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ABSTRACT
In this study we extend the resource-based view of the firm to include inter-organizational complementary resources. We use web services as an example of a technology that extends firm resources beyond organizational boundaries. The modular design of web services enables the integration of monolithic applications within and across enterprises, creating the vision of an extended enterprise that is more adaptable and responsive to market changes. As the technology continues to mature, web services will create a dynamic capability that will sustain organizational competitive advantage.

Keywords  
Web Services, Resource Based View, Dynamic Capabilities, Extended Enterprises.

INTRODUCTION
The Resource Based View of the firm is a conceptualization of organizational resource configuration as a source of sustained competitive advantage (Mata and Fuerst 1995; Bharadwaj 2000; Wade and Hulland 2004). Because resources can be combined in many different ways, a firm implementing a strategy with a resource configuration that cannot be imitable or easily recognized by competing firms will have a sustained competitive advantage (Barney 1991). One aspect, however, that the theory does not consider is the possible integration of complementary resources owned by other firms. The limited view that the Resource Based Theory holds of resources may constrain organizations from truly sustaining competitive advantage in a changing market, as it deprives firms from a wellspring of external resources that organizations can incorporate to generate value. Extending resources to include external assets and services provide organizations with a wider range of resources from which they can generate an even larger number of complex configurations that are difficult to imitate, transfer or substitute. In this paper, we use web services as an example of a technology that enables companies to incorporate the IT assets and services of external organizations, creating a virtual extended enterprise that can better adapt and respond to market opportunities or threats.

Web Services, a set of standards that are positioned as the magic potion for IT infrastructure integration, represent a new IT application development paradigm. Actively supported by major IT players like IBM, Microsoft, and Sun Microsystems, the model is expected to gain legitimacy in the near future. Based on XML, the different elements of the technology allow the integration of heterogeneous applications within and across organizations. With web services technology, business processes can span across departments, divisions and enterprise boundaries, allowing firms to integrate the services of multiple applications without worrying about their underlying technologies and implementation characteristics. A Vacation Planner is one example of an extended enterprise application that became popular in the tourism industry. It enables vacationers to seamlessly utilize the services of several business partners on just one site. Among the services offered are the ability to check the interior of a hotel through WebCam, convert currencies, check the weather outside, check flight schedule of different airliners. A key enabler of such an application is the clear separation between the description and the implementation of software applications. The modular design of web services allows IT assets to be consumed by any application.
How does the Technology Work?

A key enabler of the web service model is the XML technology. XML allows all types of information to be exchanged among disparate applications, irrespective of any proprietary standards that may be embedded within any service. Software components are able to interchange data within the extended applications through XML documents. The extended application does not contain the software code that makes up a web service. It only contains calls to web services using XML documents as a means of conveying input parameters and receiving output. The remote calling of services is done using a protocol known as SOAP (Simple Object Access Protocol). It is SOAP that also transfers the XML documents between applications. Web services employ HTTP as the transport mechanisms for floating SOAP messages.

In this paper we pose web services as a technology that allows firms to extend resources beyond their own boundaries and integrate the complementary services of other organizations. The technology does not put any restrictions on the implementation of services leaving it open for organizations to choose the services that best serve their needs and add value to their resources. Given the adaptability of web services, we expect the technology to build organizational dynamic capabilities that create and reconfigure organizational competencies to sustain competitive advantage (Henderson and Cockburn 1994; Teece, Pisano et al. 1997). The technology will allow companies to “renew competencies ...[by] appropriately adapting, integrating and reconfiguring internal and external organizational skills, resources, and functional competencies, to match the requirements of a changing environment.” (Teece, Pisano et al. 1997). The technology will also allow firms to be more adaptable and responsive to changing market conditions through the easy incorporation of value-added services or exclusion of low value services.

The ability of web services to sustain competitive advantage for the organization will largely depend on the value created by the selected services and the strength of the relationships organizations maintain with web service providers. The organizational structure must also be highly decentralized to allow for the rapid and uncomplicated mobilization of external services with the right internal resources. We thus hypothesize that extended resources will help create sustained competitive advantage if they are complementary to a firm’s own resources, the firm maintains close relationship with the provider, and the firm’s structure is highly decentralized to allow for the adaptable integration of external services.

The following section describes our theoretical model and lists our hypotheses.

THEORETICAL MODEL AND HYPOTHESES

In this paper, we pose mechanisms for integrating complementary external resources with a firm’s valuable resources as a source of sustained competitive advantage. Web services, a new software development paradigm, are an example. The technology is likely to sustain competitive advantage as it facilitates the integration of external IT services that are complementary to the firm’s own valuable IT resources. Web services allow organizations to link monolithic applications within and across enterprises. If exploited, the flexibility of the web services model can make organizational IT infrastructure more adaptable to changing market conditions. Organizations would have the ability to add or drop services of other business partners without worrying about the implementation details. For web services to deliver such a promise, management must adapt the organizational structure to allow for easy integration of external and internal resources. Careful consideration must be given to the identification of business partners and the recognition of complementary services. Once partners and services are identified, the relationship with these business partners must be carefully managed. An illustration of the research model appears in Figure 1.

Sustained Competitive Advantage

The Resource-Based View of the firm contends that a firm’s nexus of resources and capabilities can be a potent source of sustained competitive advantage if the combination of these resources is heterogeneous (firm-specific) and immobile (not imitable) (Barney 1991). A firm’s resources “are assets and capabilities that are available and useful in detecting and responding to market opportunities or threats….Assets are defined as anything tangible or intangible while capabilities are repeatable patterns of actions in the use of assets to create, produce, and/or offer products to market… Capabilities transform inputs into outputs of greater worth,” (Wade and Hulland 2004, pg. 109).

Several IS researchers have argued that IT, combined with other firm’s resources, create sustained competitive advantage (Bharadwaj 2000; Wade and Hulland 2004). Wade and Hulland (2004) created a typology of IS resources and capabilities that includes: inside-out, outside in, and spanning. Inside-out capabilities have an internal focus in response to an external market requirement. Inside-out capabilities leverage internal IT skills, technology, and infrastructure to cost effectively handle required back-office business processes, such as inventory management. Outside-in capabilities are externally focused on the market and emphasize capabilities to support the management of customer relationships, the collection of
competitive intelligence, and predicting and responding to changes in the market. Spanning capabilities, such as web enabled customer order tracking and supply chain management, are integrative capabilities that involve the integration of both internal and external IT resources. In this paper, we focus on these spanning capabilities that enable a firm to integrate external IT resources and capabilities and combine them with the firm’s own IT resources.

![Figure 1: Extended Enterprises and Sustained Competitive Advantage](image)

**Extended Enterprise Applications**

"Extended enterprise" views organizational resources beyond the internal tangible and intangible assets and capabilities and includes complementary resources of an organization’s business partners, its suppliers, and even its customers. The success of an extended enterprise depends on the willingness of all members to cooperate. Web technologies have played a vital role in driving the existence of extended enterprises through the development of extended applications, software systems that span company boundaries to incorporate partners, customers, suppliers, and markets. The extended enterprise application creates an intricate, interconnected network of applications to provide a complete solution to high-level business processes. Users of the extended application, however, are shielded from the complexity of the application and are not even aware of the boundaries of one service to the next.

Web services are a new software development model that allows organizations to seamlessly integrate third party specialized and customized “niche” applications of different business logic and with different implementation details. A service represents a software component that is modular, self contained and self describing. Users can remotely invoke these services over the web. The interoperability of the services allows them to be incorporated within any other application on any platform. While services can be automatically discovered over the web through the Universal Description, Discovery and Integration (UDDI), an industry initiative to create a platform-independent, open framework for describing services, discovering businesses, and integrating business services, in this paper we focus on extended applications that constitute the complementary services of collaborating business partners.

The ability to incorporate complementary value-added services of other firms allows companies to focus on their core activities and competencies, saving them the time and cost of in house development. The provider of a service supplies all computing resources required for consuming the service, which include servers, storage systems, networking components and internet connectivity. The provider, also, fully maintains the service, conducting all updates, testing and certification. In addition, the interoperability capability of web services allows firms to dynamically restructure extended applications through the “pick and choose”, and “plug and play” functionality (Dan et al. 2004).

The above arguments related to the benefits in adding specialized software functionality and adapting extended enterprise applications associated with web services lead to the first research hypothesis:

**Hypothesis 1:** The greater the scope of an enterprise application the higher the degree of sustained competitive advantage.
Resource Complementarity

The true value of the extended enterprise applications will depend on the degree of complementarity that exists among the software components that make up the extended application. Two services are complements “if the marginal benefit of each activity increases in the level of the other activity.” (Siggelkow 2002, pg. 901). For example, internet retailers can add services for the sale of other retailers’ complementary products if the additional products would increase the appeal and sales of its own product lines. The well-coordinated matching between services will yield a competitive advantage that none of the members can realize on their own (Jap 1999).

A major challenge for management of the extended enterprise will be in choosing between services and deciding on the right mix of activities to sustain competitive advantage. Understanding the type and strength of interactions between services will be critical. Given that the impact of decision maker’s misperceptions regarding complements is more costly than misperceptions regarding substitutes (Siggelkow 2002), managers should spend resources mitigating the effect of the services to be included within the extended application.

The above argument leads to the second research hypothesis:

**Hypothesis 2:** The higher the complementarity of services within the extended enterprise application the greater the ability of the extended enterprise application to sustain competitive advantage.

Organizational Design

For the extended enterprise to be dynamically capable of reconfiguring its competencies to sustain competitive advantage, it should be structured in a way that allow each business partner to choose and find the best approach to maximize value of its service, while at the same time, allow a central organization to integrate the efforts and monitor the performance of all partners and ensure that changes initiated by one partner does not diminish the value other partners attain from the extended application. Strict centralization leads to a lack of diversity in thought and results in a tendency for the extended enterprise to stay close to their local solutions and not search out the best possible alternative. A combinatory structure of decentralization with reintegration yields the highest long-term performance. Temporary decentralization followed by reintegration have been proven to work best under all conditions including conditions with heavy cross interdependencies between divisions and conditions with little to no interdependencies (Siggelkow and Levinthal 2003). Such a structure would emphasize innovation, evolution and adaptability (Henderson and Clark 1990; Galunic and Eisenhardt 2001)

The above argument leads to the third research hypothesis:

**Hypothesis 3:** The decentralization of services along with the reintegration by a central organization, the greater the ability of the extended enterprise application to sustain competitive advantage.

Relationship Management

The ability of an extended application to sustain competitive advantage will depend to a large degree on how relationships are managed between partners of the extended enterprise. A key success factor will be the development of trust among partners (Jap and Anderson 2003); trust that each partner will provide reliable services that will create value for the extended enterprise. To safeguard against opportunism, users and providers of services must define a service contract that details the level of service (specifying the performance objectives such as response time and throughputs), service guarantees and the appropriate actions to be taken if a noncompliance is detected (Dan et al. 2004).

Creating Incentives would be another governance structure to preserve partners’ outcomes and interests against opportunistic behavior by other parties (Jap and Anderson 2003). Incentives will help coordinate and motive partners activities to create value for the extended enterprise. Incentives would be initiated be the leader to promote the adaptability of the extended application. Given the continuous change that the IT industry juggles with, incentives would be required to drive partners to evolve their services to create value for the extended enterprise.

The above arguments lead to the fourth research hypothesis:

**Hypothesis 4:** Relationship management (contracting provision and incentives) will positively moderate the relationship between extended enterprise applications and sustained competitive advantage.
CONCLUSION

In this study, we have extended the Resource Based View of the firm to include complementary resources of other firms. We argued that the ability of organizations to identify complementary resources and to match them with internal assets and capabilities will sustain competitive advantage. We explored web services as a technology that extends the IT resources of an organization to include the software functionality of other business partners creating an extended enterprise application. We identify resource complementarity and organizational structure as two factors that will affect the ability of the extended application to sustain competitive advantage. Once developed, managing the relationship between business partners will be critical for the success of the extended enterprise.

REFERENCES