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ABSTRACT

Web Services have the potential to facilitate applications and information to be delivered over the Internet, which can be accessed by disparate devices from handhelds to large servers. Web Services offer a company the capability of conducting business electronically with potential business partners in a multitude of ways at a reasonable cost. Web Services technology is an emerging technology. As a result, there exists some technical papers in Web Services, but behavioral and attitudinal aspects toward Web Services have not been explored. To address behavioral issues, we apply diffusion theory (Moore and Benbasat 1991) and security related research in technology adoption and propose a model. Nine hypotheses are proposed.

Keywords

Web Services, diffusion theory, technology adoption, security, service oriented architecture

INTRODUCTION

Web Services have invoked a great interest for industries. This is probably due to the fact that companies have disparate systems and face the challenges of system integration and software reuse. Web Services have the potential to facilitate applications and information to be delivered over the Internet, which can be accessed by disparate devices from handhelds to large servers. Web Services offer a company the capability of conducting business electronically with potential business partners in a multitude of ways at a reasonable cost. According to Digital Vector (2003), an IT consulting and research firm, Web Services are fast emerging as a disruptive enterprise computing technology which holds the promise of enabling seamless and flexible interactions across applications for internal as well as external business operations.

Web Services technology is an emerging technology. As a result, there exists some technical papers in Web Services, but behavioral and attitudinal aspects toward Web Services have not been explored. To address behavioral issues, we apply diffusion theory (Moore and Benbasat 1991) because diffusion posits that innovation attributes affect adoption intention and offers powerful explanation for peoples' behavior. Specifically, our research questions are as follows:

1. Are innovation attributes related to intention to adopt Web Services?
2. Is self efficacy related to Web Services adoption?

PRIOR RESEARCH

Web Services

The W3C Web Services Architecture Working Group defines Web Services as a software application identified by a URI, whose interfaces and bindings are capable of being defined, described, and discovered as XML artifacts. Simple Object Access Protocol (SOAP), Web Service Definition Language (WSDL), and Universal Data Definition Interface (UDDI) are the essential foundations for Web Services. These three technologies provide an open, language-independent and platform-neutral infrastructure. Such technologies support the dynamic nature of enterprise (Ferris and Farrell, 2003).

In today's competitive environment, it is critical for businesses to manage information flow and effectively and efficiently manage value chains. Estrem (2003) proposes a framework for evaluating the viability of Web Services technologies to support the business needs and requirements of next generation manufacturing enterprises. The framework focuses on economic, technical, and organizational contexts that will influence the ability of manufacturing-related enterprises to implement Web Services to support the complex business processes and effectively collaborate with suppliers, customers, and other stakeholders in virtual enterprise environments. Also, Cardoso and Sheth (2003) emphasize the importance of Web Services to be integrated as part of workflow processes.

Other studies have discussed different technologies to develop Web Services, manage Web Services and pros and cons of different technology. For example, Miller (2003) states that Microsoft .NET will generally be a better choice for most companies in most situations whereas Williams (2003) states the pros and cons of J2EE and .NET claiming that J2EE offers more flexibility and robustness. Lim and Wen (2003) analyze the benefits and drawbacks of Web Services from the technical perspectives and associated challenges and difficulties. In Web Services management, Sayal et al (2003) call for the need for standards in Web Services management.

In summary, prior studies have addressed the evolution of Web Services, design, development and programming services approaches, as well as the supporting technologies and infrastructures. However, these prior works have been descriptive in nature and have focused on technical aspects. In this work, we explore Web Services deployment from behavioral perspectives.

Diffusion Theory

Diffusion theory has gained widespread acceptance for studies in innovation adoption (Ahire and Ravichandran 2001;Teng et al 2002). To examine technology acceptance and diffusion, several theories offer insights and explanations for technology adoption behavior. The Technology Acceptance Model (Davis 1989), diffusion theory and assimilation of complex technology could be used as theoretical foundations to explore technological innovations. Assimilation of complex technology focuses on the institutional aspect and the stage research model of organizational level implementation (Gallivan 2001). This model is relatively new and has not been empirically tested. Some of the constructs in the Technology Acceptance model are similar to constructs in diffusion theory (Moore and Benbasat 1991). In terms of the number of constructs, diffusion theory contains more constructs in that aspect; diffusion theory offers a richer picture in exploring technology innovation. We chose diffusion theory – theory of innovation characteristics because 1) the theory is directly related to our research questions 2) Web Services is not only a technological innovation but also a business process innovation 3) the diffusion innovation characteristics theory are well suited to technology adoption   4) diffusion theory is well tested and applied to diverse technological innovation (Moore and Benbasat 1991; Slyke et al. 2002; Venkatesh et al 2003) 5) perceived innovation attributes provide the framework for the evaluation of an innovation by the potential adopters 6) diffusion theory has been successful in explaining the variance in the adoption (Rogers 1971)

Rogers (1995) explains that there are four major theories that deal with the diffusion of innovations. These are the innovation-decision process theory, the individual innovativeness theory, the rate of adoption theory, and the theory of perceived attributes. Prior research on investigations of the diffusion of new products and technologies in various disciplines suggests that acceptance or adoption is significantly influenced by innovation characteristics and adopter perceptions (Rogers 1995; Mazis et al. 1981; Lee et al. 2002; Danaher et al; 2001). Moore and Benbasat (1991) refined Rogers' (1983) innovation attributes and adapted diffusion theory to information technology. The diffusion instrument Moore and Benbasat (1991) developed is intended for the study of the initial adoption and eventual diffusion of IT innovations within organizations. They concluded that eight factors affect innovation adoption: voluntariness, relative advantage, compatibility, image, ease of use, result demonstrability, visibility, and trialability. Slyke et al. (2002) use diffusion of innovation theory to investigate factors that may influence intentions to use a specific groupware application. Their findings indicate that perceptions of relative advantage, complexity, compatibility and result demonstrability are significantly related to intentions to use a certain groupware: Domino Discussion Databases.

Security and Trust

The Security of a system is a combination of its ability to support system availability, data integrity, accountability and data confidentiality. Accountability is an objective developed with the emergence of Ecommerce, which means that the sender or receiver can not deny sending or receiving a message (Rohrig and Knorr 2004). Security is closely related to the complexity and interconnectivity of computer systems. Security has been increasingly attracting corporate' attention as worms, viruses and hackers are actively searching for ways to break into or destroy others' computer systems.

Santos defines security as freedom from danger, risk or doubt during the service process (2003). Security is one of the important aspects affecting service-quality on the Web. Security include safe transaction , secured personal information and the notice of privacy policy (Van Riel et al 2003). Users expect security on the Web (Van Riel et al 2003). For electronic service, the dimensions relating to reliability and security deserve the greatest attention. Security remains as the major obstacle for e-commerce (Santos 2003).

Web Services has the potential to blur the lines between intranets, extranets and the public domain thereby exposing interfaces that have not been previously exposed. More interfaces mean more potential security vulnerabilities. It is possible to have denial of service attacks on Web Services (Mark Rabkin 2002). Overall, Web Services brings a reusable security

code to the security issue. Web Services represent a challenge to the security of business environments. Until the issue of authentication can be resolved, the security issue will remain one of the primary roadblocks to Web Services adoption going beyond use with previously known and trusted partners (Weiss 2001).
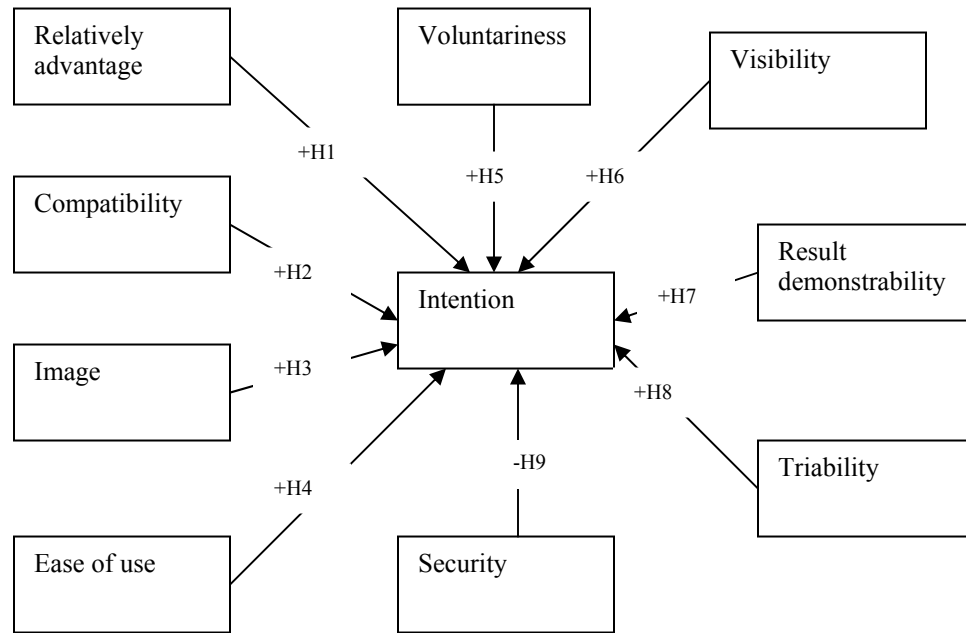
RESEARCH FRAMEWORK

Figure 1 Research Framework

Hypotheses

H1: there is a positive relationship between relative advantage and intention to adopt Web Services.

H2: there is a positive relationship between compatibility and intention to adopt Web Services.

H3: there is a positive relationship between image and intention to adopt Web Services.

H4: there is a positive relationship between Ease of use and intention to adopt Web Services.

H5: there is a positive relationship between voluntariness and intention to adopt Web Services.

H6: there is a positive relationship between visibility and intention to adopt Web Services.

H7: there is a positive relationship between result demonstrability and intention to adopt Web Services.

H8: there is a positive relationship between triability and intention to adopt Web Services.

H9: there is a negative relationship between security and intention to adopt Web Services.

RESEARCH METHODOLOGY

Research Method

This study will use a survey as the research method. According to Pinsonneault and Kraemer (1993), survey research is appropriate when the examination of research questions under study is in a natural setting with clearly defined independent and dependent variables for the purpose of understanding why certain phenomena occur. This study is supported by the well-established diffusion theory and the constructs in the model have been validated in other studies within the literature. Thus, the use of the survey method is justified.

Measures

To measure innovation attributes such as compatibility, complexity image, visibility, result demonstrability, voluntariness, ease of use, triability, and relevant advantage, items used by Moore and Benbasat (1991) are modified to fit the Web service context. Specifically, five items will be used to measure relatively advantage. Four items will be used to measure compatibility; four items for image; three items for ease of use; four items for result demonstrability; two for visibility; five for triability; and four for voluntariness. Intention to adopt is measured with four items adapted from Plouff, Hulland and Vandenbosch's study (2001). A 7-point Likert-type scale is used with 1 representing strongly disagree and 7 representing strongly agree.

Data Collection

We intend to survey 200 local companies in various industries on their implementation intentions for Web Services. These 200 companies will be selected randomly based on the directory for local businesses. These 200 companies are from diverse industries. We intend to survey three groups of people for each company: managers, Web Services developers and Web Services users. Phone calls will be made to each company to identify the potential respondents. Questionnaires will be mailed out to each of the 200 selected companies.

Data Analysis

Because the constructs used in this study were measured in prior works, confirmatory analysis is appropriate validate the relationships in Figure 1. To confirm the relationships in the research model, regression analysis will be performed.

STATUS, EXPECTED RESULTS AND CONTRIBUTIONS

We are currently finalizing the survey instrument. The next step is to perform pilot study. Then we will proceed to the full-scale data collection. We expect that preliminary findings should be available in six months. We expect that the items will load on their expected constructs. We also anticipate that positive evidence would be found for supporting all the hypotheses. From a research perspective, this study can make a contribution to the dearth of Web Services, which, as argued at the beginning of this paper, is getting more and more important. From a managerial perspective, findings of this study can provide insights for corporations on devising appropriate strategies on their deployment of Web Services technologies. The findings can also provide information that will allow Web service developers to better target the desired features of Web Services.

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