

B2B e-commerce adoption decisions in Taiwan: The interaction of cultural and other institutional factors

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Abstract

Business-to-business (B2B) e-commerce has become an important initiative among firms in the last few years. This study is based on data derived from over 20 interviews with CEOs, CIOs, and MIS managers in electronics and textile companies in Taiwan. This study contributes to existing literature by describing the degree to which various organizational, industrial, governmental and cultural factors influence B2B e-commerce adoption decisions in Taiwan. It is one of the first studies investigating the interaction of B2B e-commerce adoption decision factors and provides insights into the impact of Chinese culture on B2B adoption. Results indicate that organizational, industrial, governmental, and cultural factors do indeed influence B2B e-commerce adoption decisions. In addition, the nature of the cultural influence is dictated by industry conditions.

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1. Introduction

In recent years, many firms have been undergoing profound transformations in the pursuit of reducing costs and providing better services to customers. Whole value chains between firms and their customers and suppliers are being re-engineered. Inter-organizational systems have been an essential part of managing these changing relationships. In addition, the increasingly internationalization of products and companies has created the need for cross-border inter-organizational relationships that rely on B2B e-commerce systems. Although some research has begun to address adoption of information technology (IT) in general and e-commerce in particular in emerging economies (e.g., India [19], Singapore [61], Malaysia [42], Mexico [27], Brazil [63], and South Korea [43]), there are still many research questions left unanswered.

Despite previous theoretical arguments suggesting that organizational, governmental, industrial and cultural factors have a similar impact on IT and B2B e-commerce adoption, very little empirical research has looked at the extent to which this is true [24,57]. In addition, little research has investigated the magnitude of all these factors on B2B e-commerce adoption in emerging economies. Therefore, the purpose of this paper is twofold. First, we delineate some salient features of organizational, industrial, governmental, and cultural factors that support or hinder the decision to adopt B2B E-commerce systems in Taiwanese companies. Second, we describe the magnitude of the results as they apply to B2B e-commerce adoption decisions in two different industries in Taiwan.

2. Background on Taiwan

As a Newly Industrializing Economy (NIE), Taiwan is unique among Asia-Pacific countries. Both Taiwan's GDP and GDP per capita are situated in the middle of

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the 21 members of the Asia-Pacific Economic Cooperation (APEC), below the US and Hong Kong, and above China [5]. In 2001 Taiwan's Global Competitiveness Ranking (GCR) was 21st [68] and its Network Readiness Index (NRI) ranking was 15th [69]; these rankings are commensurate with Taiwan's economic performance amongst APEC countries. Taiwan produced US\$ 22,157 million worth of IT hardware in 2000, ranking it fourth in the world, just behind the US, Japan, and Singapore [14]. However, Taiwan spent only 1.47% of its GDP on IT products in 2000, below the average of APEC countries. IT applications (e.g., websites, Intranets, electronic data interchange, call centers, and electronic funds transfer) used by the manufacturing industry in Taiwan were below the global average [13]. Despite a well-developed information infrastructure and export-driven economy, Taiwan's B2B e-commerce sales comprised less than 1% of its GDP in 2000 [29].

According to United Nations Conference on Trade and Development (UNCTAD) *E-commerce and Development Report 2004*, while economic levels and adoption of information and communication technology (ICT) have a positive correlation, countries with similar levels of GDP have very different levels of adoption of ICT, and vice versa [66]. Given the contradictory macro-statistical facts between Taiwan's economic performance and IT application use, we are interested in understanding what drives B2B e-commerce adoption by companies in different industries in such an emerging economy. In this paper, we focus specifically on how the organizational, industrial, governmental, and cultural factors support or hinder the decision to adopt B2B e-commerce by Taiwanese companies.

3. IT Adoption literature review and its application to Taiwan

3.1. B2B E-commerce

B2B e-commerce encompasses a wide range of technologies and there is no standard definition. For the purposes of this paper, we have defined B2B e-commerce as the process of deploying information and communication technologies to support the entire value chain from suppliers through the firm to customers [52]. More traditionally, e-commerce has involved the use of electronic data interchange (EDI) in which suppliers' and customers' computers are able to send formatted messages electronically. EDI has been the basis for early supply chain management (SCM) systems. The Internet has opened up a new set of B2B applications. Moving beyond simple web-based ordering systems, customer relations management (CRM) systems allow suppliers to facilitate cooperation and collaboration with their customers [51]. Certain manufacturers are even providing customers with limited electronic access to their enterprise resource planning (ERP) systems to provide them data on the production process and to allow for more advanced forms of electronic collaboration. What is impor-

tant about these examples is that the SCM, CRM and ERP technologies are built on the foundation of mutual interdependence in the buyer-seller relationship [16,56].

We can draw from models of IT adoption to understand B2B e-commerce adoption decisions. IT adoption models recognize both organizational and extra-organizational factors. A brief review of both the conceptual and empirical literature provided below discusses some of the most important factors that affect IT and B2B e-commerce adoption decisions. Where relevant we also report on studies that have evaluated IT/B2B e-commerce adoption in Taiwan.

3.2. Organizational factors and IT adoption

Innovation and adoption research has been used to theoretically explain the relationship between organizational factors and IT adoption [54]. For example, organizational behavior researchers explain the intention of organization adoption of new technology by applying general social-psychological models to the IT context [15]. Such models include the technology acceptance model, the infusion model, and the task-technology fit model [7]. These models focus on characteristics of the technology or users' perceptions of the technology, and assume that the innovation adoption decision is based on rational decision making [30].

Organizational readiness and the degree to which IT infrastructure is sophisticated have often been identified as predictors of successful IT adoption [39]. A cross-country case study, however, shows that organizational readiness is in fact low in many countries due to business cultures that do not support innovation and the use of new technology [29].

The size of the organization has also been identified as a predictor of IT and more specifically, SCM systems adoption [54,57]. Large firms tend to be leaders in adopting e-commerce, as they possess the IT resources and capability to leverage IT investments over a large revenue base. Therefore, some researchers have argued that the dominance of small and medium-sized enterprises (SMEs) in emerging economies poses a structural inhibitor to e-commerce adoption and use [29]. However, a recent empirical study shows that contrary to this belief, firm size does not have a significant effect on B2B e-commerce adoption [30]. Chen [14] found that small firms in the IT industry in Taiwan are pressured to adopt B2B e-commerce systems but do not do so because of the financial and human resource costs. Trappey and Trappey [64] suggest that other organizational considerations for B2B e-commerce adoption decisions in Taiwan are the IT/MIS department budgets; risks associated with upgrades, re-design, and implementation of e-commerce systems; and return on investment.

It has been widely recognized that the support of top management is a crucial success factor in IT adoption [53,54] because top management support and commitment gener-

ally requires personal and managerial knowledge of e-commerce potential [23]. Another critical factor for adoption is that B2B e-commerce be consistent with the company's business strategy [23]. The strongest driver of e-commerce is thought to be a business strategy of protecting and extending existing markets, reaching new markets, or gaining advantage over competitors [29]. In support of this view, Tsao, Lin and Lin [65] investigated 300 Taiwanese small and medium size enterprises (SMEs) and found that the central issues in adopting B2B e-commerce are internal factors such as the consistency between B2B e-commerce and business strategies, reducing operating expenses, increasing transactions, or developing new markets.

3.3. *Extra-organizational factors and IT adoption*

The relationship between extra-organizational factors and IT adoption can be partially explained by institutional theory. Institutions are "any standing social entity that exerts influence and regulation over other social entities" [40]. Researchers from the area of New Institutional Economics define the institutional environment as the "set of fundamental political, social and legal ground rules that established the basis for production, exchange and distribution" [50]. Literature in institutional theory posits that pressures exerted by industries, governments, and cultures influence the structure and operations of organizations [20,48]. Institutional contexts may be particularly important when IT systems crossover both organizational and international boundaries; however, studies of the effects of institutions on information technology phenomena are limited [17,41]. In addition to the organizational factors discussed earlier, Shore proposes that three institutional factors influence successful data sharing between corporations: the nature of the industry; government support; and national culture [57]. We now discuss these three institutional factors in turn.

3.3.1. *Industrial factors and IT adoption*

The industry within which an organization operates may be instrumental in determining the degree to which an organization participates in B2B e-commerce [57]. King et al. [40] argue that trend-setting companies (defined as powerful domestic companies performing important functions that have influence) and multi-national corporations (defined as cross-national companies that influence the movement of technology where they operate) both have influence on IT innovations. Industry pressures could involve a dominant customer pressuring its suppliers to implement relationship-specific IT investments such as EDI, SCM, or CRM [22,56]. International companies often insist that Asian suppliers use particular electronic services or lose their business [47]. B2B e-commerce systems tend to be tightly coupled systems and must work together seamlessly. In addition, they tend to be expensive and require a lot of manpower to implement so it is important that any decision a company makes with regard to a

B2B e-commerce system will be supported by the companies with which it has relationships. Industries driving e-commerce tend to be in sectors that are internationally competitive (e.g., electronics; textiles) since firms in those industries are motivated to adopt e-commerce in order to enhance productivity and provide better services [29].

Taiwan is a major producer of computer hardware and semiconductors in the world market. Beginning in the second half of the 1990s, Taiwan's IT industry faced a challenge in preserving their position in the global production network while relocating their manufacturing activities to China. E-commerce played an important role in this restructuring process. In the PC industry large firms are driven by international brand marketers to adopt e-commerce systems thereby increasing the speed of orders, production and shipping cycles. E-commerce systems helped Taiwanese firms not only connect to their international buyers, but also coordinate with their upstream suppliers across countries more efficiently and quickly [14,64]. A case study on Taiwan's PC and IC industries find similar industry factors as well as rules established by local industry leaders affect B2B e-commerce adoption [12]. Chen [12] also found that CRM was an important motivation of e-commerce adoption in the IT-related industries that he studied.

3.3.2. *Governmental factors and IT adoption*

Institutional forces may be political in nature as when organizations must conform to government regulations and pressures [6,20,48]. Governments may also play a critical role in creating the institutional environment that fosters private investment [50]. Shore [57] argues that country IT support can be characterized by the availability and quality of labor, technical infrastructure (i.e., data security), attitudes towards cross-border data flow, and national policy for training and maintaining an adequate workforce. Some studies have found that government promotion and investment, especially in SMEs, is a major enabler of e-commerce; national policies such as trade and telecommunication liberalization are also likely to have a big impact on e-commerce, by making IT more affordable to firms and increasing pressure on firms to adopt e-commerce [29].

The adoption of EDI in Singapore was extremely successful due to the government's control of IT developments and by launching a major educational program exposing the business community to EDI; there are similar success stories from other nations [10,58]. Wang [67] used longitudinal data over a 16-year period to conclude that building national ICT infrastructure and regulatory reform were policy choices supporting IT adoption in Taiwan and other newly industrialized economies. However, the potential negative impact of transparent transactions on the complex bargaining relationship between government entities and a firm may actually discourage implementation of B2B commerce [9]. For example, Foster, Goodman and Tan [26] found that many companies in The People's Republic of China were hesitant to adopt technology that made it easier for their own government to determine their financial state.

Another key inhibitor to B2B e-commerce in China is the prevalence of political agendas and short-term goals (due to frequent shifts in power) over long-term investment in IT infrastructure [29].

3.3.3. National cultural factors and IT adoption

Douglas [21] posits that one aspect of institutional theory explains that preferences arise from cultural biases that, in turn, shape positions and preferences in social processes. Culture has been defined as the shared values of a particular group of people [25] and as “the collective programming of the mind which distinguishes the members of one group or category of people from another” [36]. In either case, national culture refers to the idea that a group of people will feel, think and react similarly in a given context.

There are primarily two views on the role of culture in the use and adoption of information technology. The first view is that culture plays no role and organizations adopt technology that is useful and provides them with some economic benefit [1]. An alternative view is that culture plays an important role in determining not only whether organizations in a particular country adopt a certain technology but the degree to which it is accepted and the ways in which it is used [33]. The limited research that has been done in this area seems to support the latter view.

Technologies often reflect the socio-cultural systems of the country in which they are developed [8,60]. Gefen and Straub [28] and Straub [59] found that perceptions and use of information technology differed between Japanese and US workers. Ho, Raman and Watson [35] and Raman and Wei [55] found that perceptions and use of electronic meeting systems were influenced by culture. Hill, Loch, Straub and El-Sheshai [34] found that communicating via technological means is not desirable since it runs counter to the affective nature of communicating with a family member, peer, employer, or employee. Christiaanse and Huigen [17] found that in the case where an inter-organizational system (IOS) was successfully implemented, the implementation process occurred in an egalitarian fashion that reflected the cultural biases of both the users and the producers of the software. In the case where the implementation failed, the actors were unable to reconcile the components of the IOS with the way that work was done. Goodman and Green [31] argued that cultural and political factors are the main explanations for the lack of IT diffusion in the Middle East because the Western assumption that free movement of information has positive connotations violates many Middle Eastern countries.

Burn [10] found that there were a number of cultural inhibitors to the development of a public EDI service in Hong Kong including the unwillingness of organizations to share information and extend their business chains through other organizational networks. One aspect of B2B e-commerce is a willingness to freely share information with other companies. On the other hand, B2B e-commerce systems automate processes that are traditionally done either face-to-face or between individuals who have an

established relationship. Culture may be a factor which encourages or inhibits this sharing of information [57].

Perhaps one of the most accessible frameworks for exploring the role of culture in information technology comes from Hofstede [37]. Based on a survey of 160,000 employees from 40 countries, Hofstede [37] found that national culture explained more of the differences in work-related values than title, gender or age. The five dimensions found in Hofstede’s study are:

- *Power distance*. The extent to which the members of a society accept that the power in organizations is distributed unequally.
- *Uncertainty avoidance*. The degree to which members of a society feel uncomfortable with uncertainty and ambiguity.
- *Individualism vs collectivism*. The extent to which a person sees herself as an individual rather than part of a group.
- *Masculinity vs femininity*. Preference for achievement, heroism, assertiveness and material success as opposed to feminism which refers to a preference for relationships, caring and quality of life.
- *Time orientation*. The relative importance of the here-and-now versus the future.

We also draw from Hall and Hall’s cultural dimension of context [32]. This variable can be described as:

- *High context vs. low context*. The amount of information that surrounds an event, inextricably bound up with the meaning of that event. In a high context culture, the information surrounding an event is already in the person, and very little in the coded, explicit, transmitted part of any communication between participants. In low context cultures, the mass of information is vested in the explicit code.

The Taiwanese culture is rated as relatively high on the dimensions of power distance and uncertainty avoidance, very high on the dimensions of collectivism and long-term orientation, and relatively low on the dimension of masculinity compared to other countries [37,38]. Taiwan is seen as a high context society as determined by Hall and Hall’s [32] cultural dimensions and is related to the notion of *guanxi*. *Guanxi* is most often used to refer to the importance of whom one knows but it is also the reciprocal interdependencies that result from the relationship. In doing business with Chinese companies much has been made of the need for *guanxi*. The concept of *guanxi* has a close interdependence with Hofstede’s cultural dimensions of collectivism, high uncertainty avoidance and low masculinity.

3.4. Summary of the literature review

In conclusion, previous research reveals some organizational, governmental, and industrial factors contributing to

B2B e-commerce adoption in Taiwan. However, the reason that B2B e-commerce adoption in Taiwan is low relative to comparable economies is still unclear. In order to address this question, we examine the extent to which organizational and extra-organizational factors have a positive or negative effect on B2B e-commerce adoptions when examined within the context of a specific industry. Finally, adoption studies do not typically include national cultural factors, but with an increasing emphasis on IT diffusion in the context of globalization, there is a need to discuss potential cultural impacts as well as empirically check for their significance [44]. Considering the representativeness and uniqueness of Taiwan's society, geography, technology, and culture among Asian emerging economies, this study on the interaction of organizational, industrial, governmental, and cultural factors in Taiwan will not only help researchers understand comprehensively the drivers of IT adoption for future study, but may also have public policy implications for other countries.

4. Research questions

Based on the literature review and findings from previous research, this study explores the organizational, industrial, governmental, and cultural factors influencing B2B e-commerce adoption decisions in Taiwan. Two key research questions emerge from the theoretical discussion:

Question 1: When looked at comprehensively, which organizational, industrial, governmental, and cultural factors influence the decision to adopt B2B e-commerce systems in Taiwanese companies?

Question 2: What are the relative strengths among organizational, industrial, governmental, and cultural factors on the decision to adopt B2B e-commerce systems in Taiwanese companies?

5. Research study

5.1. Methodology

The methodology used for this research is both qualitative and interpretive as specified by Miles and Huberman [46]. The four phases of the methodology are data collection, data reduction, data display, and the drawing of conclusions. All the data was text-based and comprised of organizational documents, documents from government agencies, and transcripts of semi-structured interviews with IT staff, CIOs and CEOs of organizations. In these interviews the researchers recorded answers to specific questions on the history of the organization's relationships with its suppliers and customers, its familiarity with various forms of B2B e-commerce, its current and future plans for adopting and implementing B2B e-commerce systems, and the attitudes influencing their B2B e-commerce-related deci-

sions. As soon as possible after each interview, a written transcript was developed. Any other information that was collected (informally before or after the interviews) was written down as soon as possible after the interview was completed.

These reports and documents were then analyzed by comparing the information in them to the parameters of organizational, industrial, governmental and cultural factors as laid out earlier in this paper. We extracted only that data which relates to these four factors. The specific parameters are displayed in Table 1.

5.2. Data collection methods

We picked interviewees from two manufacturing industries, electronics and textiles, for the following reasons. According to Chen's research on Taiwan's industry structure [14], the share of manufacturing in Taiwan's GDP declined from 33.3% in 1990 to 26.3% in 2000; however, the manufacturing sector is more receptive to e-commerce than the service sector because of its close linkage to American firms that are leading the drive toward electronic transactions. Within the manufacturing sector, the electrical and electronics sector accounted for 36.7% of total manufacturing output in 2000; in contrast, the traditional textiles and apparel sector showed a rapid loss in their output share, representing only 5.1% in 2000 [14]. Therefore we believe the data from these two industries is representative and comparable for analysis.

Table 1
Impact of factors on B2B adoption decisions in the electronics and textile industries

Factors	Impact on B2B in electronics industry	Impact on B2B in textile industry
<i>Organizational</i>		
IT Sophistication	++	+
Top Management Support	++	--
Firm size	++	NA
<i>Industry</i>		
Importance of responsiveness	++	+
Importance of cost cutting	+	--
Multinational companies	++	++
Trendsetting companies	++	N/A
<i>Government</i>		
Policies promoting B2B	++	-
Subsides promoting B2B	++	+
<i>Culture</i>		
Power distance	++	-
Uncertainty avoidance	++	--
Individualism vs collectivism	++	-
Masculinity vs femininity	+	-
Time orientation	+	-
High context vs low context	++	--

++, very strong positive effect on B2B adoption decision; +, positive effect on B2B adoption decision; -, negative effect on B2B adoption decision; --, very strong negative effect on B2B adoption decision; N/A, not applicable.

The electronics and textile companies that were included in this study were selected from lists provided by the Taiwan government's Market Intelligence Center. The electronics company list included all the Tier 1 original equipment manufacturers (OEMs) participating in the government's Plan B program. Plan B companies are large Taiwanese original equipment manufacturers (OEMs) such as Arima, Delta and Acer. All but two of the Plan B companies were interviewed. The textile list included over 30 companies.

The data used for this study is descriptive in nature and the method of collection is as follows. Data on the adoption of B2B e-commerce systems in the Taiwanese electronics industry was collected by one of the co-authors during a three-week trip to Taiwan in May. Although not native to the region, the co-author has spent an extensive period of time in Greater China studying telecommunications policy in the region. Participants from the textile industry were interviewed by an additional member of our research team during a one-week period in July. A translator accompanied both interviewers on all of the interviews. In addition, a copy of the interview questions in Chinese was available in case there was any confusion with regard to the nature of the questions. Before the data collection visits, there were preliminary contacts to identify the organizations and interviewees were appropriately informed about the study.

6. Results

6.1. Organizational influences

6.1.1. Electronics industry

The electronics companies we interviewed had all been in business for over ten years. The firms interviewed had between 2000 and 5000 employees and had manufacturing facilities in both Taiwan and the PRC. Many also had operations in North America and Europe.

The IT infrastructure of our participants in this industry was relatively advanced as all of the companies had implemented EDI approximately five years or so ago, primarily using the GE information service's (GEIS) value added network (VAN). Over the past couple of years, the participants also implemented EDI with their larger local suppliers using a Taiwanese based VAN. All of the electronics OEMs that we interviewed had implemented some form of enterprise resource planning (ERP) application. Most of the companies had four or five years of experience with ERP and were involved to some degree in Enterprise Application Integration (EAI). Firms saw that the inter-organizational integration involved in B2B e-commerce had the potential to pay significant dividends because it leveraged the internal integration within the firm.

The top management of the top-tier Taiwanese OEMs, many who had been educated in the West, were committed to implementing, and were willing to make the investments in, sophisticated information technology strategies that integrated B2B e-commerce with ERP and EAI. Top man-

agement support was often cited as a major driver of advanced e-commerce in the electronics industry. One MIS Director explained, "top management supports more B2B connectivity, especially system to system connectivity."

6.1.2. Textile industry

The textile companies we interviewed had been in business between 25 and 50 years reflecting a more mature industry than that of the electronics companies. The firms interviewed had between 2000 and 10,000 employees and had manufacturing facilities in both Taiwan and the PRC.

The companies in the textile industry were much less sophisticated in terms of the use of information technology. Information silos exist that serve as barriers to the automation of the workflow of the firm. Although EDI was used by some firms, some firms had to re-key data into different systems. Because of a lack of enterprise integration, firms were not ready to leverage sophisticated forms of B2B e-commerce. Few of the top managers had been educated in the West and top management commitment to adoption and implementation of B2B e-commerce was unclear. For example, one interviewee said that the MIS department was directly under the Board of Director's control but that the "Director of the Board has not yet realized the importance of B2B." This resulted in a loss of one of their biggest customers.

6.2. Industry influences

As has been shown in previous research [22], industry pressures are a main source of influence in the adoption of technology in Taiwanese businesses. International customers for Taiwanese IT products have been demanding shorter delivery times [2]. This sentiment was echoed in our interviews with Taiwanese MIS managers. When asked why they were automating their value chains, the MIS managers generally responded that, "We have no choice, and we have to stay in business."

6.2.1. Electronics industry

The competitive pressure in an industry does not only influence the initial technology acceptance decision but also influence the type of technology that a firm adopts. The electronics firms, each of which has multiple customers, have found integrating multiple systems into their own ERP system both difficult and expensive. In developing B2B e-commerce systems, it quickly became clear that implementing proprietary web-based solutions had its limitations. Suppliers were confronted with a different interface and procedures for each customer. It was clear that what was needed was a standard-based way of facilitating inter-organizational communication between ERP systems. Under an initiative called Rosettanet, the global electronics industry is collectively developing such process-based standards based on the EXtensible Markup Language (XML) to facilitate inter-organizational communication.

Taiwan is rapidly adopting Rosettanet technology. Although it will take years for Rosettanet, or its replacement, to spread from the initial companies to Taiwan's whole supply chain, the electronics companies are putting the human and technical resources in place to integrate the ERP systems of multiple supply chains. Because the Rosettanet standards are still evolving, there is the possibility that Taiwan's electronic manufacturers, by implementing it now, will be locked into an immature technology. However, it is more likely that they will be in a good position to integrate progressively more advanced technology when it becomes available. By staying at the cutting edge of B2B e-commerce technology, the Taiwanese electronic OEMs are ensuring that they can interface with the communication standards of the world's top computer companies.

Shore [57] suggests that companies entering a high-tech consumer-related industry must develop sophisticated supply chain management systems because the industry is characterized by responsiveness. The electronic companies we interviewed in Taiwan are pressured to be both responsive and to reduce costs. Thus, the investment in B2B e-commerce systems is occurring simultaneously with the movement of manufacturing sites to the PRC. Information from industry association sources and the interviews with electronics company managers agree that industry forces are a leading influence in affecting B2B e-commerce adoption decisions.

6.2.2. Textile industry

Individuals working in the textile industry were also strongly influenced by the industry; specifically, international customers. There is little in the way of industry association sources with regard to the development or adoption of B2B e-commerce systems in the textile industry. However, all of the respondents in our study said that they did not have an extensive CRM or SCM system established but both e-mail and EDI were used to exchange information and even to place orders. In addition, all of the textile company managers we interviewed said that at least one large international company (usually from the US) required that they use a predetermined web site or platform to bid on a particular order. When companies did business with more than one large international company, they were often forced to use different systems. For example, one interviewee stated, "our second largest customer in the US, which requires us to use B2B, retains an agent website other than the one that [the largest customer] uses... we have to purchase another system in order to transact with the second customer."

All of our interviewees were in agreement that their industry is "customer-driven" and they would respond to the requests of their largest customers to engage in B2B e-commerce systems. The interviewees also felt that B2B e-commerce would not succeed in the Taiwanese textile industry until (1) seamless ERP integration had occurred across internal departments, (2) a common platform in

the textile industry was established, and (3) that top management bought into the idea.

The textile industry, in contrast to the electronics industry, is responding mainly to issues of efficiency rather than responsiveness. As mentioned in the interviews, the industry is using various technologies (e-mail, EDI, ERP) so that they can provide cheaper goods to their customers. They are even engaging in the use of these technologies when there are potential downsides because efficiency issues are crucial. This is reflected in one interviewee's comment, "Currently we are worrying more about efficiency of our communication than security issues." Therefore, like in the electronics industry, industry factors have a very strong influence on the degree to which companies are adopting B2B e-commerce systems.

6.3. Government influences

The existence (or non-existence) of governmental policies and incentives are influential in encouraging (or discouraging) companies to adopt B2B e-commerce systems in Taiwan. In contrast to the US, the Taiwanese government has been heavily involved in encouraging B2B e-commerce in some industries [2].

6.3.1. Electronics industry

In 1999, Taiwan's Executive Yuan, the nation's highest administrative body, released the Industry Automation and e-Business Plan commonly known as the A and B Plans that directly influence the electronics industry. Plan A companies refer to the large global customers such as IBM, Compaq, and HP. Plan B companies are the larger Taiwanese original equipment manufacturers (OEMs) such as Arima, Delta and Acer. Tier 2 companies are suppliers to Plan B companies. The goal of this plan is to facilitate the transformation of the personal computer industry in Taiwan as well as other related IT product industries by automating the supply chain process [2]. While Plan A targets automation of the relationships between global companies and their Taiwanese vendors, Plan B targets the supply chains of the Taiwanese vendors and the component manufacturers that support them. Under Plan B, companies implement process-based standards based on XML with 20–30 of their Tier 2 suppliers through the Rosettanet effort. This has required considerable effort on the part of Plan B companies. Although there is much pressure from customers to automate, it is clear that most of the Plan B companies implemented Rosettanet with a few chosen suppliers due to government efforts.

Managers from the electronics companies that we interviewed did feel that the government incentives and plans influenced their decision to implement Rosettanet. For example, one individual said, "The government's Rosettanet program has been very useful to moving our enterprise forward." Another emphasized, "Money helps!" Although the subsidies were important in influencing their decision,

for many firms the government's commitment to and involvement in the Rosettanet standard was a more important incentive. It enabled the Plan B companies to evoke the government plan when "pushing" the system onto their suppliers. This is reflected in one interviewee's comment, "The government made things happen by setting deadlines."

6.3.2. Textile industry

The government's involvement in the textile industry has looked substantially different from in the electronics industry. There is no standard platform that the government has endorsed for the textile industry. Some company representatives saw that as a major problem. "We think that it's necessary for the government to make the standard for the industry." Others seemed to think that it would be better for the industry players to make decisions instead of governments. "Actually, we don't expect too much from the government. We think it's better and practical to do it by ourselves."

Taiwan's Bureau of Industry has developed plans for promoting e-commerce in traditional industries and the government does provide tax deductions for e-commerce implementations. It is, however, nowhere near the outright subsidy of US\$ 29 million that is provided to companies in the electronics industries. The respondents replied that this tax deduction is "inadequate" for the encouragement of adopting a B2B e-commerce system. The lack of government involvement in B2B e-commerce systems in the textile industry has had a big impact on the companies. The people we interviewed with were keenly aware of the degree to which the government was involved in the electronics industry and were disappointed in the government's policies toward textiles. As one respondent put it, "We have given suggestions to the government many times. But the government hasn't protected us... they let the textile industry stand alone."

Thus, both the government policies and monetary incentives have had a huge positive impact on the electronics industry as they move forward with the adoption of the Rosettanet platform. On the other hand, the textile companies feel that the lack of a formal plan by the government has hindered their move to B2B e-commerce systems despite monetary incentives (tax deductions).

6.4. Cultural influences

Since all respondents came from Taiwan, we assumed that they were all representative of the Taiwanese culture regardless of organizational or industry affiliation. We were originally interested in whether or not the cultural factors that have been investigated in previous research were seen to be factors in B2B e-commerce adoption decisions. Our findings suggest that cultural factors do indeed influence adoption decisions but what was surprising is that culture seemed to have differential effects on adoption decisions depending on the interviewees' industry affilia-

tion. To describe our findings, we look at each of the cultural dimensions in turn.

6.4.1. Power distance

The Taiwanese, according to Hofstede, have a relatively large power distance [37] and this is reflected in the way that B2B e-commerce adoption decisions are being made. Within the electronics industry, top-down efforts reflected by industry pressures and government policies have been influential in company decisions to adopt and implement Rosettanet. There seems to be genuine respect and desire for the government to play a strong role in this issue which may not necessarily work in countries where there are low levels of power distance. Power distance in the electronics industry is also reflected in the way that Plan B companies plan to "push" the Rosettanet system onto their Tier 2 suppliers with little resistance.

Within the textile industry there has been little movement by the government, industry associations, or top management in making crucial decisions affecting B2B e-commerce adoption decisions. Many of the people we interviewed (MIS managers/CIOs) saw the benefits of B2B e-commerce and knew that in order for their company to survive they would need to invest in B2B e-commerce systems. However, these individuals felt that the power structure provided them with little opportunity to encourage such investment. Thus, in the electronics industry, government, industry and management forces cumulatively encouraged B2B e-commerce adoption; there was no such concerted effort in the textiles industry. In addition, the cultural tendencies related to power distance inhibited MIS managers from moving forward with B2B e-commerce initiatives.

6.4.2. Uncertainty avoidance

The Taiwanese have a medium-strong desire for uncertainty avoidance [37]. Getting involved with supply chain management through the development of a web-based application represents, at least for the electronics industry in Taiwan, a response based on a relatively high level of uncertainty avoidance. Given the realities of competitive pressure, electronics companies feel they are unable to take the risk of not automating. However, adoption of Rosettanet, which is a standard that is still evolving and is very complex, can only be explained by the fact that the government is pushing the industry to adopt this emerging standard and thus represents the option with the least amount of risk.

For individuals in the textile industry, uncertainty avoidance plays an equally important role in how they have responded to competitive pressures. Textile companies have agreed to engage in some B2B e-commerce where there is the chance of losing large customers and in some cases they have purchased multiple systems and work off of multiple platforms. Within this industry, efficiency has been stressed over responsiveness; thus, there has been more focus on cost-reduction rather than automating inter-

nal and external processes. Many firms in the textile industry also discussed the uncertainty associated with doing business electronically rather than face-to-face. For example, one interviewee stated, “so far we don’t use B2B because in Taiwan personal contacts/relationships are important in doing business in Taiwan.” By interacting with customers and suppliers directly, managers believe they have access to more information. This reduces the risk associated with doing business. Without the influence of the government and a concerted industry policy, the least risky path for textile firms with regard to adoption of B2B-commerce systems is to respond only to the demands of the largest customers.

6.4.3. *Individualism vs collectivism*

According to Hofstede’s research, Taiwanese people have more of a collectivistic orientation than an individualistic one [37]. In the electronics industry, managers were embracing new standards and re-engineering for the good of their companies and their customers. In none of the interviews did we get a sense that the companies’ B2B effort was the result of one individual’s vision or drive. B2B was something that the government, the industry, and the individual companies were committed to from the management on down. The MIS managers were focused on carrying out this collective vision. This was particularly true in the case of implementing Rosettanet, which involved significant difficulties and risks for some MIS managers.

The collectivistic orientation can also help explain why managers in the textile industry have not been as actively involved as the managers in the electronic industry in the adoption of B2B e-commerce systems. Given that there is no agreement among the government, industry associations, and players in the industry on what standard should be used, companies feel uncomfortable going out on their own. The language that was used by the interviewees in the textile industry reflected a collectivistic orientation and a sense that unless decisions were made by a coalition of industry, government, and company representatives, little would be done to adopt B2B e-commerce systems.

6.4.4. *Masculinity vs femininity*

The way that B2B e-commerce systems are implemented may partially reflect the relative femininity of the Taiwanese culture. Within the electronics industry, the fact that Taiwanese firms are implementing B2B systems to enhance their relationships with their customers is a reflection of the femininity of the culture, even if it is also a response to competitive forces. Despite the “pushing” of Rosettanet onto Tier 2 suppliers, Tier 1 suppliers have also shown concern for how their B2B efforts would impact their suppliers. One firm expressed a desire to “track improvements in its suppliers’ performance indicators.” B2B implementation within a more masculine culture may involve a more aggressive approach toward suppliers. Within the electronics industry, some managers expressed the hope that B2B

e-commerce would enable them to improve their personal relationships with the customers and suppliers because they could spend more time nurturing the relationships and less time responding to administrative details.

The femininity trait was reflected in discussions with managers in the textile industry in a couple of ways. First, many managers worried that electronic interactions would reduce the amount of friendships/personal relationships that were so important in business. Second, many employees in textile firms are older and not well-versed in computers. Managers were concerned about how these employees would feel if forced to engage in computer work. “It’s a very big problem that when we want our employees to do their jobs by computer, it is very challenging and hard work for them to do it.” Third, there was a desire for the company to grow in a way that incorporated better relationships with customers and suppliers. “When our ERP can work better than today in the future, we can have better business relationships with our customers and suppliers, and do more things with B2B.” Thus, respondents from both industries expressed concern for their workers and their business partners as they contemplated the move to B2B e-commerce systems.

6.4.5. *Time orientation*

Taiwan’s Confucian culture takes a long-term view [38]. Policy makers and business leaders make decisions based on long-term consequences. This is particularly true of the decision by the government to have each of the Plan B electronics companies implement Rosettanet with a few key customers in the interests of the long-term maturation of Taiwan’s electronics supply chain. The sentiment was that the Taiwanese government felt that the electronics industry is crucial to both the current and future development of the economy; thus, policy and funding should be used to support the industry.

Taiwan’s business and political leaders that we talked to did not see much long-term success for the textile businesses in Taiwan. One interviewee said, “I personally believe in the next few years the textile factories in Taiwan will all be closed. Taiwan will become a transaction agent center, only for placing orders and purchasing.” This interviewee went on to suggest that a good way to survive would be to implement B2B systems that would enable them to become a transaction agent center. On the other hand, some of our respondents felt that the only way they would survive would be to lower their costs and move all their offices and factories to the PRC. Thus, all respondents in the textile industry were making business decisions based on the long-term orientation characteristics of Confucian cultures but they were responding in different ways. Part of the respondents felt that B2B e-commerce would not enable them to survive in this competitive low-cost industry. Others felt that B2B e-commerce systems would enable them to play a different role (that of a transaction agent) in the future textile industry; however, these respondents felt that before moving forward with adopting a B2B

e-commerce system they needed more guidance from the government and the industry.

6.4.6. *High context vs low context*

Taiwanese culture, as most Asian cultures, scores relatively high on Hall and Hall's concept of the importance of context in communications [32]. There is much more meaning to a relationship than is coded in a particular transaction. This is an interesting variable because it gets at the relationship between information and personal relationships. As mentioned earlier, managers in the electronics industries felt that adopting B2B e-commerce systems would allow for better "personal" relationships because administrative issues would have been automated by the system.

In our interviews with textile managers, there was a sense of wariness about B2B systems because it was believed that they would not support high context relationships developed through *guanxi*. Individuals spoke about a "Taiwanese" way of doing business that is very much based on personal relationships. They emphasized the importance of "looking their suppliers in the eyes" when asking for a quote. They felt that automating their processes may not be effective since they will be unable to rely on the personal relationships that have been nurtured over a period of years.

There was a common agreement among the interviewees across industries that the context of relationships was important, but there were different outcomes with regard to adoption decisions. It may be that most of the interviewees who worked for electronics companies, where the decision to adopt B2B e-commerce systems had already been made, felt the need to explain how using B2B e-commerce systems was consistent with their culture. This differed substantially from the responses from individuals with a more traditionally based view, as represented by the textile industry.

For a summary of our findings, please see Table 1. The results of our interviews illustrate how different organizational, governmental, and cultural factors interact with industry conditions to support B2B e-commerce decisions in Taiwan.

7. Discussion and conclusion

Consistent with previous studies on IT adoption in Taiwan, there is strong evidence that organizational, industry, and governmental factors influence B2B e-commerce adoption by Taiwanese companies. Our results go further, however, in showing that culture also provides an explanation for the degree of B2B e-commerce adoption in particular industries. We do not claim that cultural factors are a main driver of adoption decisions but it is clear that cultural factors can help us better understand how the confluence of organizational, industry and governmental factors do indeed influence decision making. One cannot view cultural institutions as independent from organizational, industrial and governmental factors. It is clear in the case of the tex-

tile industry that culture itself hampered the degree to which companies have decided to engage in B2B e-commerce. In the case of the electronics industry, it was clear from the number of times that the interviewees mentioned industry factors that competitive pressures overrode cultural tendencies. In addition, under different industry and government pressures the same cultural values that might be a source of resistance in one circumstance may promote implementation of B2B e-commerce systems in another. In other words, research investigating the role of culture in IT adoption decisions may find no effects of culture until one differentiates between different industries.

We investigated organizational and extra-organizational factors in two different manufacturing industries: electronics and textiles. It would be interesting to explore the extent to which other manufacturing industries are affected by these factors. We expect that older, more traditional industries may interpret their national culture in ways that lead to inhibiting B2B e-commerce adoption decisions. It would also be interesting to explore whether service industries are influenced by these factors. Service industries have grown rapidly in the last two decades and in 2001 they accounted for 68% of the world's GDP [3]. Meanwhile we have seen strategic moves in B2B e-commerce by large service companies in the US financial industry [11]. This is evidenced by the emerging outsourcing taking place in India and active usage of the Internet by service sector companies in Latin America [66]. We expect that organizational considerations of business strategy, restructuring of business relationships with manufacturing industries, industrial standards set by leading companies, and increased deregulation and competition within industries will impact B2B e-commerce adoption in the service sector.

This paper also has important implications for those interested in studying B2B e-commerce adoption in other countries. Although Taiwan and the People's Republic of China (PRC) differ significantly, there are lessons that can be drawn from a study of Taiwan about the impact of Chinese culture on B2B adoption that is relevant for the PRC. The results of our interviews with members of Taiwan's electronic industry show that Chinese culture, given the right combination of industry, government, and organizational pressures, can be very supportive of B2B e-commerce initiatives. But as our interviews of the Taiwanese textile industry have shown, Chinese culture can be a barrier to automation under different combinations of organizational, industrial, and governmental forces.

It has been assumed in the West that every position that can be automated should be automated [45]. The case for automation is not as evident in the PRC and other emerging economies where human labor is cheap relative to enterprise software solutions. More importantly, companies in the PRC are under pressure to put as many people to work as possible [4]. Thus, even if computer solutions are implemented between a PRC company and its customers and suppliers they may be worked on by an army of clerks rather than being routed through an enterprise soft-

ware network. Although Chinese culture tends to be very respectful of power differences, there is also a great distrust of the government in the PRC [26] thus it is important that all four factors discussed in this paper (organizational, industry, government, and culture) be understood when exploring the speed and form of B2B e-commerce adoption in the PRC.

We can also see the importance of understanding the interaction of government, industry, organizational, and cultural factors on B2B e-commerce adoption in other emerging economies such as Ghana. Ghana's government has an initiative to make its textile industry competitive in the world economy. B2B e-commerce adoption has the potential to make the Ghanaian textile industry more responsive to global merchandisers which could give Ghanaian textile companies an advantage over textile companies from other countries [18]. Ghanaian culture is relatively collectivistic such that group members care deeply about one another. Okoli [49] found that high power distance and high uncertainty avoidance in Ghana did not impact e-commerce adoption. However, the presence of "technology champions" did drive information technology adoption [49]. Once one company demonstrated economic success, institutional industry forces mandated that the company be imitated by others.

Thus, the challenge the Ghanaian government faces is how to promote "technology champions" in the textile industry while not stifling innovation – a common predicament of African governments [70]. This challenge is made extra difficult given the high degree of collectivism in organizations whereby individuals are not often willing to stand up for something on their own.

We can also see how a comprehensive understanding of these four factors informs our understanding of B2B e-commerce adoption in developed countries such as the United States. Unlike Taiwan, both the electronics and textile industries in the United States have been rapid adopters of B2B technology. Also, we can see the adoption of B2B e-commerce by large customers has driven the adoption of B2B by their suppliers [53]. In the United States, the electronics industry has also been more advanced than the textile industry in terms of linking ERP systems between organizations [62]. The US government has not directly mandated or financed B2B adoption as the Taiwanese government has. The culture in the United States is, under Hall and Hall's framework [32], relatively low context. Because of its low context culture, US procurement officers are willing to automate relationships at the potential expense of individual personal-based relationships. In the individualistic culture of the United States, a "technology champion" who is not the CEO often drives the adoption of information technology. This is very different from Chinese cultures where technology adoption is more of a collective effort driven by a confluence of government, industry, and management initiatives.

Our results have important public policy implications. Government policies to spur B2B need to take into account

organizational, industrial and cultural factors when making decisions. The same government policy may have different results depending on the culture and industry in which it is enacted. As countries, such as the PRC, try to encourage B2B e-commerce adoption, there is a need for more research into the interaction of industry, culture, and government factors. We have seen from the Taiwanese electronics and textile industries that Chinese culture can be either resistant to or supportive of B2B e-commerce given the right political and economic forces. We encourage further studies that investigate the interplay of organizational, government, industry, and cultural factors.

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