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Abstract

Internet EDI is expected to replace traditional EDI by bringing many benefits that are not offered by traditional EDI and solving the market penetration rate problem. This research explores organizations' adoption intentions from two important factors: trust in technology and application knowledge. Based on organizational learning theory, it is further suggested the use of the Internet and EDI can change an organization's application knowledge and trust in technology, which in turn will influence an organization's intention to adopt Internet EDI.

Keywords: Internet, EDI, adoption, trust, knowledge

Introduction

The dramatic growth of interorganizational information systems (IOS or IOIS) has changed the way organizations collaborate with partners and conduct business, which has resulted in significant tangible and intangible benefits being realized by participating firms (Clemons and Row, 1988; Johnston and Vitale, 1988; Premkumar and Ramamurthy, 1995; Vitale, 1986). Among all kinds of IOS studied by researchers, EDI is the one of the most widely implemented and most widely studied IOS. There are many benefits for organizations to implement EDI including economic benefits and social benefits.

The diffusion rate of EDI has never reached people's expectation, actual market penetration rate of EDI is as low as 2% nationwide due to the low participation of SMEs (Fran, 1993). Three reasons are accountable for the low penetration: the high costs of EDI are hard to be justified; complex technology is beyond the capability of potential adopters; and unmatched goals of trading partners lead fragile relationship between partners. Many substitute technologies have been sought by organizations. Large organizations want to link all partners through the same EDI system and small organizations want to benefit from EDI as well. Among all these efforts, Internet EDI is one of the most important technologies that transcends its antecedent in many facets (Baum, 1997; Werner, 1999). Internet EDI is "a closed interorganizational business documentation exchange system in a standard, structured, machine-processable form over open protocol Internet networks." It embraces two technological elements: EDI standards and Internet connections.

The maturity and popularity of the Internet technologies and the exponential growth of e-commerce has forced organization to move IOS from proprietary network based (direct point to point connection) or semi-public network based (such as VAN linked) to Internet based. Internet-based IOS such as Internet EDI is believed to be able to lower establishment and operation costs, reduce transaction costs of participating firms, increase interorganizational information exchange, and facilitate globalization strategy (Werner, 1999). Internet EDI does not abandon past EDI investment but add innovative elements to this "old" technology. Internet

EDI is an innovation because it brings new technological elements to EDI which can dramatically change the business environment and transaction methods (Rogers, 1983). Both big and small companies have already begun their trial of Internet EDI, e.g., FedEx (Williams and Frolick, 2001), International Paper, and Newark Electronics (Sullivan, 2001). Due to the infancy of the technology, organizations' intention to adopt Internet EDI is unknown. To fill this void, this research is going to explore organization's adoption intention toward Internet EDI.

Following sections are organized as this, first, background research is introduced, which is followed by a research model and propositions, and finally, conclusions and implications are provided.

Background Research

Unlike internal IS systems, the implementation of IOS requires the cooperation and commitment of both internal and external stakeholders. These participating members may have different technological expertise, varied economic background and complex business relationships among themselves that result in a number of technological, economic, political, and social factors influencing the adoption and implementation of IOS. Due to this, previous research has sought out those socio-political factors such as trust and power to explain EDI adoption, which has led to a research stream for IOS adoption (Premkumar and Ramamurthy, 1995). The socio-political stream argues that a firm forms interorganizational linkages primarily to gain control over critical resources and thereby reduce uncertainty in their acquisition. Firms use various forms of social means such as trust and power to control such linkage (Emerson, 1962; Gaski, 1984). Social-political oriented researchers contend that interorganizational relationship could exist even if they are not cost-efficient because of other social and political forces (Pfeffer, 1982).

From early 90's, trust and power have been empirically tested about the effects on EDI adoption. For example, Saunders and Clark (1992) found trust and net dependence marginally influence organization's intention to adopt EDI, and that trust is negatively correlated with an organization's adoption intention. Hart and Saunders (1997) explored power and trust on the EDI adoption and found "the role of power and trust in EDI adoption has important implications for interorganizational theory." Further, Hart and Saunders (1998) tested power and trust, with electronic data interchange (EDI) in terms of volume of transactions and EDI transaction diversity. They found that the relationships among commitment, trust, and EDI use were different for volume and diversity, in which trust significantly influences diversity of EDI use but not volume of EDI transactions.

When it comes to the Internet era, trust has a more important role to play. As Keen, et al. (2000) comments: "trust is the cornerstone of e-commerce." Rosenbloom (2000) argues that online interactions represent a complex blend of human actors and technology which results technology-mediated trust problem. Tseng and Fogg (1999) claim a "credibility crisis of computing technology" when people start to doubt about the trustworthy of the computing technology they are using every day. The trace of trust in technology problem can be found in EDI use as well. Organizations may resist this technology, or they might not use it as often as expected after adopted this technology because they do not want to continue investment (Hart and Saunders, 1998). Mishra (1993) identified four interrelated dimensions of trust: competence, openness, caring, and reliability. Each of these dimensions represents behaviors which demonstrate "good will". However, technology does not have and can not spontaneously express such "good will" to reinforce humans' trust in it. It is almost a unidirectional behavior in which a human takes an attitude toward a technology: trust or not. Tseng and Fogg (1999) provide a framework of technology credibility which entails four human-behavioral elements: presumed credibility, reputed credibility, surface credibility, experienced credibility. However, we believe, technological attributes have an impact on human trust behavior. One major purpose of this research is to expand trust domain to technology-mediated trust and propose a measurement model for trust in technology.

Like interpersonal trust, trust in technology has antecedents. Tseng and Fogg (1999) identify four elements influencing people's evaluation of credibility including user expertise, user understanding, user need for information, evaluation errors. As Nambisan and Wang (1999) point out, knowledge is roadblock to the adoption of the Internet technology. Organizations have to possess adequate knowledge before they will adopt the Internet for critical business tasks. The more application knowledge an organization has, the likely it will make an informed trust decision.

Research Model Development

The model proposed for this study considers two major variables: 1) trust in technology and application knowledge identified by previous research and 2) the influence on an organization's adoption of Internet EDI. The complete model is illustrated in Figure 1. In the research model, the *Internet usage* and *traditional EDI usage* influence organization's application knowledge, and change organization's attitude toward the use of technology, i.e., trust in technology. In turn, *application knowledge* and *trust in technology* influence organization's adoption decision of Internet EDI. Application knowledge and trust in technology reflect

the results of an organizational learning process, the more usage and experience an organization has over certain technologies, the more knowledge an organization will have. Accumulated experience and application knowledge will lead to rational positive attitude toward that technology.

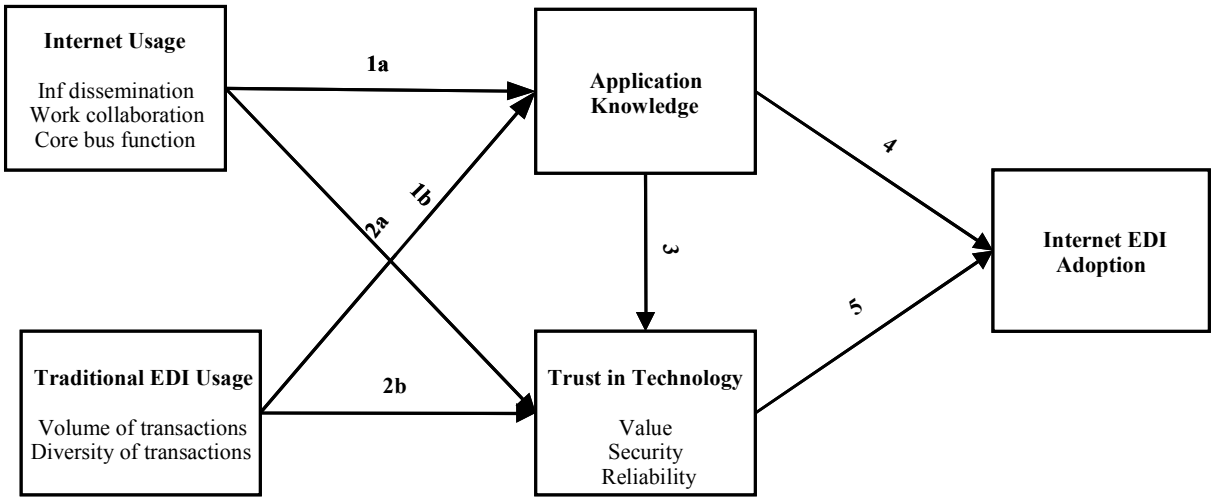

Figure 1. Research Model

Adoption as an Organizational Learning Process

Innovation Diffusion Theory (IDT) (Rogers, 1983; Rogers, 1995) has served as a fundamental theory that explains organizations adoption of innovation by analyzing the attributes of the innovation, and has been the foundation for much of EDI research (Chwelos, et al., 2001). Some research of the adoption of Internet for strategic use has been based on IDT as well (Teo, et al., 1998). Nambisan and Wang (1999) argue that technology adoption is not only related with organization intention but also their capability to adopt. A knowledge barrier may exist that impedes the adoption of sophisticated (knowledge intensive) technology such as web data warehousing. They find the large majority of organizations (even Fortune 500 companies) are using the Web primarily for information dissemination, a low level usage of the Woiceshyn (2000) suggests that adoption should be viewed as a process of organizational learning which proceeds in a feedback loop from observing, interpreting, integrating to acting. Argyris and Schon (1978) argue that learning requires a conscious acquisition of knowledge by the learning organization. Chaston, et al. (2001) find that organizations using double-loop learning style are more deeply involved with using various types of Internet technologies. Double-loop learning means that organizations learn by exposing themselves to new sources of knowledge.

In summary, the following conclusions can be made. First, research on technology adoption processes, e.g., from organizational learning perspective is rare but effective (Woiceshyn, 2000). Second, Internet EDI represents a complex innovation that could represent a knowledge barrier for adopting organizations. Finally, organizations that have used traditional EDI and Internet for interorganizational information have more knowledge and expertise on these technologies and thus more prepared for Internet EDI adoption.

Research Propositions

Based on the research model, the following propositions explaining the relationships between the research variables and the decision model for Internet EDI are presented below.

Internet Usage

The Internet can be used to serve many business objectives. Nambisan and Wang (1999) provide a hierarchy that delineates the Internet usage by organizations. The bottom level (level 1) of Internet use is information access, including corporate web sites,

intranets, and email etc. At the level 2, the Internet is used for collaborative work, including intranet/extranet, Internet EDI, Internet telephony, etc. At the highest level, the Internet is used to serve core business transactions, such as e-commerce, Internet EDI, Internet-based extended ERP, etc. The higher the level of use of Internet technologies, the more support will be needed from linked partners.

Organizational learning theories have indicated that the use of knowledge is the important source of new knowledge. An organization use of the Internet leverages its knowledge of the Internet, which brings new knowledge. The use of the Internet can change an organization attitude toward the technology. One of the most important attitudes is the trust of the technology, which has been intensively discussed in human-computer interaction literature. We posit following relationship exist

Proposition 1a: Internet usage positively influences an organization's application knowledge on Internet-based systems such as Internet EDI.

Proposition 1b: Internet usage positively influences an organization's trust in Internet EDI. That is, the more one uses the Internet, the more one trusts Internet-based technologies.

Traditional EDI Usage

Massetti and Zmud (1996) suggestion measuring EDI initiatives from four facets: volume, diversity, breadth and depth of a firm's EDI. Volume is determined by dividing the total number of documents a function handles via EDI by the total number of the function's documents or transactions. Diversity refers to the number of distinct document types an organization handles via EDI connections with its trading partners. These four measurements have been widely used to measure the degree of EDI usage in an organization, especially the first two measurements, e.g., Hart and Saunders (1998) and Ramamurthy, et al. (1999). However, in accordance with organizational learning theory, earlier use of EDI should bring new knowledge about EDI (and trust) and thus facilitate Internet EDI adoption. Thus we propose the following:

Proposition 2a: Traditional EDI usage positively influences an organization's application knowledge of EDI.

Proposition 2b: Traditional EDI usage positively influences an organization's trust in Internet EDI. That is, the more one uses EDI, the more one trusts Internet-based technologies.

Application Knowledge

Application knowledge has been defined in a variety of ways: as know-how knowledge an organization possesses on certain technologies or applications (Huang, et al., 2002); as a dimension of IT sophistication that refers to the level of technological expertise within the organization (Pare and Raymond, 1991); as the level of management understanding of and support for using IT to achieve organizational objectives (Chwelos, et al., 2001). Application knowledge is a result of organizational learning in the implementation of innovations. It is composed of three aspects: 1) technology-related knowledge regarding the appropriate hardware and software infrastructure, technology features, security, and standards, and the organization's unique business context; 2) project-related knowledge regarding (financial and human) resource requirement for application development, development process/duration, project leadership, functional participation; and 3) knowledge regarding the specific business objectives that will be served by the application, the value of the various technology features for the adopting unit, the key business assumptions required to be made for deploying the technology, and the potential for integrating the application with existing IT applications etc (Nambisan and Wang, 1999). The better application knowledge an organization has, the more likely an organization is ready to adoption innovation.

Proposition 3: Application knowledge positively influences an organization's trust in Internet EDI. The more application knowledge, the more trust in Internet-based technologies.

Proposition 4: Application knowledge positively influences an organization's intention to adopt Internet EDI.

Trust in Technology

Trust in technology reflects an internally diffused attitude or a sub-culture an organization possesses toward technologies. Different from partner-related trust, which can be applied to interpersonal and interorganizational relationships, trust in technology is unique to the IS discipline in that it delineates the relationship between human and computing technology. Trust in technology is not new to researchers of human-machine interactions (e.g., "trust in information," "accept the advice," "believe the output," etc.). The technology credibility problem is becoming more significant due to the explosive growth of the Internet. Tseng and Fogg (1999) contend that "like many aspects of human society, computers seem to be facing a credibility crisis," and "the cultural myth of the highly credible computer may soon be history."

In their framework, Tseng and Fogg (1999) propose four types of technology credibility: presumed credibility, reputed credibility, surface credibility, experienced credibility. Presumed credibility describes how much a perceiver believes someone or something because of the general assumptions in the perceiver's mind. For example, people assume that their friends tell the truth, so they view their friends as credible. Reputed credibility describes how much a perceiver believes someone or something because of what third party has reported. Surface credibility describes how much a perceiver believes someone or something based on simple inspection. Experienced credibility refers to how much a perceiver believes someone or something based on first hand experience. Technology credibility influences people's attitude toward such technology, which further influences their intention to use such technology. For example, if users perceive that Internet technology is not secure, they will not trust the Internet and will not shop online. User's experience (knowledge) can significantly change their trust toward the technology. After users learn more about the Internet transmission protocols, security methods such as encryption, digital signature, and authentication, they will be more comfortable with using Internet for critical tasks rather than for lower-level tasks. Of the technology credibility framework of Tseng and Fogg (1999), experienced credibility is highly dynamical and can be significantly and purposefully changed by the user. The more users use and learn about technology, the more experience and knowledge they have, and the more trustworthy the technology seems to them. Thus, we posit application knowledge (Nambisan and Wang, 1999; Wells, et al., 2001) is an important antecedent of trust in technology.

Trust in technology can significantly influence people's adoption decision toward certain technologies. Adopting a technology not only results from an organization's intention but also with its ability (Nambisan and Wang, 1999). Thus, we posit:

> *Proposition 5: Trust in internet-based technology (Internet EDI) positively influences an organization's intention to adopt Internet EDI.*

Conclusion and Implications of the Research

In this research, we first introduced Internet EDI, an innovation that is pursued by organizations to replace traditional EDI. Internet EDI has several advantages that make it superior to traditional EDI, in terms of affordability, reachability, globalizability, and integratability in the supply chain. With the Internet as transmission vehicle, Internet EDI can significantly reduce the implementation cost of EDI and solve the penetration rate problem of EDI. Internet EDI allows adopters to reach most trading partners and facilitate their globalization strategy. The implementation of Internet EDI has drastically improved operational efficiency that changes the competition from company versus company to supply chain versus supply chain.

There are two major contributions of this study. First, we expand and enrich the trust concept by introducing trust in technology in a new context. Trust in technology is an important variable that sheds a light on the Internet-based technology research when computing credibility becomes a serious issue in the Internet environment. Second, this study opens a new perspective from which to study the Internet-based system adoption from organization's knowledge and trust in technology. An organization's knowledge is of essence to the adoption of innovation and the adoption process should be emphasized. Application knowledge and trust in technology are relatively new and have recently gained more interests by IS researchers. As such, more empirical research will be meaningful and valuable in this area.

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