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DYNAMIC OUTSOURCING WITH WEB SERVICES: A MULTI-FACETED PERSPECTIVE

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Abstract

In a fully dynamic web services implementation, business processes are supported by allocating the underlying information processing tasks to many inter-operating service modules, each of which would be procured over the Internet from an on-line market for web services. In this research we propose to investigate the web services adoption phenomena from three different perspectives viz. business process outsourcing, innovation adoption, and web-based commerce. We use the 'technology-push and need-pull' framework and integrate it with dynamic outsourcing and web-based commerce factors to get the richer and deeper insight into the WS adoption phenomenon.

Keywords: Technology adoption, Technology-push, Need-pull, Business process outsourcing

Introduction and Motivation

Outsourcing of IT activities and services has become increasingly common over the past decade, and in recent years the domain of outsourced activities has extended to IT-enabled business processes and services (Gurbaxani et al. 2002). Web services (Hereafter referred to as WS) take this concept one step further. WS, an emerging technology driven by the determination to securely expose business logic beyond the firewall, lets organizations encapsulate existing business processes, publish them as services, search for and subscribe to other services, and exchange information throughout and beyond the enterprise (Kaye 2003). In a fully dynamic WS implementation, business processes are supported by allocating the underlying information processing tasks to many inter-operating service modules, each of which would be procured over the Internet from an on-line market for WS¹. Hagel and Brown (2001) suggest migrating to WS is not only a matter of adopting a new technology, but also requires broad organizational and managerial changes as well as the development of new kinds of capabilities. Since adoption of WS represents a major departure from the traditional way of executing business processes, it has major ramifications on the IT infrastructure with long-lasting effects.

Research question pursued in this study is: "What are the factors that influence adoption of web services-based application in organizations and in what ways are these factors differ from the adoption of other web-based applications?" The umbrella objective of this research is to understand and empirically investigate the factors influencing the WS adoption decision. To achieve the same, we explore this phenomenon from different viewpoints viz. business process outsourcing, innovation adoption, and web-based commerce to get a richer insight into it. *First*, popular business press and major proponents of WS have been promoting the use of WS for outsourcing business processes without many of the traditional outsourcing hassles. This has been apparent in the efforts made by these proponents in bringing this vision to reality, for example WSFL, XLANG, and BPEL4WS (Andrews et al. 2003). Since the service providers can now be subscribed/ unsubscribed to as and when needed, WS introduce innovative model of web-based on-demand business processes outsourcing (Leymann et al. 2002), making WS markedly different from traditional outsourcing. *Second*, Hitt et al. (1998) suggest that many firms use innovations in IT as a competitive weapon since use of new technology can contribute to strategic flexibility and increased

¹ For example, suppliers can purchase process functionality in the form of a web service (not a software application) that could authenticate requests from manufacturers to examine their inventory and shipping records. Instead of buying software and its requisite platforms, each party would simply contract for process functionality and data services (Mooney et al. 2002).

speed of action. As per Swanson's typology² (1994), Type III innovation of such kind (for example, WS in this case) is more likely when IS has strategic importance to the firm. This further demands in-depth investigation of the phenomenon from perspective of the innovation adoption of e-services. *Finally*, since WS are realized in the open hostile environment of the Internet with unfamiliar providers, examination of issues related to web-based commerce is essential.

Related Work

In this section we provide brief background on each of abovementioned areas and draw upon that literature to address the research question³.

Outsourcing

Prior research on the IS/IT outsourcing has focused on issues such as i) factors influencing outsourcing decision (Benamati et al. 2002) ii) factors affecting success of outsourcing relationships (Lee 2001) iii) factors affecting/issues concerning global, offshore/near-shore outsourcing (Alan et al. 1996) iv) identification/impact of basic risks and risk mitigation of outsourcing (Willcocks et al. 1999), and v) impact of outsourcing on various organizational factors (Martinsons et al. 2001). Most of the prior research assumes traditional outsourcing relationship with the known, trusted service provider where Service Level Agreements (SLA) is negotiated beforehand and typically require long-term commitments.

With recent advances in communications and networking technology, other forms of outsourcing such as net-sourcing involving web-based application service providers (ASP) are changing the way outsourcing is typically done. There are primarily two interpretations of the term ASP. Kern et al. (2002) define it as outsourcing on a contractual or rental or 'pay-as-you-use' access basis to centrally managed applications made available to multiple users from a shared data center over the Internet or other networks. Yankee Group defines it as the outsourcing of critical infrastructure for web-based e-commerce and other next-generation e-business applications and suggests that a true net-sourcing solution delivers a complete, turnkey infrastructure that accelerates e-business application deployment, minimizes downtime and lowers total cost of ownership (IntiraCorp 2000). We subscribe to the earlier definition as it focuses largely on the concept of process outsourcing rather than actual physical outsourcing of the infrastructure as suggested by the Yankee Group.

WS deliver this concept of net-sourcing, but with an additional twist to provide dynamic outsourcing (Ströbel 2000). Dynamic outsourcing involves a set of provider organizations competing in an electronic market. Whenever a service needs to be performed, the consumer organization dynamically selects the 'best' provider using XML-based technologies. This continues until, for example, either the service is no longer needed or some external factor with impacts on the overall outsourcing strategy changes. The relationship between consumer and provider organization in dynamic outsourcing is characterized by its short-term nature and a very loose coupling (Ströbel 2000). Very few studies have studied net-sourcing related issues (Kern et al. 2002) while to our best knowledge none has addressed such issues for web-based dynamic outsourcing.

Innovation Adoption

When firms opt for WS for implementing their business processes, it has two additional consequences; software-as-service and on-demand web-based production and consumption of such services. With this, we review innovation adoption literature. We also briefly discuss technology acceptance literature as the two are closely related. Legris et al. (2003) in their meta-analysis of empirical research done with TAM conclude that most research investigated the introduction of office automation or systems development tools and urged that future research needs to focus on acceptance/adoption issues for the software used for realizing business processes. As Day and Herbig (1990) suggest consumer adopters differ from organizational adopters in several ways.

Frambach and Schillewaert (2002) discuss various factors affecting innovation adoption at organizational level for example, supplier marketing efforts, social network, environmental influences, adopter characteristics, and perceived innovation

² Swanson defines different types of IS innovation. Type I innovation is defined as process innovation restricted to the functional IS core, other aspects of business are mostly indirectly affected, through gains in IS efficiency. Type II innovation applies IS products and services to the administrative core of the host organization business. Type III integrates IS products and services with core business technology, and typically impacts upon general business administration as well.

³ For the sake of brevity, we cite only those studies that have synthesized and/or reviewed prior literature, given the numerous studies done in these areas.

characteristics. Chau and Tam (2000) review past innovation adoption research and suggest a research model of factors affecting the decision for open-systems adoption using the ‘Technology Push–Need Pull (TP-NP)’ concept stating inadequacy of existing innovation diffusion theories to explain adoption of complex organizational technology. Dembla et al. (2003) address the adoption of web-based transaction processing services, but don’t make any distinction of software-as-service nor do they account for issues we consider in the next sub-section. As Straub et al. (2002) suggest, it is necessary to distinguish between traditional and web-based services. Little research has addressed issues with software-as-service for B2B web-based commerce rather than software-as-product/system.

Web-based Commerce

Web services-based applications make use of internet-based communication platform in order to access the functionality provided by the web services. This implies that when studying the adoption of web services by organizations, it is important to capture the perceptions of the organizations about the web-based communication platform and standards associated with them. Although many studies have investigated influencing factors enabling Enterprise Data Interchange (EDI) adoption (Teo et al. 2003) there is a dearth of research in the area of webEDI. There have been studies that identify differences and similarities between EDI and Internet adoption (Mehrtens et al. 2001). Since WS operate in open and hostile environment of the Internet, security related issues are important. Factors that enable the adoption of B2C web-based commerce should also be applicable to adoption of B2B web-based commerce to a certain extent. Several studies (Straub et al. 2002) have been conducted to identify the possible factors driving adoption of web-based consumer services where consumers either receive a tangible good or access to the functionality provided by a web-portal.

Research Framework

Although there are many innovation adoption models, we employ Chau and Tam’s (2000) TP-NP innovation adoption framework as it considers the nature of technology. We then integrate it with dynamic outsourcing and web-based commerce factors to derive our theoretical framework (See Figure 1) to get a richer insight into the factors that influence WS adoption by organizations. In the next subsection, we briefly detail our hypotheses.

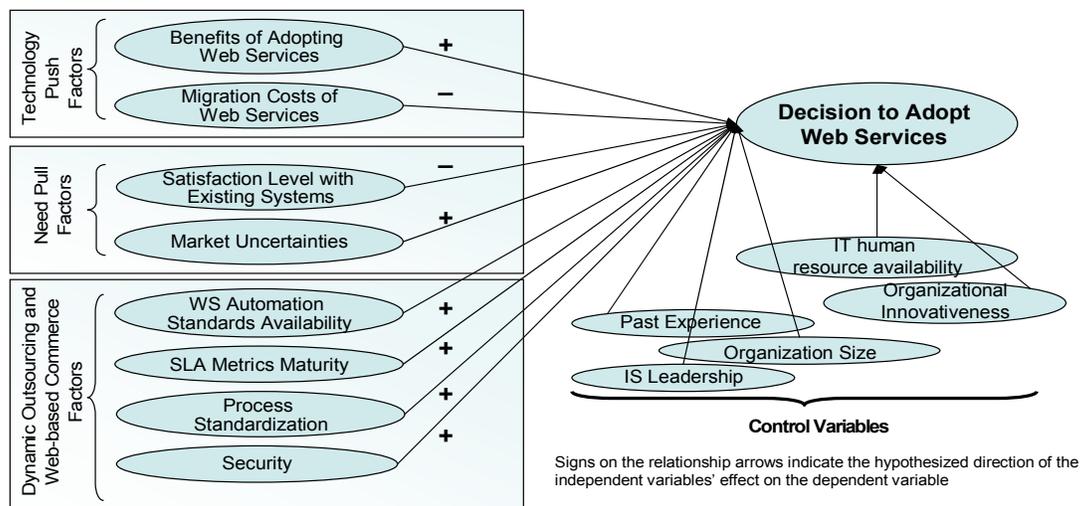


Figure 1: Research Framework

Technology Push Factors

The Technology Push School of thoughts suggests that innovation is driven by science, and thus drives technology and application: scientific discovery triggers the sequence of events which end in diffusion or application of the discovery (Chau

et al. 2000)⁴.

Benefits of adopting WS: This factor represents the benefits of WS with respect to the organization's specific setting (Chau et al. 1997). WS enables disparate applications running on different machines to easily exchange data with one another without requiring additional, proprietary third-party software or hardware. Thus, their implementation is likely to result in decreased integration costs, increased flexibility and improved software reusability (Milroy et al. 2002).

H1a: Greater the benefit of WS to the organization, greater is the likelihood of WS adoption.

Migration costs of WS: Though cost and a reduction in complexity are two of the major benefits of WS, changes to IT architecture may be perceived complex (Tornatzky et al. 1982) based on maturity level of IS department and may incur significant costs if IT personnel needs to be trained (Chau et al. 2000). This will impact the decision to adopt WS.

H1b: Higher the perceived migration cost of WS to the organization, lesser is the likelihood of WS adoption.

Need Pull Factors

The Need Pull proponents argue that user needs are the key drivers of adoption. Zmud (1984) also find that need pull innovations are characterized by higher probabilities for commercial success.

Satisfaction level with existing systems: When organizations perceive performance gap with their existing computing infrastructure in terms of their price/performance ratio or inability to fulfill organization's strategic needs or goals, organizations seek alternative options that possess or promise solutions to their existing systems problem (Chau et al. 2000).

H2a: Lower the satisfaction level with the existing infrastructure of the organization, greater is the likelihood of WS adoption.

Market Uncertainties: Imitation and communication among industry competitors and marketing efforts by the technology vendors have strong influence on the adoption of innovative e-commerce application by organizations (Santos et al. 1998). When organizations are faced with complex and rapidly changing environment, IT innovations are deemed necessary.

H2b: Higher the level of market uncertainties felt by the organization, greater is the likelihood of WS adoption.

Dynamic Outsourcing and Web-based Commerce Factors

The prior work on outsourcing has assumed the stable contracts with the known provider parties. Since the goal of dynamic deployment of WS is to lower the need for human intervention in business processes, importance of enabling standards and technologies is paramount.

Process Standardization: Strobel (2000) suggests that many firms reengineer their existing processes according the reference models, templates and patterns of the application platform chosen to minimize customization efforts, thus standardizing them. He also suggests that outsourcing is typically done where high standardizations are widespread. Having the standardized, well defined processes and task elements already existing, it is likely to reduce organizations effort to implement WS, making it an enticing alternative.

H3a: Higher the level of process standardization within the organization, greater is the likelihood of WS adoption.

WS Automation Standards: This factor relates to the maturity and significance of the standards that enable effective functionality of WS, for example automated run-time discovery of the best possible task provider. Currently these standards do not support semantic discovery of the service providers, which can further result into more precise discovery of service provider as per organizations' defined needs.

H3b: Higher the level of maturity of WS automation standards and technologies, greater is the likelihood of WS adoption.

Service Level Agreement (SLA) Metrics Standards: SLA metrics are at the heart of any outsourcing initiative (Cameron et al. 2002). With full blown WS deployment, the service providers are unknown until the runtime. Thus the significance and maturity of standards enabling such SLA specification and negotiation is crucial for WS adoption.

⁴ Zmud (1984) suggests that while innovation may be induced by either a performance gap or by recognizing promising new technology, successful innovation is most likely to occur when a need and the means to resolve it emerge simultaneously.

H3c: Higher the level of maturity of SLA specification and negotiation standards, greater is the likelihood of WS adoption

Security: Security in general has been one of the major issues when conducting transactions online. It becomes fundamental for WS, as they execute critical business processes/exchange data with remote systems, which opens up a door on those systems to the outside world (Fontana 2002). Thus maturity of WS security standards will affect the WS adoption.

H3d: Higher the maturity of security standards, greater is the likelihood of WS adoption.

Control Variables

Prior research on innovation adoption suggests a number of additional factors be included in the model because of their potential influence on the innovation adoption decision, to eliminate possible confounds. These factors include organization contextual variables (Nystrom et al. 2002) such as organization size, IT human-resource availability, innovativeness and past experience with similar technology (Teo et al. 2003). Usually, size is found to be positively related to innovation adoption. This, it is argued, is because larger organizations feel a greater need to adopt innovations in order to support and improve their performance. On the other hand, it is argued also that smaller organizations are more flexible and innovative, resulting in an enhanced receptiveness towards new products. These apparently contrary relations and results may be largely attributable to the correlation of organization size with other variables, such as structure, strategy, and culture (Frambach et al. 2002). Past researchers have found empirical relationship between human resource availability and innovation adoption. Chau et al. (1997; 2000) suggest that this may be because larger organizations have higher tolerance levels when innovations fail. Finally, Sharma and Rai (2003) suggest that IS leadership also influences organization intention to innovation adoption. We use these aforementioned variables as control variables to minimize any confounding effects.

Contributions

This study has novel contributions as it combines insights from different research streams and emerging industrial standards knowledge bodies. By using TP-NP theoretical framework, it pulls in unique aspects of the technology that were usually ignored in the past innovation studies. Since TP-NP framework though appealing has not been widely used, this study may provide further insights into its applicability for studying complex technology adoption by the organizations. Currently we're developing and validating measures for our framework.

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