survive and thrive. This reconfiguration of the business strategy causes a mismatch with the existing IS strategy in place. Hence companies are forced to change their IS strategy to align it with their business strategy in order to achieve superior business performance. This is easier said than done because the IS infrastructure is rigid and mechanistic in nature. When a company makes a change to its IS strategy by updating an exiting application(s) or purchasing new application(s) it has to integrate the new/modified application(s) with the existing IS infrastructure. Application integration is extremely hard and costly to achieve (Linthicum, 1999). The difficulty is due to the lack of interoperability between different systems. In order to achieve interoperability between different applications one has to use adapter, which helps in converting data from one form to another enabling different systems to communicate. The problem of interoperability occurs because most of the applications are proprietary and have different standards; for example a SAP application will have difficulty in communicating with the Oracle application unless an adapter is in place for converting one data form to another. This example was just between two applications, imagine an organization having multiple of different applications. There are bound to be integration problems if a company is trying to change its IS strategy, mainly due to the lack of interoperability among the different applications. The spaghetti of different systems makes the IS infrastructure very rigid and therefore very hard, costly and time consuming to make the required change in the IS strategy (Linthicum, 1999).

When the environment change forces the business strategy to change, an organization wishing to change its IS strategy to align it with its business strategy cannot respond quickly as it is time consuming and a hard process to change a rigid infrastructure (Linthicum, 1999). It may very well be that by the time a company fully makes the change in its IS strategy to align with the existing business strategy the environment might have changed yet again forcing the business strategy to change. In this dynamic environment where there are constant interactions between environment, business and IS strategies, the IS infrastructure rigidities make it hard for the business strategy and IS strategy to be aligned successfully all the time. If one takes a static view to this it is possible to achieve the perfect alignment but from a dynamic perspective we get to fully understand the difficulty in maintaining the alignment between IS and business strategies. Therefore we conclude that the rigid infrastructure creates a mismatch between the IS and business strategies and thereby lead to lower performance.

The above scenario was offered when the business strategy changes force the IS strategy to change but the change can very well be the other way round i.e. a revolutionary technology causes a change in the business strategy. Another important point to remember is that the example above was just for single organization but when you have multiple organizations put together (suppliers, buyers etc.) the problem of disparate system becomes compounded and even more difficult to implement.

Therefore researchers like Weill et al. (2002) have highlighted the importance of having a flexible and agile IS infrastructure. A flexible and agile IS infrastructure can be defined as one which is interoperable and has open standards; this is precisely what web services offers. Kreger (2001) states that web services reduce cost and help in deploying solutions faster. Web services through their open standards and interoperability allow different applications to communicate back and forth without the many problems encountered previously. Also with the flexibility offered by the web services companies can now align their IS strategy with business strategy more quickly than they could have done in the past because by using web services they are considerably reducing not only the amount of time but also the cost of trying to integrate the disparate applications existing in organizations today.

Without using web services companies could theoretically also attain the alignment between business and IS strategy if they had endless resources and did not have to worry about performance impact from investing endlessly into IS in order to gain advantage over their competitors.  But as we all know the purpose of organization is to make profits, and it is hard to make profits if your costs are too high. We briefly look into the IS literature of cost-benefit analysis and resource based view to understand how web services can improve firms performance.

**Cost – Benefit and Resource-Based Analysis**

To keep up with the changing business environment, companies usually invest in new IT infrastructure. In the previous section we have described how this creates infrastructural rigidities resulting in a spaghetti of different systems, which are often mechanistic in nature compounding the problem further. This also goes against the concept of dynamic environment in

which firms are required to have a more flexible and agile IT architecture to respond to the dynamic environment (Cook, 1996).  This cyclic nature of events creates a "survival paradox" for the firm; on the one hand they need to invest in IS infrastructure to remain competitive, while on the other these investment rarely seems to payoff (for details please refer to Robert Solow's "productivity paradox", 1998).

One way of avoiding this would be to perpetually invest in new technology (or applications) – in reality companies just cannot keep up with the changing environment because the cost associated with developing new IS applications is just too high and therefore firms tend to stay away from investing endlessly without full benefits in return. This is bound to create mismatches between the IS strategy and the business strategy.

Companies also face the problem of imitation i.e. companies find it extremely difficult to maintain competitive advantage for a long time on the basis of IS application. For example, a company develops a "cutting edge" application with the intent of utilizing it for competitive advantage; it is able to do so for a limited time until others imitate it. The imitation erodes the competitive value offered by the application and hence the benefits anticipated by the company in developing this "cutting edge" application remain unrealized. Few resource based studies have paid attention to the conditions necessary and sufficient for competitive advantage of the temporary kind. An exception to this is Barney (1991, 1996). From his pioneering efforts, it is now widely accepted that two conditions regarding a firm's resources are necessary and sufficient for competitive advantage: they must be both valuable and rare (Barney, 1991, 1996). Barney asserted that valuable and rare resources 'will be sources of at least temporary competitive advantage' as long as the number of firms possessing them 'is less than the number of firms needed to generate perfect competition dynamics in an industry' (Barney, 1996: 149).

Recently researchers have argued that capabilities should be defined not in terms of resources but in terms of functions that they serve (Peteraf and Bergen, 2003).  They argue that scarcity is necessary for competitive advantage, but it is not scarcity of resource type that really matters. It is scarcity in terms of resource functionality or utility. By functionally or utility scarcity we infer Peteraf and Bergen (2003) to imply that the application offers an organization a unique way of doing something, which had not been done previously. For example, Microsoft authentication system or the Amazon's one click shopping were unique functionality when they were developed. The underlying technology used to develop these applications did not matter.

Under the traditional resource based view, technology would have been considered as a resource if a company had one type of technology (Ex: Oracle9*i*) and another company had a different type of technology (Ex: SQL Sever 2000) they would be considered unique and hence according to the definition of resource based theorist offered competitive advantage to both these two companies. But Peteraf and Bergen (2003) argue that this is not the case because if company A used technology A to make an application "star" and company B used technology B to build the same application "star" (at least functionally similar). This illustrates that technology did not matter because the same functionality (application) could be built using either of the technology. According to Peteraf and Bergen (2003) it is the uniqueness of the functionality that would offer a company competitive advantage, in our case it would be the uniqueness of business application. Taking this view we will look at how web services will enable companies to develop competitive advantage mainly through a series of limited time competitive advantage.

## WEB SERVICES LIFE CYCLE STAGES

We state that companies can achieve competitive advantage by adopting web services. The reasons are as follows: Firms develop applications by scanning the environment and aligning it to suit their business processes. They make huge investments to build this application perhaps with the aim of creating competitive advantage by using it, but others generally imitate these applications and thus any competitive advantage the company enjoyed is eroded before firms can fully enjoy the benefits of the cost incurred in developing the application.

In our opinion a company could enjoy a period of limited time competitive advantage by using an application internally for some time and before the application turns into a commodity the company can expose this application externally by using web services for others to use. Not only has this company enjoyed a period of competitive advantage but it could also generate revenues through subscription by exposing this application. We now briefly describe the stages a company could go through in developing a series of limited time competitive advantage by using web services.

### The Exploration Stage

In this stage a company would explore its environment, identify opportunities and undertake feasibility studies to build an application that could give them competitive advantage. Based on the resource-based theory this application should be heterogeneously distributed for the company to attain some kind of competitive advantage i.e. the functionality this application offers should be unique.

### The Exploitation Stage

During this stage the company that owns this application can attain competitive advantage by using this application internally. This period can last until some other firm can duplicate the application (i.e. functionality duplication).

### The Maturity Stage

During this stage the application is getting commoditized. This means that at this point the company does not enjoy any competitive advantage by using the application.
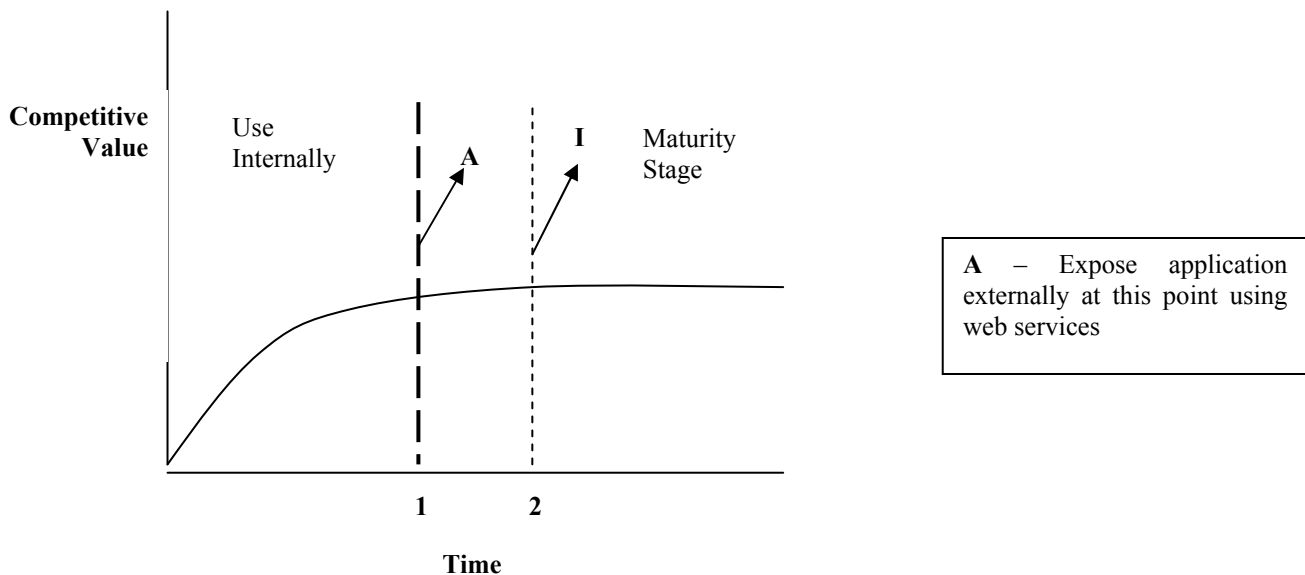


**Figure 2: Lifecycle**

From Figure 2, we see that theoretically firms can build an application and use it internally until point A, at which point the company can choose to expose the application externally by using web services. Point A lies before the maturity stage point I at which the application is in danger of getting commoditized. By exposing the application at a point before the maturity stage (point I), the company can gain not only by possibly attaining first mover advantage but by also preempting others (mainly its competitors) from developing a similar application by expending a large amount of capital. The company that develops an application stands to gain on two grounds. Firstly they can attain temporary competitive advantage by using the system internally for some time and secondly generating revenues by exposing the application through web services before others can duplicate (i.e. they can expose the application through web services for others to use on a subscription fee basis). Thereby firms are not only able to get some competitive advantage out of the application that they built, but are also able to generate revenues through it. They could then go ahead and build the next application after scanning the environment, which ensures that they are always ahead of the curve and also aligned with the environment. Companies that develop web services applications could also benefit from the whole learning experience and this could assist them not only in developing a new web services applications but also in sustaining competitive advantage. The competitive advantage is achieved by doing it first and doing it frequently (D'Aveni, 1994).

The choice of point A depends on the application; if it is a complex application it might take competitors some time to imitate while if it is a relatively simpler application than it would take lesser time. The company that builds the application should have a fair idea from its experience as to how long will it take an imitator to build an application that has similar functionality. Based on this the company should decide on point A. It is important that the point A is before the time taken to

imitate the product. If point I is the point where an imitator brings out an application with similar application the point A should be before such a stage. For example if an imitator can make a similar application by Time 2, the company that owns the "unique" application should expose it at Time 1, where Time 1 < Time 2. Therefore in our opinion the point A varies, it could be a short period on 3 months or a relatively longer period of 1 year. The main purpose of exposing the application at point A is to erode the competitive advantage of the existing application with the intention of preventing a competitor cannot attain any advantage by using similar application.

D'Aveni (1994) states that

*Instead of long-range plans an enduring competitive advantages, a succession of small, often easily duplicated strategic attacks are more typically used in a rapidly changing hypercompetitive environments. By stringing together a series of these short-term advantages, the firm can effectively create a long-term sustainable advantage in the marketplace. (pp. 11)*

By using web services companies can achieve something similar i.e. a series of limited time competitive advantage. Also the concept of web service also makes it financially feasible to pursue this type of strategy. This was not possible in the past due to the high cost of developing an application and lack of supporting technology (web services). But by using web services the companies can off-set the high cost of developing the application through revenues generated by exposing the application externally.

## PROPOSITIONS

From the above discussions of strategic alignment, dynamic capabilities, cost-benefit and resource-based analysis and description of web services life cycle stages we propose the following:

**Proposition 1**: Firms that <u>utilize</u> web services applications have more flexibility in aligning the IS and business strategy than those that do not utilize web services applications.

**Proposition 2**: Firms that <u>utilize</u> web services applications are in a better financial position to align IS and business strategy than those that do not utilize web services applications.

**Proposition 3**: Firms that <u>develop</u> web services applications are in a better position to not only attain but also sustain competitive advantage (i.e. through a series of limited time competitive advantage).

Miles and Snow (1978) identified three viable business strategies: Defenders, Prospectors, and Analyzers.

The Defender is the most stable of the three business strategies. It seeks to seal off a stable and predictable but narrow niche in its industry by offering superior products or services at low prices. The companies pursuing this type of business strategy stress on operational efficiency and economies of scale and have a mechanistic organization structure. They also have greater fixed-asset intensity than the other strategic types, with investments in highly cost efficient but few core technologies. An important feature of companies pursing the defender strategy is that they do not tend to search outside their domain for new opportunities, and rarely make major adjustments in their structure or technology.

The Prospector continuously seeks new product/market opportunities, and is the creator of change in its market. Companies following prospector strategy emphasize on and tend to invest heavily in product R&D and environmental scanning. To function in a broad and dynamic domain, they seek flexibility in technology which is reflected by their low fixed-asset intensity and an organic organization structure.

The Analyzer shares some characteristics with each of the other two strategies. Combining the strengths of the other two types, it seeks to simultaneously minimize risk while maximizing opportunities for growth. Companies following analyzer strategy maintain a stable domain of core products, while seeking new product and/or market opportunities. They usually do not initiate new products but often follow the Prospector by very quickly introducing similar products. They do not avoid change like the Defenders nor do they initiate change like the Prospectors. To address conflicting demands of efficiency and innovation, they use a matrix organization structure, and a dual technological core, with stable and flexible components. Based on the description of these three business strategies we propose the following:

**Proposition 4:** Companies that follow the prospector strategy are innovative and therefore are usually the first to *develop* a specific web services application

**Proposition 5**: Companies that follow the analyzer strategy are usually among the first few to *adopt* a new web services application.

**Proposition 6**: Companies that follow the defender strategy tend to utilize the same web services application for a longer period of time
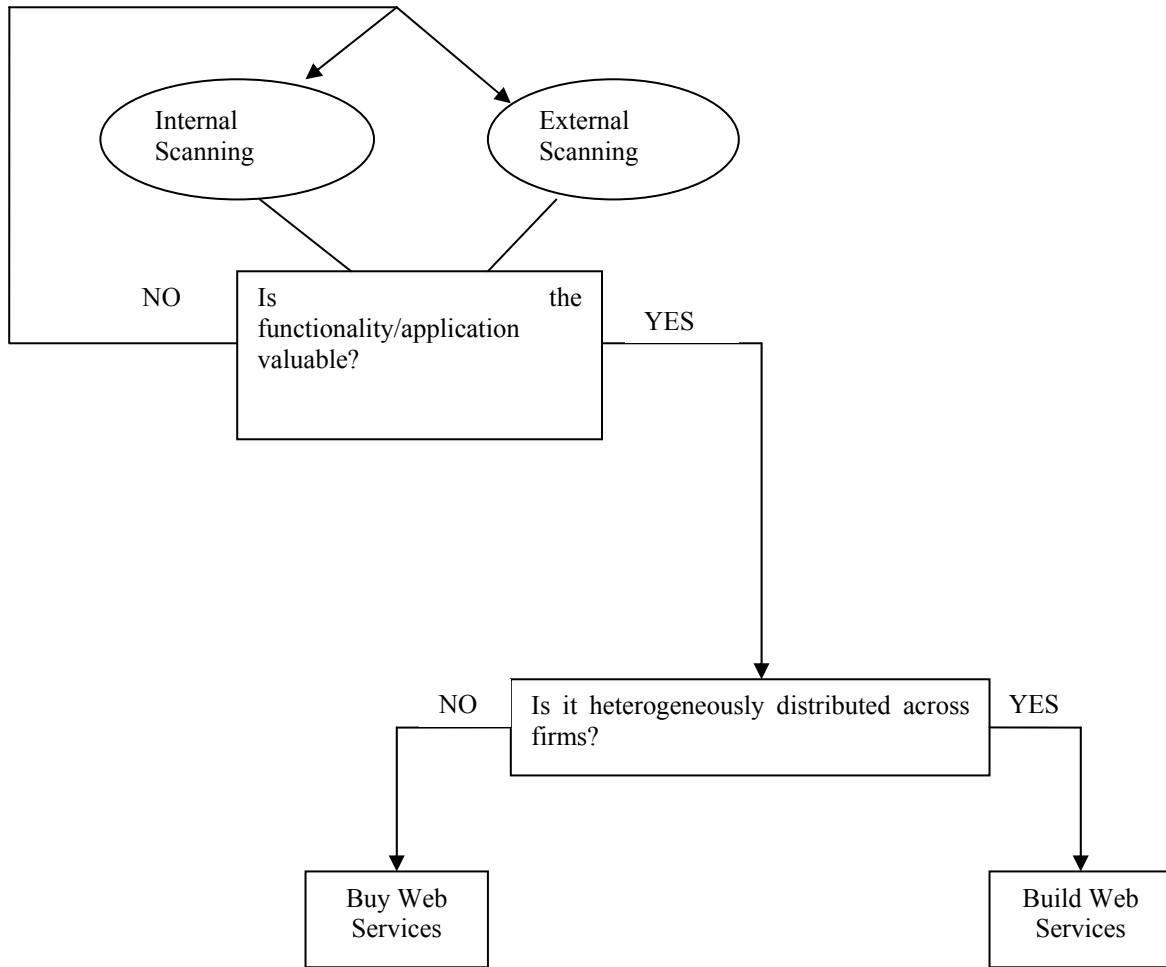


**Figure 3: Buy-Build Decision Tree**

## DISCUSSION

This preliminary study seeks to provide a foundational framework to understand the benefits of web services. We argue that both the buyer and the seller of web services benefit by using it. The companies that develop the application can not only retain competitive advantage for a limited time, but also generate revenues by exposing the application externally through web services. On the other hand, the companies which purchase web services from others also stand to benefit by not only

being able to use an application at an affordable price but also by avoiding the uncertainties and complexities involved in developing an application. From Figure 3 we briefly outline the steps that firms should undertake when considering developing or buying web services.

The firms that develop an application are the ones that are probably high scanners and by developing and using the application mainly internally would have gained sufficient learning from the process and can build on this capability that they acquired to sustain perpetual temporary competitive advantage until a disruptive force occurs. Hence we feel that web services offer firms an opportunity to achieve a series of limited time competitive advantage. Those companies that do it first and do it frequently stand to gain by using web services. To strengthen our understanding of the benefits offered by web services we have analyzed it from the viewpoint of the three viable business strategies: Defenders, Prospectors, and Analyzers (Miles and Snow, 1978) and are of the opinion that companies that follow prospectors strategy will benefit the most by utilizing web services.

This study can further benefit by looking into the literature of organizational learning, transaction cost economics and more deeply into the dynamic capability literature. Only then can we better understand the competitive advantages offered by web services. Future researchers should undertake both the positivist and interpretive approach to gain insights on the practicality of using web services and in identifying application characteristics that have good potential for web services.

A limitation of this study is that the concept of web services is still emerging and is yet to be fully developed but the good thing is that all the big IT players (e.g. Microsoft, Sun, IBM) are behind the concept of web services and are working together to develop standards and things do look bright for the future of web services. Managers wishing to employ web services should take a cautious approach and have full understanding of its capabilities and their own organizational capabilities before undertaking a massive approach. A good way to go about would be to employ web services for some internal non-critical applications for sometime, before moving on to internal critical applications. Finally, if everything works out well they could use it for external use among their business partners and suppliers before proceeding on exposing it externally. In summary web services might not be a good option for all organizations, its usefulness will depend on the organization context.

The implications of this study are that the interoperable nature of web services can help companies to achieve a series of limited time competitive advantage, achieve higher degree of alignment between their IS and business strategies and also generate revenues through the exposing the application externally on subscription basis. This study also highlights that by using web services innovators stand to gain more in the future than they had in the past because not only can they achieve some temporary advantage by using the application internally but they can also generate revenues by exposing the application externally, which will help in achieving ROI faster.

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