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Rueylin Hsiao
National University of Singapore

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TECHNOLOGY FEARS: BARRIERS TO THE ADOPTION OF BUSINESS-TO-BUSINESS E-COMMERCE

Rueylin Hsiao
Business School
National University of Singapore
rueylin@nus.edu.sg

Abstract

This research presents a qualitative study of the difficulties encountered in the adoption of B2B (business-to-business) electronic commerce. It is concerned with an initiative that was intended to help SMEs (small- and medium-sized enterprises) in Singapore adopt an Internet-based electronic marketplace. Drawing on the theory of technological frames, the study traces the case over 13 months and analyzes the early adoption problem in three time periods. Consideration is given to why the technology provider failed to gain the commitment of adopters even though all of the favorable conditions were present. Inductively, the results indicate four key issues that explain the adoption difficulties: lack of familiarity (with B2B e-commerce), risk aversion, lack of trust (among trading partners), and incongruent cultural practice. The results suggest that unless the technology fears of adopters are acknowledged, the technologist's well-intended programs may be met by adopters' negative responses and may lead to the failure of IOS (inter-organizational systems) adoption. The proposed conceptual basis has implications for both research and practice as enterprises are rapidly venturing into the evolving forms of B2B e-commerce in Asia.

Keywords: B2B electronic commerce, technological frames, technology fears, IOS adoption, SME, Singapore.

INTRODUCTION

This paper explores the barriers to the adoption of inter-organizational systems (IOS). It investigates an Internet-based B2B (business-to-business) electronic commerce project called SMEOnline.com (a pseudonym) over an introduction period of 13 months. Although the technology provider devised innovative strategies and offered the necessary support, most potential adopters (SMEs: small- and medium-sized businesses) responded unenthusiastically. The research seeks to understand the controversies involved in the adoption difficulty by exploring the process of technology adoption within the inter-organizational context from a cognitive perspective (Orlikowski and Gash 1994). This qualitative approach aims to extend the scope of the current literature on IOS adoption and IT acceptance.

The paper has three main emphases. First, it investigates Internet-based B2B e-commerce in order to extend the current EDI-based systems (e.g., Iacovou et al. 1995). Second, the study focuses on the electronic marketplace rather than electronic procurement systems. Third, the study has a special interest in the Asian context. Although market analysts recognize the importance of fitting B2B e-commerce to the special needs of the Asian business environment (Dhawan et al. 2000), there is still little empirical work on this subject. The Asian focus of this study is on Chinese business communities with the aim of enabling comparison with previous research based on the U.S. and European environments (e.g., Choudhury et al. 1998; Reekers and Smithson 1996).

The paper is structured as follows. First, it reviews the literature on the barriers to IOS adoption, mainly focusing on EDI-based systems. Second, it explains the research design, data collection protocol, and data analysis methods. Third, the findings are presented for three time periods, illustrating the incongruent interpretation of adoption between the technologist and the adopters.

Finally, in the discussion section, the concept of technology fears is developed and related to the case evidence. The theoretical development of technology fears is further elaborated by relating this phenomenon to previous studies in different technological contexts such as automation, groupware, and EDI.

BARRIERS TO IOS ADOPTION

The difficulties associated with IOS adoption are generally considered to be more complex than those associated with the adoption of intra-organizational systems (Kumar and van Dissel 1996). For example, IS adoption requiring inter-firm collaboration may lead to more conflict than with IS adoption across departments within the same company. The specific question of IOS adoption difficulty has been addressed mainly with reference to EDI-based systems (see, for example, Bakos 1991; O'Callaghan et al. 1992). There are still few empirical works on Internet-based B2B e-commerce systems. For this reason, the literature review in the present paper will draw on the EDI-based IOS literature to form the conceptual basis for the study.

Why is it difficult to adopt B2B e-commerce? Previous studies suggest three groups of adoption barriers: technological, intra-organizational, and inter-organizational (based on Iacovou et al. 1995; Kumar and Crook 1999; Premkumar and Ramamurthy 1995). A review of these factors will help us understand the problems associated with the introduction of B2B e-commerce systems (see Table 1).

Table 1. A List of IOS Adoption Bbarriers Summarized from the Current EDI-based Literature

Technology Barriers	Intra-organizational Barriers	Inter-organizational Barriers
Security such as payment gateway Technological standards Technological complexity System integration Compatibility Infrastructure High set-up costs Bandwidth	Perceived benefits Lack of awareness Business process reengineering Presence of champions Education and training	Lack of peer pressure Power Trust Culture

First, by *technological barriers* we refer to the problems related to the use of technology. Key factors of EDI adoption difficulty include, for example, network security, system integration, system migration, data conversion, and the compatibility of hardware and software (Jones and Beatty 1998). From an operational viewpoint, companies resist the adoption of B2B e-commerce because EDI technology is too expensive (Bamfield 1994). The costs may include those of leasing a VAN (value-added network), purchasing EDI-related software, and buying computer hardware. As security technology is still in its embryonic stage, companies are also concerned about the safety of electronic transactions (Ratnasingham 1998). Moreover, the adoption of EDI also involves the complex integration of incompatible information systems. The migration from legacy systems to EDI systems usually requires the company to convert from an old data format to a new one (Truman 2000). Moreover, the problems of data transmission and network bandwidth also add to the complexity of technology management (Hart and Estrin 1991).

The second group of adoption barriers are related to *intra-organizational factors*. Researchers indicate that the negative acceptance of B2B e-commerce can be attributed to the ignorance of perceived benefits and lack of awareness of EDI technology (Arunachalam 1995; Iacovou et al. 1995). Because inter-organizational systems also involve sophisticated operations between partner firms, a lack of appropriate training can prevent users from using the information systems effectively (Arunachalam 1997). Furthermore, EDI systems often require companies to redesign their internal business processes in order to optimize the whole supply chain process (Clark and Stoddard 1996; Riggins and Mukhopadhyay 1994).

The third group of barriers involves *inter-organizational barriers*. Current studies highlight four important factors: competitive pressure, power, trust, and cultural assumptions. Researchers have found that, in stable industries, companies have less incentive to adopt IOS-enabled collaboration because the competition is not threatening (Premkumar et al. 1997; Reekers and Smithson 1996). Power is the next important factor: buyers in a strong position, who instigate the use of IOS, can influence their trading partners to introduce B2B e-commerce (Clemons and Row 1993; Hart and Saunders 1997). Powerful firms can incur resistance

to IOS when the lead firm exercises domination over the technological use (Webster 1995). Allen et al. (2000) also highlight the role of trust in maintaining productive IOS adoption. Mistrust, once introduced, will set off a vicious cycle and inhibit productive communication (Hart and Saunders 1997, 1998). Another barrier to IOS adoption is the cultural factor. Stakeholders with different organizational sub-cultures, who have different views of how EDI systems should be used, can potentially hinder the use of B2B e-commerce among trading partners. For example, Barrett (1999) examines the four-year adoption of EDI in the London Insurance Market and explains that the different cultural expectations of technology use can potentially impede EDI implementation. As a result, the companies involved in EDI-based e-commerce are often incapable of overcoming the limits of their different cultures.

There is a potential limitation of the current literature on IOS adoption. The EDI-based studies seem to emphasize a *factor-based* analysis (as defined by Robey and Newman 1996). They contain mainly survey-based analyses which investigate the causal relationships between variables (see the criticism in Markus and Robey 1988). These factor-based studies hypothesize a list of factors and test it by means of a large sample survey (e.g., Howells and Wood 1995). Although the factor-based approach is useful in compiling a checklist of adoption barriers, there is a paucity of in-depth understanding of organizational issues. Some researchers worry that such an approach tends to ignore the problems attached to context-specific situations and, therefore, promotes oversimplified solutions (e.g., Baskerville and Smithson 1995).

In light of these concerns, there is a need to extend IOS studies to include more *context-based* studies. For this reason, the present analysis offers contextual details of IOS adoption in order to understand how problems are developed and how social actors shape outcomes (Pettigrew 1990). Through a process analysis supported by the theory of technological frames (Orlikowski and Gash 1994), this study proposes an alternative group of adoption barrier characterized by technology fears. The concept of technology fears is concerned with how social actors make sense of technological use within their macro-cultural context.

RESEARCH METHODS

The case-study method. A qualitative approach was used to collect and analyze the data in order to offer a detailed examination of a series of related events exhibiting some theoretical principles (Yin 1989). The purpose is to understand human experience and action in organizational contexts so that the intended audience can see how the investigated situation emerged and evolved (Klein and Myers 1999, pg. 73). For this reason, the study employs the single case-study approach with the aim of organizing social data so as to "preserve the unitary character of the social object being studied" (Smith 1990, pg. 127). This approach is valuable for refining theory, suggesting complexities for further investigation, and establishing the limits of theoretical generalization (Stake 1994, pg. 245).

The research site. The field study was conducted within DecisionSys (a pseudonym), which is a Singapore-based consulting firm specializing in IS-related services and operating mainly in the Asia-Pacific region. In August 1999, DecisionSys decided to shift to an ASP (application service provider). Being an ASP means that DecisionSys has to set up software as part of a pre-configured service which is able to run on servers at a managed data center and which allows users to access the application remotely in return for usage-related payment. DecisionSys offered a B2B electronic marketplace called SMEOnline.com for SMEs of various industries in Singapore (with a focus on Chinese business communities operating in Singapore, Hong Kong, Taiwan, and China). The findings reflect these SME adopters' expectations of, as well as their early exposure to, B2B e-commerce systems.

Data collection: Field data were collected through semi-structured interviews and on-site observation. Other examined materials included company archives and project documents (such as promotional brochures, training materials and annual reports). Over 50 interviews were conducted, each about an hour in length, during which field notes were taken. In addition to the implementation team of SMEOnline (a total of 15 staff, representing the technologist), 41 SME executives (representing the adopters) were interviewed (about 23 of them via telephone), as shown in Table 2.

Table 2. Interview Scheme

	Technologists	**SME Adopters**	**Total**
Executives/Partners	5	12	17
Middle Managers	4	29	36
Consultants	6		6
Total	15	41	56

The researcher also participated in four key project meetings and several other key events (such as company exhibitions and seminars) in order to facilitate in-depth observation of the implementation process. This on-site observation is especially useful for relating the ongoing organizational contexts to emerging themes. During the 13 months of the real-time study (end of October 1999 to November 2000), access to the B2B portal was also available through the Internet, thereby allowing observation of the adopters' activities in the e-marketplace. This kind of multiple-source data collection seeks to enable triangulation and enhance data integrity, and to strengthen emerging theoretical concepts.

Data analysis. The data were analyzed in order to get as close as possible to the world of the technologist and the adopters, thus making it possible to illustrate their frame-induced actions and surface their deep-seated assumption about technology use. The case descriptions attempt to explicate the unique experiences as bases for theoretical development in relation to other studies (Dyer and Wilkins 1991, pg. 614). To achieve this, the study employs Orlikowski and Gash's (1994) analytical method: technological frames. Their theoretical proposition explains that social actors often apply technology with a tacit "frame" embedded with a certain assumption, intention, or interest. Social actors thus produce "frame-induced actions" that lead to unfruitful results. Three theoretical constructs are used in their data analysis: the nature of technology (what the selected technology means to the social actors), technology strategy (how the social actors seek to apply the technology), and technology-in-use (how the social actors think of the application of the technology-in-use).

Using a similar arrangement, this study reports the data in three phases (see Figure 1): Time 1 explains the technologist's view of how the technology should be introduced in order to achieve customer satisfaction and market success. The analysis first reports the technologist's strategies to introduce the e-marketplace system; and secondly it examines the underlying frames of the technologist toward technology strategy.

Time 2 traces the adopters rejections of B2B e-commerce. It reports the adopters concerns around technology use by highlighting four core themes—the lack of familiarity (with Internet technology), risk aversion, lack of trust (among trading partners, and incongruent cultural practice—which emerged inductively from the data analysis. The analysis then explains these four types of fears by examining the adopters frames concerning the nature of technology and technology-in-use.

Time 3 considers the technologist's response to the adopters feedback. The analysis examines the technologist's frames underlying the reorientation of technology strategy by redesigning the business model and enhancing the Internet infrastructure Finally, the analysis concludes by reporting the unsatisfactory outcomes of IOS adoption.

RESEARCH RESULTS AND ANALYSIS

The theoretical framework developed above is employed to structure the findings of this study. Figure 1 offers an overview of the three time periods.

Time 1: Technology Strategy (October 1999)

In 1999, DecisionSys decided to move to a new operating model: ASP (application service provider). The aim was to provide e-commerce services in three areas: (1) one-stop consulting services to launch business on the Internet, (2) centralized technology resources managed by DecisionSys, (3) an integrated platform for information systems that could upgrade the latest software at low cost.

The frame-induced actions of the technologist: To enable the ASP model, DecisionSys decided to launch a B2B e-marketplace for SMEs in Singapore. It employed an adoption strategy called "B2C2B." First, the idea was to offer a low-cost B2C (business-to-customer) e-commerce service by building e-stores over the Internet at a cost of only U.S. $4,000. The B2C solution involved designing a website, building membership management, and setting up web-based e-mail systems. The second part of this strategy meant that once DecisionSys managed to reach a critical mass of B2C customers, they would turn the e-stores into a B2B e-marketplace, where SMEs could identify trading opportunities and conduct transactions over the Internet.

At the beginning of its launch, SMEOnline quickly built 60 B2C e-commerce websites for firms from various industries such as food distribution, furniture, chemicals, construction materials, automobiles, and electronics. In order to line up more SMEs, DecisionSys sought support from the government agent in Singapore to offer a matching fund scheme for SME applicants. It also instituted a special promotion scheme for SMEs in different trade associations. DecisionSys expected to reach 2,000 adopters by the end of the year 2000.
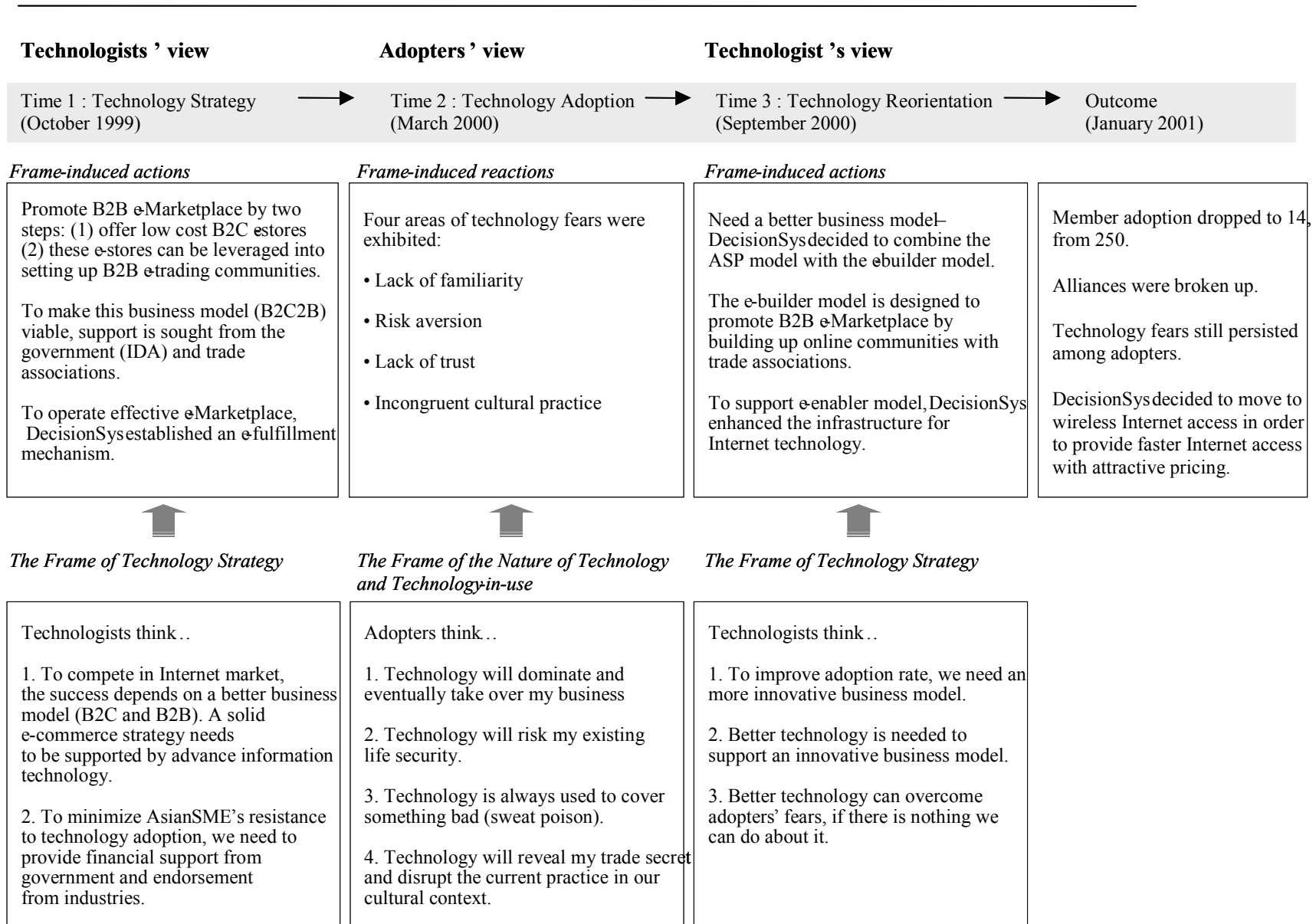
Technologists' view

Adopters' view

Technologist's view

| Time 1 : Technology Strategy (October 1999) → | Time 2 : Technology Adoption (March 2000) → | Time 3 : Technology Reorientation (September 2000) → | Outcome (January 2001) |

Frame-induced actions

Frame-induced reactions

Frame-induced actions

| Promote B2B e-Marketplace by two steps: (1) offer low cost B2C e-stores (2) these e-stores can be leveraged into setting up B2B e-trading communities.

To make this business model (B2C2B) viable, support is sought from the government (IDA) and trade associations.

To operate effective e-Marketplace, DecisionSys established an e-fulfillment mechanism. | Four areas of technology fears were exhibited:

• Lack of familiarity

• Risk aversion

• Lack of trust

• Incongruent cultural practice | Need a better business model — DecisionSys decided to combine the ASP model with the e-builder model.

The e-builder model is designed to promote B2B e-Marketplace by building up online communities with trade associations.

To support e-enabler model, DecisionSys enhanced the infrastructure for Internet technology. | Member adoption dropped to 14, from 250.

Alliances were broken up.

Technology fears still persisted among adopters.

DecisionSys decided to move to wireless Internet access in order to provide faster Internet access with attractive pricing. |

The Frame of Technology Strategy

The Frame of the Nature of Technology and Technology-in-use

The Frame of Technology Strategy

| Technologists think…

1. To compete in Internet market, the success depends on a better business model (B2C and B2B). A solid e-commerce strategy needs to be supported by advance information technology.

2. To minimize AsianSME's resistance to technology adoption, we need to provide financial support from government and endorsement from industries. | Adopters think…

1. Technology will dominate and eventually take over my business

2. Technology will risk my existing life security.

3. Technology is always used to cover something bad (sweat poison).

4. Technology will reveal my trade secret and disrupt the current practice in our cultural context. | Technologists think…

1. To improve adoption rate, we need an more innovative business model.

2. Better technology is needed to support an innovative business model.

3. Better technology can overcome adopters' fears, if there is nothing we can do about it. | |

Figure 1. The Findings Analyzed by Technological Frame (based on Orlikowski and Gash 1994)

At the same time, the chief operation officer incorporated the fulfilment mechanism for the B2B e-marketplace. He was concerned that the effective operation of an e-marketplace required logistic support and business intelligence services. DecisionSys quickly established strategic alliances with three partners in June 2000. These partners were (all pseudonyms) TransLog (a Singapore-based logistic provider), ExcelMail (an automated mailing company), and DataSolutions (a firm specializing in data-mining). With the help of these partners, DecisionSys aimed to offer logistic services, effective communication among trading partners, and intelligent customer data-mining.

However, the result was unsatisfactory: until the first quarter of 2000, DecisionSys only received about 80 inquiries for B2C e-stores and 20 traders for SMEOnline. Most of the traders were from the chemical industry because the association had asked DecisionSys to build and run a B2B portal for its members. DecisionSys's top team were perplexed by this result and decided to investigate why the B2C2B model had not been received well by SME customers.

The frame of technology strategy: In Time 1, the researcher observed that there were at least two implicit assumptions held by the technologist when formulating the technology strategy. The first assumption was that to compete in the Internet market, success depends on a better business model enabled by advanced technology. In this case, the business model was the B2C2B and the enabling technologies included B2C e-commerce (e-stores) and B2B exchanges (SMEOnline). The technologist was worried more about building the business model through Internet technologies and fulfilment partners (TransLog, ExcelMail, and DataSolutions). These well-devised solutions (e.g., low-cost entry and one-stop consulting services) reflect the rational actions of the technologist, who paid little attention to social actions from the users viewpoints.

Time 2: Technology Adoption (March 2000)

In Time 2, the researcher was involved in the investigation to collect feedback from the existing adopters and the executives of other potential SME customers. The investigation took about three months to complete. Interestingly, the adopters' responses did not seem to be very relevant to the rational actions designed by the technologist. This section describes the fears of these potential adopters toward technology adoption with reference to four areas: lack of familiarity (with B2B e-commerce), risk aversion, lack of trust (in trading partnership), and incongruent cultural practice. These four dimensions of technology fears are reported by relating how potential adopters perceived the "nature of technology" and "technology-in-use." In particular, special attention is given to the adoption issues related to the specific contexts of Chinese business communities.

First, *lack of familiarity* refers to adopters ignorance of B2B e-commerce applications (similar to the factor of lack of awareness reported by Iacovou et al. 1995): 16% of adopters comments (18 out of 112) reveal an unrealistic, and often incorrect, expectation toward B2B e-commerce. For example, the president of a small electronics company was worried that B2B e-commerce might result in his business getting out of control:

> My understanding of B2B e-commerce is to have Internet hardware to handle my business transactions. I don't like the idea of having the machine take over my business and tell me what I should do for my clients.

Others associate B2B e-commerce with services such as those offered by advertising agencies. As one owner running a small business in the transportation sector explained:

> I know B2B e-commerce is a bit like a big electronic yellow page. We can advertise our services in cyberspace and attract more businesses….The reason for us registering with SMEOnline is to get exposure.

Most managers of SMEs consider that B2B e-commerce systems are similar in their functions to those of the fax machine and e-mail. According to this view, B2B systems are used simply for better communication. This is similar to the findings reported in Orlikowski and Gash, which show that users tend to relate new technology to something they have experienced before. A senior executive in the clothing industry explained her idea of B2B systems:

> I know how to use e-mail and MS Office software….I believe B2B e-commerce is a similar kind of software. But what I find is fairly disappointing: B2B e-commerce is nothing more than a few hypertext links. I don't know how useful this B2B stuff would be for my business.

The second dimension of technology fears is *risk aversion*, which refers to the lethargy shown toward adopting a new technology and the unwillingness to deal with uncertainties. The study finds that 22% of respondents express this tendency toward risk

aversion (25 out of 112). The following comment by a senior manager, a veteran who has worked in a computer company for over 10 years, is typical:

> I like the idea of doing business exchange over the Internet. But I worry that my role in this company will quickly become unnecessary. I'll then lose my job here. I have been working here for over 10 years and it's my turn for the senior executive position soon. I would not like the idea of losing promotion.

The third concern is with *lack of trust* (24%; 27 out of 112) and has different implications from those highlighted in previous studies. The emphasis of this distrust is more on the brand name, trade security, and technology security. As the manager of a trading company nervously pointed out:

> My idea of such B2B e-commerce is that it should be hosted by big names such as IBM or NCS [National Computer Systems, a key IS provider in Singapore]. Big companies can give me better services, and their technological solutions are probably better too. I cannot see any recognizable names in there. I won't use their site for B2B trading.

Interestingly, the company seems not to recognize that they have to pay a premium for the services offered by companies with a reputable brand. Another adopter, the president of a small chemical firm, expressed his distrust of Internet transactions:

> I know all the local companies; I know all the suppliers. I've been in the business for over 20 years. I know my business partners very well. We know which companies are bad paymasters and so we don't want to sell them anything. We know which companies have good links to our competitors so that we don't want to deal with them. And we know which companies pay us good commission so that we need to provide good services to them. It is very much a trust-based trading relationship. You would be too naïve to think that B2B e-commerce can replace all this knowledge about your trading partners.

The fourth problem emerging from the investigation is the *incongruent cultural practice* induced by B2B e-commerce systems (38%; 42 out of 112). The adopters of SMEOnline felt that the B2B systems would disrupt their current practice in their cultural contexts. One manager's dismissive comment is typical of the responses on this issue:

> I don't think the idea of B2B e-commerce will get any further in Chinese business communities. We value the *Guan-Shi* [relationship-based] networks before conducting formal businesses. Normally, we have to meet our partners three times before any formal business transaction can really happen….[Therefore,] it is important for us to maintain our reputation in the network, and this is based on the relationship within this *Guan-Shi* network. It's a word-of-honor business. I don't believe the B2B e-commerce can replace this kind of trust with a group of strangers. All it can do is just disrupt our current practice. (A logistic provider operating in Singapore, China, and Hong Kong)

Other managers seem to have a more unrealistic expectation of B2B e-commerce systems. One manager, who monitors business within the Chinese business community, discussed his own expectation of B2B systems (a view that was shared by his colleagues in the same trade association). He wanted a kind of "money laundry" facility within the B2B e-marketplace systems:

> I would use B2B e-commerce if they can provide my company with money laundry services. You see, in the China market [PRC], trade regulations prohibit businesses from sending money back to the home country. I would like to participate in SMEOnline if the portal could help me transact business and direct the payment right back to my account in Singapore from China. This kind of payment gateway would definitely be an incentive for my company and my fellow partners. (The owner of a semiconductor trader operating in China, Taiwan, and Singapore)

The frame of the nature of technology and technology-in-use: Adopters' responses were typically far from being rational. We can observe four implicit assumptions in how adopters perceived the nature of technology and technology-in-use: (1) the new technology (SMEOnline) would dominate and eventually take over adopters' businesses; (2) the new technology would bring risk to their existing life security; (3) the new technology was seen as just a "sweet poison" to cover crime and bad trading practices; and (4) the new technology would reveal the company's trade secrets and disrupt current practice in the adopters' cultural context. These four assumptions provide a useful basis for understanding why these adopters were fearful of the introduction of B2B e-commerce.

Time 3: Technology Reorientation

The adopters' feedback was reported to the top management of DecisionSys in order to reorient adoption strategies and counter the previous setback. Interestingly, the technologist's responses showed a pattern of technology imperative (that is: if we offer better technology features, user resistance will be minimized; see Rogers 1995). DecisionSys felt that it could not deal with most of the irrational causes of adoption problems. The company, therefore, decided to hold on to something more tangible and feasible in order to achieve measurable outcomes. Some of these sentiments are captured in the following quotations:

> SME does not have money to invest in its future. What we need to do is to reduce the price [for B2C e-stores and the SMEOnline subscription fee] again. (A senior consultant)

> I think the B2B market in Asia is not ready. These comments [SMEs' feedback statements] are unrealistic and ignorant. SMEs cannot embark on e-business simply because most of their internal processes are untidy. (A senior executive)

> I know SMEs are worried about security issues….But there is nothing we can do about it. It's the government's role. You cannot possibly ask us to do all this e-security for our clients. (A marketing director)

In the search for a better strategic position, in October 2000, DecisionSys decided to encourage SMEOnline adoption by building e-communities. The aim was to position DecisionSys as an "e-builder," promoting the adoption of the B2B e-marketplace by building systems to manage online communities for different trade associations. DecisionSys would offer consulting services including customer relationship management, knowledge management, and electronic learning. The company's top team believed that ultimately, when there were enough online communities, B2B transactions would grow.

As the top team gave more of its attention to the e-community idea, it began to consider upgrading the technology infrastructure in order to make the new business model viable. Eventually, the point was reached when no one in DecisionSys discussed the four areas of technology fears any longer. Resources were invested to promote the e-community idea to trade associations. The engineering team concentrated on developing a new version of B2B e-commerce systems that incorporated the functions of an online community. The company explained this important move in technology improvement:

> For Internet business, electronic infrastructure is the foundation of all services. You need to begin by building a solid basis. Otherwise, when you scale up your business, the whole business will falter like the Tower of Pisa. What we can do is to invest in more data centers, security software, and a payment gateway mechanism in order to ensure that the security issue is dealt with effectively. (Chief Technology Officer)

The frame of technology strategy: In Time 3, the technologist was interested in what could be controlled, and thus remedial actions were based mainly on rational decisions (as perceived by the technologist) such as new business model formation and technology enhancement. We can observe three assumptions about technology strategy in the re-orientation period: (1) in order to improve the adoption rate, the technologist thinks they need a more innovative business model; (2) better technological infrastructure is needed to support a viable business model; and (3) better technology can overcome adopters' resistance to technology use, as most of these irrational causes are uncontrollable.

The Outcome of SMEOnline Adoption

By the end of 2000, DecisionSys found that the adoption rate was still unsatisfactory. The company had recruited 250 adopters in the B2B e-marketplace (via B2C e-stores). By early February 2001, the number had dropped to 14. Initially, DecisionSys still managed to maintain up to 200 traders in the chemical e-marketplace. Later in 2000, only 60 infrequent adopters were trading through SMEOnline. The company continued to implement the e-builder business model, and at the same time began to conceive of yet another new business model. The top managers believed that it was normal in the Internet world to maintain ongoing change for the purpose of adaptation.

DISCUSSION AND CONCLUSION

This section explains the preliminary findings of the study by relating the results to the literature on IOS adoption difficulty. Special emphasis is placed on elaborating the concept of technology fears and exploring the previous treatments of this concept.

The Relationship to the Current Literature on IOS Adoption Difficulties

The barriers of IOS adoption suggested by the idea of technology fears cannot be categorized easily into the existing understanding of technological, intra-organizational, and inter-organizational difficulties. In a selected e-marketplace experience, this study suggests that technology fear is a much more decisive adoption barrier in terms of four factors: lack of familiarity (with B2B e-commerce), risk aversion, lack of trust (in trading partners), and incongruent cultural practice. At first glance, the concept of technology fear is similar to the notion of lack of awareness (in EDI technology, as observed in Iacovou et al. 1995). However, a closer examination may lead to a different conclusion (considering that lack of familiarity accounts for only 16% of the adopters' comments counted).

The results indicate that technology fears are more frame-induced. People usually have tacit frames about what technology is and how technology should be used. The tacit frames, which are often unnoticed, can shape customers' justification of—and can influence their action toward—technology adoption. As shown in Figure 1, these different interpretations are typically not articulated; they may result in conflicting expectations and unanticipated consequences. Particularly, we need to note that the adopters' fears of new technology (B2B e-commerce systems) are influenced by their macro-cultural context (the Chinese trading communities in Asia).

This reminds us of Markus and Soh's (2001) discussion of the structural constraints imposed in the Asian business environment. They suggest that researchers should not overemphasize the difficulties in the area of technology and intra-organizational issues when Asian B2B e-commerce is considered. Structural constraints such as poor telecommunications infrastructure, financial infrastructure, language, and culture are also key factors that determine IOS adoption difficulties. This study accordingly focuses on the cultural dimension of the adoption barriers to B2B e-commerce in the cultural group of Chinese business communities. It suggests that IOS adoption difficulties cannot be fully appreciated without understanding adopters' fears of technological use— fears that are directly influenced by the situated cultural context.

With reference to the case study, the rationalist thinking can be observed in Time 1 and Time 3 of this study, where the technologists were striving for better Internet applications to support new business models (in Time 1). Moreover, the technologist decided to ignore the feedback provided by the adopters and move on to building better infrastructure (in Time 3). There was nothing wrong with these actions. But without acknowledging how the adopters perceived the nature of the technology and what they expected from technology-in-use, these well-intended actions were ultimately unsuccessful.

Therefore, the technology fears paradigm offers two useful lessons for IOS adoption. First, we must not see the four elements of technology fears as irrational. The reason why such technology fears are often considered irrational is because the technologist overlooks the expectations arising out of actors' past experiences, which in turn define their perceptions of the probable reactions of others. Thus, the adopters' reactions should be considered as natural because the adopters chose to act in those ways that seemed most likely to produce what they regarded as a satisfactory outcome, and to avoid what they regarded as a threat (as discussed in Silverman 1970, pg. 32).

Secondly, we need to acknowledge the complexity of inter-firm collaboration. IOS adoption involves diverse social actors, in different organizations, who hold very different frames. These social actors, as Schön and Rein (1994, pg. 26) point out, describe what is wrong with the present situation in such a way as to set the direction for their future actions. We can, therefore, understand why the technologist, not reflecting on the rationalist frame (but knowing the adopters' responses), ignored the adopters' feedback and insisted on more rational solutions (as perceived by the technologist). Accordingly, the IT failure had nothing to do with DecisionSys's new ASP strategy nor the business model renewal and better business and technology infrastructure. Without examining the tacit frames of adopters (influenced by their cultural context) and reflecting on the technologist's own frames, well-intended solutions may result in more problems and induce more fears of technology among adopters.

Reflecting on Previous Treatments of Technology Fears

Previous studies have illustrated the concept of technology fears in different contexts of MIS implementation, groupware introduction, and EDI adoption, using various analytical lenses. To show their relevance to this study, we here discuss three particular works by Zuboff (1988), Orlikowski and Gash (1994), and Barrett (1999).

First, Zuboff's treatment of "informated organization" explains that employees are fearful because information systems lead to the abstraction of their physical work. This demonstrates the barriers associated with lack of familiarity and risk aversion. Zuboff cites one factory worker's technology fear:

> When I go out and touch something, I know what will happen. There is a fear of not being out on the floor watching things. It is like turning your back in a dark alley... It all becomes remote from you, and it makes you feel vulnerable. (Zuboff 1988, pp. 63-64)

Orlikowski and Gash's study offers a second treatment of technology fears. From a users' perspective, they describe the lack of familiarity and distrust in the context of groupware adoption:

> I would be more fearful that I'd put something out there [in a Notes database], and it was wrong and somebody would catch it. (Orlikowski and Gash 1994, pg. 96)

Barrett provides the third elaboration of technology fears, in the use of EDI for electronic trading. The adopters (brokers and underwriters in the insurance e-marketplace) were concerned that human negotiation would be replaced by electronic negotiation. Their fears were that the future of their work in risk placement would involve only limited social interactions with their clients. For the adopters, human negotiation and social interaction were seen as vital cultural practices that were inseparable from their everyday work. This fear ultimately led to the deterioration of their relationship with technologists and to the development of feelings of distrust:

> The [underwriting] business is based largely on relationships and trust. This is why it is so vital to carry out business in a face-to-face manner…you are negotiating the business… you use a lot of different skills in negotiating. (Barrett 1999, pg. 12)

The adopters believed that the adoption of EDI would undermine the principle of trust in the market. However, the "real" fear behind this was that once the EDI systems were live, the computerization of work tasks would eliminate the mystique associated with financial service jobs (risk aversion). Table 3 shows the different perspectives on technology fears in these studies. It illustrates how the four proposed adoption problems identified in the present analysis relate to these studies.

Table 3. Different Interpretations of Technology Fears

Author(s)	Context	Technology fears	Descriptions
Zuboff (1988)	MIS automation in factory in the U.S.	The abstraction of industrial work	Lack of familiarity: "There is a *fear* of not being out on the floor watching things. "If I push the wrong button, *will I screw up*?"
Orlikowski and Gash (1994)	Groupware implementation in one organization	Fears of being exploited via electronic texts	Lack of familiarity: "I would be more *fearful* that I'd put something out there [in a Notes database], and it was wrong and somebody would catch it."
Barrett (1999)	EDI adoption in electronic trading in UK's London Insurance Market	The loss of social interactions	Lack of trust: "The [underwriting] business is based largely on *relationships* and *trust*." Incongruent cultural practice: "This is why it is so vital to carry out business in a *face-to-face* manner…"
This study suggests…	B2B electronic marketplace enabled by Internet in Asia (Singapore)	Asian SMEs' fears of new technology	Lack of familiarity: "I know B2B e-commerce is a bit like a big electronic *yellow page*." Risk aversion: "But I *worry* that my role in this company would quickly become unnecessary." Lack of trust: "Before my company is involved in any B2B activity, I want to make sure that these companies I trade with are sound and I won't *get cheated*." Cultural practice: "We value the *Guan-Shi* network before conducting formal businesses."

CLOSING REMARKS

This study explores the barriers to the adoption of inter-organizational systems by the investigation of a failed B2B electronic marketplace in Singapore for SMEs. To appreciate the controversies among the technologist and the adopters, the study has used

the analytical lens of technology frame, which examines how social actors assign meanings to situations and to the actions of others, and how they react in terms of the interpretations suggested by these meanings. It extends the previous work of Orlikowski and Gash by adding process-based analysis (see Figure 1; a new method) to examine B2B e-commerce (a new information system based on the Internet) in the Asian SME business environment (a new context).

The study concludes that researchers need to consider the fear factor in order to achieve effective IOS adoption. Most importantly, technologists should reflect on their characteristically rationalist assumptions and pay more attention to the adopters' frame-induced fears of new technology. In future studies, researchers may find other dimensions of technology fears in other contexts, using different information systems. The findings also provide researchers with a basis for further empirical evaluation of IOS adoption difficulties when issues of structural constraint are considered in the Asian business environment. In terms of practice, managers need to tackle these four barriers in advance and should seek to help adopters overcome their fear of technology use.

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