



The effects of knowledge management capabilities and partnership attributes on the stage-based e-business diffusion

Stage-based
e-business
diffusion

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Hsiu-Fen Lin

*Department of Shipping and Transportation Management,
National Taiwan Ocean University, Keelung, Taiwan*

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Abstract

Purpose – This study aims to develop a research model to examine the antecedents of three stages of electronic business (e-business) diffusion (including e-business initiation, implementation and assimilation). The research model features knowledge management (KM) capabilities (knowledge acquisition, knowledge storage, knowledge dissemination, and knowledge protection), and partnership attributes (partner interdependence, partner trust, and partner commitment) as prominent antecedents of stage-based e-business diffusion.

Design/methodology/approach – Data gathered from 398 firms were employed to test the relationships between the research model constructs using a structural equation modeling (SEM) approach.

Findings – The results reveal that the factors for KM capabilities and partnership attributes have different impacts on three stages of e-business diffusion. In particular, knowledge dissemination has a positive effect on all three e-business diffusion stages, demonstrating its importance in the decision to shape e-business diffusion. Moreover, the findings show that three partnership attributes are important enablers during the whole e-business diffusion process.

Practical implications – In the context of e-business, knowledge dissemination activities occur not only within firms, but also between firms and their business partners. Knowledge dissemination enables employees to develop novel solutions to problems that significantly improve on current practices. Hence, the increasing importance of the field of knowledge dissemination is primarily attributed to promotion of successful e-business activities and increased level of e-business implementation.

Originality/value – Theoretically, this study aims to provide a research model that is capable of understanding the determinants of the stage-based e-business diffusion. From a managerial perspective, the findings of this study provide valuable guidelines to policy-makers and practitioners in implementing e-business and accelerating e-business diffusion.

Keywords Electronic business diffusion, Stage-based model, Knowledge management capabilities, Partnership attributes, Knowledge management, Partnership, Partners

Paper type Research paper

Introduction

Driven by growing customer demand and new technologies (such as cloud computing, service-oriented architecture, and Web 2.0), firms are increasingly trying to incorporate internet-based technologies in their business processes and systems, and building internet-based information system (IS) for transacting business with trading partners (i.e. suppliers, carrier partners, and customers). Electronic business (e-business), or the



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use of internet-based technologies to conduct business, is an overall strategy to conduct value chain upstream activities (business to business (B2B)) and downstream activities (business to consumer) by using the internet platform in conjunction with existing information technology (IT) infrastructure (Zhu *et al.*, 2006). E-business also reflects a firm's strategic intention to use the internet to integrate both internal and external information resources, facilitate transactions, improve customer service and strengthen back-office integration (Zhu, 2004; Soto-Acosta and Merono-Cerdan, 2008).

Literature on innovations describes technological diffusion as a process whereby new technology is communicated through various channels over time among members of a social system (Rogers, 1995; Fichman, 2000; Zhu *et al.*, 2006). E-business diffusion may be viewed as an evolutionary process comprising various phases or stages. The literature reviewed by Zhu *et al.* (2006) suggested that a stage-based e-business evolution analysis provides insight into available e-business solutions. Drawing upon the innovation diffusion theory (Rogers, 1995; Fichman, 2000), this study considers e-business diffusion as a series of stages from firm initial evaluation of e-business at pre-implementation stage (e-business initiation), to their formal implementation (e-business implementation), and finally to e-business becoming a routine feature of the firm and it is fully utilized by its employees, suppliers, carrier partners and customers (e-business assimilation).

Although e-business diffusion has IT components, management capabilities must be addressed regarding changes in organizational processes and interaction both within a firm and among firms (Lin and Lin, 2008). Management capabilities possessed by a firm can be thought of as belonging to one of two sets – those that reflect the internal operations and those that develop and improve inter-firm collaboration (Su *et al.*, 2009). Internally focussed capabilities emphasize exploitation of existing knowledge and abilities. In contrast, externally focussed capabilities place an emphasis on using interorganizational networks to build tight relationships with their trading partners. Little empirical work has fully examined the influence of both internal and external management capabilities on the multi-stage e-business diffusion.

Knowledge management (KM) capabilities are organizational mechanisms for generating knowledge continuously; they can encourage acquiring knowledge, storing knowledge, protecting knowledge, and facilitating knowledge sharing in an organization (Gold *et al.*, 2001). KM capabilities focus on the importance of setup of knowledge repositories and building a knowledge-sharing environment for increased awareness and diffusion of e-business. Additionally, to compete effectively, e-business diffusion must happen from B2B within the supply chain as well as within the individual businesses (Matopoulos *et al.*, 2009). Successful e-business firms need to understand how to build, maintain, and govern interorganizational partnerships and collaborative relationships with trading partners (Lee *et al.*, 2005; Pisano and Verganti, 2008). Thus, it is necessary for firms to build and govern external partnerships to improve the efficiency of inter-firm operations and facilitate the e-business evolution. Additionally, Fichman (2000) indicated that the same contextual factors may have differently directed effects on different IT diffusion stages. However, very limited empirical research has been performed to evaluate KM capabilities and partnership attributes that influence the stage-based e-business diffusion.

The objectives of this study are as follows: to identify a comprehensive set of determinants of stage-based e-business diffusion, and posit arguments for KM capabilities and partnership attributes and to examine the influence of KM capabilities and partnership attributes on different e-business diffusion stages including e-business

initiation, implementation, and assimilation). The rest of the paper is laid out as follows. First, a literature review will discuss the research objectives, paying particular attention to stages of e-business diffusion, KM capabilities, and partnership attributes. Second, the research model is developed and tested using 398 IS managers (currently and directly in charge of e-business projects in their companies) in large Taiwanese firms. Third, the research model and hypothesized relationships are empirically tested using the structural equation modeling (SEM) approach, supported by LISREL 8.8 software. Fourth, advice for researchers and practitioners is analyzed and discussed. Theoretically, this study aims to provide a research model that capable of understanding the determinants of the stage-based e-business diffusion. From a managerial perspective, the findings of this study provide valuable guidelines to policy makers and practitioners in implementing e-business and accelerating e-business diffusion.

Literature review

The two main areas of research that serve as theoretical foundations for this study are e-business diffusion stages and contextual factors of e-business diffusion. Key research on these areas is reviewed below.

E-business diffusion stages

According to the innovation diffusion literature (Rogers, 1995), technological diffusion generally refers to the spread of use of new methods, processes, or production systems through a community of firms. E-business diffusion involves not only IT components, but is often augmented by complementary business innovations, including new forms of services, business processes, and organizational structures (Zhu *et al.*, 2006; Lin and Hsia, 2011). E-business diffusion is complex and dynamic, and varies across time with distinct sets of antecedents and also involves different loci of organizational impact (Caniato and Cagliano, 2009). A stage-based e-business diffusion model helps an organization to assess its relative progress in developing e-business solutions (Teo and Pian, 2004; Zhu *et al.*, 2006). Various e-business diffusion models are proposed and validated with multiple IS research. These models are developed by different perspectives. For example, Rajagopal (2002) suggests that the diffusion of e-business applications (such as enterprise resource planning systems) grows through the following six stages: initiation, adoption, adaptation, acceptance, routinization, and infusion. Zhu *et al.* (2006) regarded the e-business assimilation as an innovation diffusion process and proposed a three-stage model. They specify initiation, adoption, and routinization as three stages of e-business assimilation. Chan *et al.* (2012) proposed and validated a three-stage model of e-collaboration diffusion, including evaluation, adoption, and routinization stages.

While the various e-business diffusion models with distinct number of stages, inherently follow a similar diffusion pattern. This pattern can be described as follows: an initiation stage classified for initiation, earliness adoption, and comprehension, where the firm starts to recognize the importance of e-business and prepare for e-business efforts; an implementation stage classified for adoption, adaptation, acceptance, and implementation, where the firm has implemented IT innovation to facilitate linkages between e-business and corporate sustainability; and assimilation classified for routinization, infusion, and assimilation, during the e-business assimilation stage, e-business has widespread application throughout the organization.

E-business diffusion frequently appears to be a multi-stage process, moving from initial firm awareness and evaluation of e-business technologies to potential, acquisition, and widespread deployment (Zhu *et al.*, 2006). E-business literature (Hsu *et al.*, 2006; Lee and Kim, 2007; Lin, 2008) suggested that when decision makers perceive e-business to have clear overall organizational benefits, they are more likely to adopt e-business within and across the organization. E-business initiation stage or the first stage of e-business diffusion is defined as the rating assigned to the potential benefits of e-business before the firm began implementing e-business.

E-business implementation follows e-business initiation. Consistent with innovation diffusion and e-business literature (Rogers, 1995; Zhu and Kraemer, 2002), e-business implementation, the second stage of e-business diffusion, is defined as the degree to which the firm uses internet-based technologies to support value chain activities such as the firm to execute electronic transactions along value chain activities (ranging from marketing, sales, and after-sales services to procurement and supply chain coordination). During the e-business implementation stage, the firm has successfully implemented e-business activates to execute electronic transactions within and across the organization.

Assimilation is often characterized as the final stage in an innovation diffusion process (Swanson and Ramiller, 2004). E-business assimilation, the final stage of e-business diffusion, is defined as the extent to which e-business has successfully implemented to improve overall organizational effectiveness (Fichman, 2000). E-business assimilation represents the steady state in which e-business can effectively adapt to change and enhances organizational performance. During this stage, e-business becomes a routine feature of the firm and it is fully utilized by its employees, suppliers, carrier partners, and customers.

E-business diffusion and contextual factors

KM capabilities. Many researchers have proposed capabilities influencing KM as preconditions or organizational resources for effective KM (Lee and Choi, 2003; Gold *et al.*, 2001; Lee and Lee, 2007). KM capabilities, defined as a firm's ability to acquire, store, transfer, and protect organizational knowledge, is an important basis of a firm's innovative capability, which depends on combining new and existing knowledge (Gold *et al.*, 2001). Tanriverdi (2005) argued that the organization with well-matured KM capabilities can support and promote the evolution of innovation activities. This study focusses on four critical KM capabilities about which the consensus is strongest (Alavi and Leidner, 2001; Gold *et al.*, 2001; Tanriverdi, 2005): knowledge acquisition, knowledge storage, knowledge dissemination, and knowledge protection. KM capabilities encompass the managerial efforts in collecting and creating useful knowledge (i.e. knowledge acquisition), storing that knowledge in the repository to enable employees to access knowledge easily (i.e. knowledge storage), sharing, and distributing knowledge throughout the organization (i.e. knowledge dissemination), and preventing inappropriate knowledge use (i.e. knowledge protection).

Various KM capabilities may affect the progress of the e-business through the different diffusion stages (ALhawamdeh, 2007). For example, in the initiation stage, KM capabilities that expand the creatively envelopes are thought to enable the firm to assess its position and build e-business strategy. As the organization begins the e-business adoption stage, and attempts to appropriate the e-business activities to better suit its own environment, KM capabilities contribute to reduce redundancy,

and respond rapidly to changing environments (Basadur and Gelade, 2006; Fosfuri and Tribo, 2008). More importantly, the key role of KM capabilities in e-business routinization and infusion stages is vital and valuable. By establishing excellent KM capabilities, it is possible for a firm to internalize the obtained knowledge and combine it with existing knowledge so that they can accumulate e-business management experience and reach their goals for organizational innovation.

Additionally, when e-business is first introduced, firms impose a substantial burden on the adopter in terms of the knowledge required to adopt and diffuse it effectively (Lin and Lee, 2005). For example, firms that effectively acquire and integrate knowledge can reduce uncertainty and increase their administrative and technological distinctiveness (Zheng *et al.*, 2010). Creativity and innovation benefit when employees can easily capture and share tangible experiences and accumulated knowledge (Kamasak and Bulutlar, 2010). Greater creativity and innovation is needed in organizational processes to facilitate better decision making in e-business initiatives. The strength of knowledge protection allows more time for the firm to profit from its creations, and also increases the controllability of intangible assets (Hurmelinna-Laukkanen and Puumalainen, 2007). These benefits may further encourage companies to promote and invest in e-business diffusion. Accordingly, this study proposes that KM capabilities in terms of knowledge acquisition, knowledge storage, knowledge dissemination, and knowledge protection provide a positive contribution to e-business diffusion.

Partnership attributes. Partnership refers to “a long-term relationship and is based on mutual recognition and understanding between the transaction parties that each companies’ success in the transaction is intrinsically dependent on the other” (Kim and Park, 2003). Therefore, the essence of the partnership between two firms matches the social exchange relations. Social interaction (such as mutual dependency, trust, and commitment) in e-business firms is related to the following key players: upstream suppliers, downstream customers, and market competitors. In the context of e-business diffusion, developing and maintaining partnerships with trading partners has become critical because online transactions are characterized by unpredictability, a multidisciplinary nature, and variability in internal and external business environment (Ramamurthy *et al.*, 1999; Lee and Lim, 2003; Ranganathan *et al.*, 2004; Fearon *et al.*, 2010).

The evolution of e-business from one stage of maturity to the next requires e-business firms to develop and sustain effective relationships with trading partners (Lin and Hsia, 2011). Willcocks *et al.* (2007) indicated that IT diffusion is an evolutionary process of three stages: delivery, reorientation, and reorganization. In the delivery stage, e-business diffusion focusses on business-IT strategic alignment and aims to develop market innovations. Fostering external partnerships can help firms to understand market needs and the potential of the industry, and then facilitate firms to orchestrate e-business initiatives. As the e-business diffusion proceeds into the reorientation stage, e-business diffusion should increase its focus on broadening partnerships and facilitating inter-firm collaboration, as well as its impact on the potential participations to adopt e-business (Lin and Hsia, 2011). In the reorganization stage, the firm has to focus more on the external market, integrating technical services with e-business transformation, and improving organizational performance. The ability to facilitate a wider dialog between trading partner and improve effectiveness in the establishment of long-term collaboration is considered to be correspondingly critical for e-business success. Therefore, when e-business evolves through different

stages, organizational partnerships, and collaborative relationships with trading partners are significant for increased e-business diffusion.

According to social exchange theory, interdependence, trust, and commitment are regarded as the important partnership attributes when one firm needs to influence another's decisions (Lee and Lim, 2003). Coyle *et al.* (2003) further argued that partnership-based linkage with supply chain partners can be viewed as the vertical integration collaboration. Vertical integration of supply chain activities are built on mutual sharing of business risks, trust, commitment, and reciprocity. Partner interdependence refers to the extent to which the firm's need to maintain a relationship with trading partners in order to achieve its goals (Heikkila, 2002). Partner interdependence created from the interorganizational collaboration would minimize risks and cost burdens of supply chain partners (Coyle *et al.*, 2003). Partner trust refers to the degree of confidence and willingness between trading partners (Ratnasingam and Pavlou, 2003). Partner commitment refers to the degree of relationship continuity pledged between trading partners (Lee and Kim, 1999). Close partnerships based on mutual trust and commitment can have positive impact on the level of internet-based IS usage (Yeung *et al.*, 2009). Lin and Hsia (2011) also indicated that successful e-business evolution often involve a high level of interdependency between firms and trading partners. Hence, it is reasonable to believe that a good transaction climate with mutual dependency, trust, and commitment may play a critical role in achieving successful e-business diffusion.

Research model and hypotheses

Based on the above literature, the research model was developed that combines factors identified in theoretical and empirical research as important determinants of e-business diffusion. This study focusses on KM capabilities (e.g. knowledge acquisition, knowledge storage, knowledge dissemination, and knowledge protection) and partnership attributes (e.g. partner interdependence, partner trust, and partner commitment) as determinants of three stages of e-business diffusion (including e-business initiation, implementation, and assimilation). The research model is proposed to address this issue (see Figure 1). Each variable involved in the research model and hypotheses are discussed next.

KM capabilities and e-business diffusion

Knowledge acquisition refers to the business process involving the accumulation of knowledge and the creation of new knowledge from existing knowledge (Gold *et al.*, 2001). Administrative and technological innovations require concerted effort and experience in recognizing and capturing new knowledge (Drucker, 1993). Researchers found that firms with high ability to acquire valuable knowledge are more likely to implement e-business and realize its benefits (Lin, 2008). E-business diffusion is not only the application and usage of IT, but also is driven by acquisition knowledge and skills (Lin and Hsia, 2011). Firms that can effectively acquire valuable knowledge are likely to modify their knowledge stock, thus facilitating e-business diffusion. Knowledge acquisition is thus expected to influence three stages of e-business diffusion:

- H1a, b, c.* Knowledge acquisition relates positively to (a) e-business initiation, (b) e-business implementation, and (c) e-business assimilation.

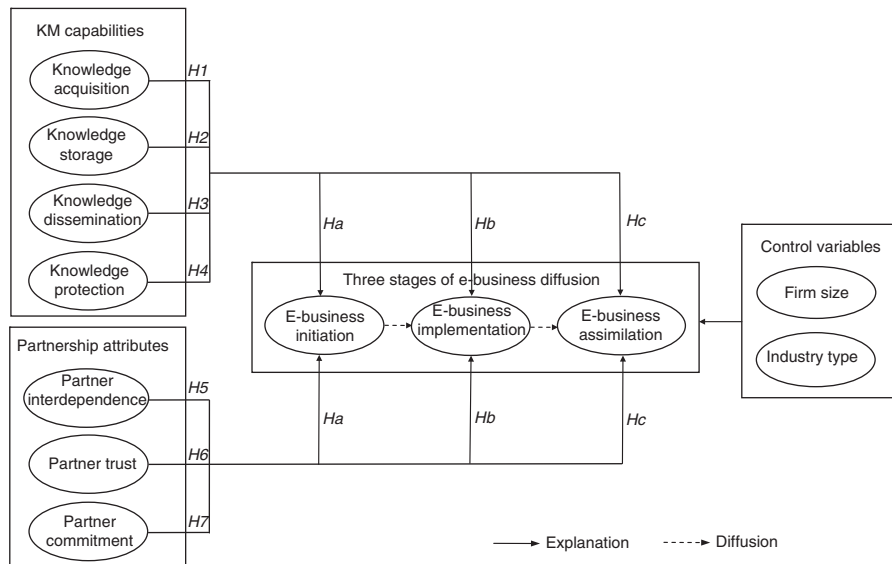


Figure 1.
Research model

Knowledge storage represents the business process by developing organizational memory (i.e. stocks of organizational knowledge) and means of accessing its content. Knowledge storage involves organizing, structuring, storing, combining, accessing, and linking digital storage such as documents and images with knowledge units. Firms need to organize and structure knowledge to make it easier for employees to access (Zheng *et al.*, 2010). Particularly, scholars have argued that knowledge storage implies combining and integrating knowledge, which can increase knowledge exploitation by making knowledge more easily accessible, possibly resulting in process and technology improvements (Kankanhalli *et al.*, 2005). Therefore, high knowledge storage capabilities may result in more mature e-business activities and facilitate the e-business diffusion:

H2a, b, c. Knowledge storage relates positively to (a) e-business initiation, (b) e-business implementation, and (c) e-business assimilation.

Knowledge dissemination can be defined as the business processes that distribute knowledge among all individuals participating in process activities. According to the survey of Caloghirou *et al.* (2004), openness toward knowledge dissemination is important for improving innovative performance. From IT adoption perspectives, knowledge transfer, knowledge dissemination, and practical application of knowledge are critical drivers for developing technological innovations (Johannessen *et al.*, 1999; Allard and Holsapple, 2002; Johannessen, 2008; Pollalis and Dimitriou, 2008; Chong *et al.*, 2009). Firms that stimulate and improve knowledge dissemination processes are more likely to continue using e-business applications (Liebowitz, 2002). Thus, knowledge dissemination capability is one of the important factors to predict the stage-based e-business diffusion. The following hypothesis is formulated:

H3a, b, c. Knowledge dissemination relates positively to (a) e-business initiation, (b) e-business implementation, and (c) e-business assimilation.

Knowledge protection refers to the ability to protect organizational knowledge from illegal or inappropriate use or theft. Previous research has considered two types of knowledge protection approaches to be important: formal protection (e.g. patents, copyrights, trademarks), which rest upon legal protection, and strategic protection (e.g. secrecy, lead time, complex design), which is built around organizational processes and procedures (Encaoua *et al.*, 2006). Formal and strategic knowledge protection is necessary for preserving organizational competitive advantage (de Faria and Sofka, 2010). Moreover, firms should contract with employees regarding the protection of confidential information, and should also establish employee rules of conduct and design jobs so as to incorporate security-oriented KM processes. Hurmelinna-Laukkanen (2011) also suggested that successful management of innovation projects depends on effectively protecting knowledge-based resources. Consequently, this study expects a close relationship between knowledge protection and three stages of e-business diffusion:

H4a, b, c. Knowledge protection relates positively to (a) e-business initiation, (b) e-business implementation, and (c) e-business assimilation.

Partnership attributes and e-business diffusion

Partner interdependence results from a relationship in which both organizations perceive mutual benefits from interacting (Lee and Kim, 1999). Both parties recognize that the advantage of interdependence provides benefits greater than either could attain singly (Simatupang and Sridharan, 2002). Previous studies (e.g. Ferrer *et al.*, 2010) provide evidence that cooperative interdependence between partners contribute to mutual success since such interdependence acts as a solid foundation for successful supply chain performance. Ranganathan *et al.* (2004) recognized the importance of partner interdependence in web-enabled supply chain activities, and increased levels of interdependence have been found to be associated with supplier-retailer collaboration (Sheu *et al.*, 2006). Accordingly, high partner interdependence is believed to promote the stage-based e-business evolution:

H5a, b, c. Partner interdependence relates positively to (a) e-business initiation, (b) e-business implementation, and (c) e-business assimilation.

Partner trust can best be described as being one party having confidence in the reliability and integrity of the other partner involved in an exchange (Morgan and Hunt, 1994). Partner trust is often emphasized as the main issue in building interorganizational collaboration, but it also results from long-term relationships between firms and trading partners (Chen *et al.*, 2011). Because of the high uncertainty associated with internet-based technologies, firms can behave opportunistically on the e-business context, leading to unpredictable behavior. Lam *et al.* (2008) and Lances and Lages (2006) suggested that trust-based relationships allow trading partners to make relationship-specific investments and engage in value chain activities. Srinivasan (2004) also proposed that online trust in the e-business context is assuming increasing importance. Consequently, this study expects an important relationship between partner trust and three stages of e-business diffusion:

H6a, b, c. Partner trust relates positively to (a) e-business initiation, (b) e-business implementation, and (c) e-business assimilation.

Partner commitment appears to be another crucial factor for achieving partnership success (Morgan and Hunt, 1994; Gundlach *et al.*, 1995). Partner commitment includes a strong belief in and acceptance of the mutual objectives in successful partnerships, and the willingness to exert considerable efforts on behalf of the relationship (Lee and Kim, 1999). Partner commitment (i.e. the willingness of trading partners to exert the effort necessary to enhance relations) affects the extent to which firms undertake electronic data interchange use and performance (Lee and Lim, 2003). MacDonald and Smith (2004) support the view that partner commitment is a crucial element to facilitate the implementation success of e-commerce activities. Therefore, the high level of partner commitment may result in collaborative arrangements and alliances that promote more mature e-business diffusion stages:

H7a, b, c. Partner commitment relates positively to (a) e-business initiation, (b) e-business implementation, and (c) e-business assimilation.

Control variables

This study includes two control variables to account for contextual differences: firm size and industry type. First, firm size may be positively related to strategic renewal and innovation efforts, since large firms are more likely to possess slack resources (Cohen and Levinthal, 1989). Second, industry type is used to control for industry-specific differences that may affect the stage-based e-business diffusion, as manufacturing and service industries differ in the extent of e-business implementation (Hsu *et al.*, 2006). The use of these variables in the research model helps control for firm- and industry-level differences that might affect e-business initiation, implementation, and assimilation.

Research method

Construct operationalization

Measurement items were developed on the basis of comprehensive literature review and interviews of managers (in charge of e-business projects in their companies) and expert opinion. After which, the survey pre-testing was carried out to ensure content validity and refine the items. The pre-testing focusses on instrument clarity, question wording and validity. During the pre-testing, three MIS management profession and five IS managers are invited to comment on the questions and wordings. The comments of these eight individuals then provided a basis for revisions to the construct measures. The operationalization of constructs and prior research support, are listed in the Appendix and discussed below.

Independent variables. First, knowledge acquisition was measured using three items, which assessed a firm's ability to acquire knowledge that is useful for developing creative new products or services (Becerra-Fernandez and Sabherwal, 2001; Gold *et al.*, 2001). Second, knowledge storage was measured using four items taken from Alavi and Leidner (2001) and Gold *et al.* (2001), which focussed on a firm's ability to codify, organize, access, and integrate relevant knowledge from organizational memory. Third, knowledge dissemination was measured by three items drawn from Gold *et al.* (2001). Knowledge dissemination focussed on a firm's ability to transfer knowledge within and outside the organization. Fourth, knowledge protection was measured by a firm's ability to protect organizational knowledge from illegal or inappropriate use or theft, a four-item scale was adapted from Gold *et al.* (2001). Fifth, partner interdependence was measured with a four-item scale that was modified from

Smith (1997) and Lee and Lim (2003). These items assessed mutual need recognition between firms and trading partners. Sixth, partner trust was measured the extent to which the confidence and willingness existing between firms and trading partners. A four-item measure taken from the work of Lee and Kim (1999) was modified to assess partner trust. Finally, partner commitment was measured using four items which focussed on willingness of firms and trading partners to expend effort on making the relationship successful (Lee and Kim, 1999; Lee and Lim, 2003).

Dependent variables. Initially the main task of a potential adopter is to gather relevant information on the IT adoption and assess its potential benefits (Rogers, 1995). Thus, e-business initiation was measured by how the potential benefits of e-business adoption were rated before the firm began adopting e-business. Six items were used: facilitate information sharing within the firm, facilitate information sharing with trading partners, provide better products or services, expand market for existing products or services, improve customer services, and gain competitive advantages (Ramamurthy and Premkumar, 1995; Zhu, 2004). Second, e-business implementation was measured by an aggregated index: whether the firm had used internet-based technologies to manage value chain activities. The eight items, ranging from upstream procurement, downstream sales, marketing to after-sales services, were based on the value chain model (Zhu *et al.*, 2006; Li *et al.*, 2010). Then, this study aggregates eight e-business implementation items and converted them into a five-point scale to form the dependent variable, e-business implementation. This approach has been suggested by the literature to measure the IT implementation (Grover and Goslar, 1993). Third, e-business assimilation was measured using four items to ask respondents about the extent to which e-business have been successfully implemented to increase sales revenue, increase staff productivity, decrease logistics cost, and improve overall organizational effectiveness. These items were adapted from Ramamurthy *et al.* (1999).

Control variables. Firm size was measured by the number of employees in the entire organization, log-transformed to reduce data variance. Industry type contains two categories, that is, manufacturing and service-oriented (including retail/wholesale distribution and financial services) industries. Industry type was coded as a dummy variable by identifying the nature of a firm's business (manufacturing or service) and then coding it as 0 for manufacturing and 1 for service.

Sample and data collection

Samples were restricted to the listed companies in order to include large-scale companies in Taiwan. Annual survey of Taiwan's large enterprises by *Common Wealth Magazine* is the source for sampling because it analyzes top 1,600 Taiwanese firms (including 1,000 manufacturing, 500 retail/wholesale distribution, and 100 financial service firms). Therefore, in this study, the population is the top 1,600 Taiwanese firms, published by 2010 *Common Wealth Magazine*. To ensure that IS managers received the questionnaire and maximize the response rate, six research assistants spent one-month telephoning these 1,600 firms; they asked the target firms whether they have implemented e-business and asked for the name of the IS managers (currently and directly in charge of e-business projects) in their companies. Firms that were not adopters of e-business or lacked permission to participate in the survey were removed from the list. As the result, about 1,150 firms across different industries formed the sampling frame for this study. The final questionnaires were mailed to the 1,150 IS managers in the spring of 2011. A cover letter explaining the study objectives

and stamped return envelope were enclosed. Follow-up letter were sent approximately one month after the initial mailing.

In total, 406 of the 1,150 firms responded, with 398 having complete data available for subsequent analysis, yielding an effective response rate of 34.6 percent. Table I shows the characteristics of the responding firms in terms of industry, total assets, number of employees, and respondent title. All respondents had worked in the firm for an average of 13.8 years. This finding result indicates that respondents are sufficiently knowledgeable to answer the survey.

Additionally, this study conducts two statistical analyses to ensure the absence of non-response bias (Armstrong and Overton, 1977). First, this study compares the responding and non-responding firms in terms of company assets and employee numbers. This information is available from the 2010 *Common Wealth Magazine*, and the independent sample *t*-test revealed no significant difference between the two groups ($p = 0.109$ and 0.117 , respectively). The respondents are then divided into two groups based on return dates. Comparison of the two groups in terms of company assets and number of employees again revealed no significant differences based on the independent sample *t*-test ($p = 0.168$ and 0.094 , respectively). Therefore, non-response bias should not be a problem in this study.

Due to the collection of all measures from the same source, this study uses the Harman single-factor test to examine the problem of common method variance (Podsakoff *et al.*, 2003). According to this approach, significant common method variance becomes evident if a single factor emerges from principal component analysis, or if one factor overwhelmingly accounts for the majority of covariance among the variables in an unrotated factor analysis. Because more than one factor emerged to explain the variance in our analysis, common method bias is unlikely to be a serious problem in this study.

Demographic characteristics	Frequency	Percentage
<i>Industry</i>		
Manufacturing	263	66.1
Retail/wholesale distribution	108	27.1
Financial services	27	6.8
<i>Total assets (NT\$)</i>		
Less than \$10 billion	123	30.9
\$11-\$50 billion	165	41.5
\$51-\$100 billion	51	12.8
Over \$100 billion	59	14.8
<i>Number of employees</i>		
Fewer than 1,000	170	42.7
1,001-5,000	191	48.0
5,001-10,000	20	5.0
Over 10,000	17	4.3
<i>Respondent title</i>		
Chief information officer	206	51.8
IS manager	112	28.1
Other manager in IS department	48	12.1
Others (IS analyst, IS specialist/engineer, other manager)	32	8.0

Note: $n = 398$

Table I.
Demographic
characteristics of the
responding firms

Data analyses and results

This study used the SEM to test the research model, supported by LISREL software (version 8.8) (Joreskog and Sorbom, 1996). LISREL software was chosen primarily because of its emphasis on the overall variance-covariance matrix and the overall model fit (Fornell and Bookstein, 1982). As the first step of the Anderson and Gerbing (1988) procedure, the measurement model used confirmatory factor analysis to test reliability and validity of the constructs. Then, the structural model examined the associations hypothesized in the research model.

One assumption of using maximum likelihood estimate in SEM is based on use of normal data. In case this assumption cannot be met, there are several solutions, including the use of other estimation procedures such as robust maximum likelihood (RML) (West *et al.*, 1995; Olsson *et al.*, 2000). Many researchers suggested that Satorra-Bentler χ^2 appears to be a reasonable approach to dealing with non-normality in samples (Curran *et al.*, 1996; Finney and DiStefano, 2006). Therefore, the RML method was used to estimate parameters for the present study and fit indices that are less sensitive to non-normal data (Satorra-Bentler χ^2) were used to interpret the model fit.

Testing the measurement model

For the measurement model to have sufficiently good model fit, several goodness-of-fit (GFI) indices were chosen to evaluate the overall model fit (Hair *et al.*, 1998; Kline, 2005): Satorra-Bentler χ^2 test ($p > 0.05$, in SEM non-significant χ^2 indicates a good model fit), GFI ≥ 0.90 , adjusted goodness fit index (AGFI ≥ 0.90), root mean square error of approximation (RMSEA ≤ 0.08), comparative fit index (CFI ≥ 0.90), and non-normed fit index (NNFI ≥ 0.90). As shown in Table II, all model-fit indices exceed commonly accepted levels with the exception of GFI (0.839) and AGFI (0.802). Although GFI and AGFI were below the recommended level of 0.90, they were all above 0.80, which is deemed acceptable for most studies (Seyal *et al.*, 2002). Therefore, the measurement model exhibited a good fit with the data collected. The measurement model was further assessed for construct reliability and validity (see Table II). The Cronbach's α values for all constructs exceed the 0.7 thresholds for acceptable reliability, as suggested by Nunnally (1971). Additionally, the composite reliabilities of the constructs ranged between 0.807 and 0.913, which exceed the recommended cut-off level of 0.70 (Nunnally and Bernstein, 1994). All constructs in the model satisfied the requirements for convergent validity (standardized loadings > 0.5 and significant at $p < 0.01$) (Hair *et al.*, 1998; Gefen *et al.*, 2000) and discriminant validity (average variance extracted greater than each square correlation) (Fornell and Larcker, 1981), suggesting adequate reliability, convergent validity, and discriminant validity.

Testing the structural model

A similar set of fit indices was used to examine the structural model. Comparison of fit indices with their corresponding recommended values provided evidence of a good model fit (Satorra-Bentler $\chi^2 = 888.831$, $df = 670$, $p = 0.102$; RMSEA = 0.029; GFI = 0.835; AGFI = 0.800; CFI = 0.992; NNFI = 0.988). Therefore, this study could proceed to examine the path coefficients of the structural model. Table III shows the standardized paths in the structural model. Within the KM capabilities, knowledge acquisition has no significant paths to e-business initiation and implementation, contrary to *H1a,b*. Knowledge acquisition has significant and positive path

Constructs	Range of standardized loadings ^a	Cronbach's α	Composite reliability	Correlation matrix														
				(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)			
(1) Knowledge acquisition	0.710-0.925	0.829	0.870	0.831														
(2) Knowledge storage	0.593-0.809	0.784	0.820	0.569	0.730													
(3) Knowledge dissemination	0.771-0.933	0.858	0.901	0.720	0.638	0.869												
(4) Knowledge protection	0.832-0.868	0.915	0.913	0.583	0.636	0.590	0.852											
(5) Partner interdependence	0.630-0.950	0.825	0.880	0.321	0.534	0.423	0.328	0.807										
(6) Partner trust	0.558-0.942	0.849	0.851	0.403	0.519	0.344	0.416	0.315	0.774									
(7) Partner commitment	0.732-0.876	0.906	0.904	0.308	0.393	0.323	0.334	0.280	0.379	0.808								
(8) E-business initiation	0.567-0.811	0.831	0.855	0.432	0.548	0.489	0.364	0.486	0.440	0.378	0.707							
(9) E-business implementation	<i>na</i>	<i>na</i>	<i>na</i>	0.246	0.312	0.218	0.244	0.246	0.222	0.297	0.310	<i>na</i>						
(10) E-business assimilation	0.649-0.711	0.752	0.807	0.587	0.630	0.622	0.599	0.576	0.515	0.435	0.674	0.264	0.715					
(11) Firm size	<i>na</i>	<i>na</i>	<i>na</i>	0.126	0.154	0.079	0.073	0.015	0.118	0.143	0.082	0.116	0.187	<i>na</i>				
(12) Industry type	<i>na</i>	<i>na</i>	<i>na</i>	0.093	0.063	0.055	0.143	0.127	0.149	0.198	0.196	0.270	0.093	0.055	<i>na</i>			

Notes: *na*, loadings, composite reliability, and average variance extracted (AVE) are not applicable to the single-item constructs. Satorra-Bentler $\chi^2 = 863.245$ ($df = 667$, $p = 0.087$); GFI = 0.839; AGFI = 0.802; RMSEA = 0.027; CFI = 0.990; NNFI = 0.9896. ^aAll standardized loadings are significant at $p < 0.01$ level. Diagonal elements represent the AVE, while off-diagonal elements represent the square correlations. For adequate discriminant validity, diagonal elements should be greater than corresponding off-diagonal elements

Table II.
Results of the
measurement model

Table III.
Results of the
structural model

Path from	Ha. E-business initiation	Path to Hb. E-business implementation	Hc. E-business assimilation
H1. Knowledge acquisition	0.084 ^{ns}	0.086 ^{ns}	0.128**
H2. Knowledge storage	0.247***	0.168**	0.019 ^{ns}
H3. Knowledge dissemination	0.167**	0.159**	0.168***
H4. Knowledge protection	0.041 ^{ns}	0.006 ^{ns}	0.176***
H5. Partner interdependence	0.234****	0.138**	0.354****
H6. Partner trust	0.125**	0.120 **	0.158***
H7. Partner commitment	0.085*	0.139**	0.093**
<i>Control variables</i>			
Firm size	0.025 ^{ns}	0.059 ^{ns}	0.116***
Industry type	0.023 ^{ns}	0.026 ^{ns}	0.021 ^{ns}
R ² (%)	47	21	68

Notes: ns, Non-significant. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$; **** $p < 0.001$

to e-business assimilation (path coefficient = 0.128, $p < 0.05$), supporting *H1c*. Knowledge storage has significant and positive paths to e-business initiation (path coefficient = 0.247, $p < 0.01$) and e-business implementation (path coefficient = 0.168, $p < 0.05$), leading support for *H2a, b*. But the standardized path from knowledge storage to e-business assimilation is not found to be significant and thus rejecting *H2c*. Consistent with *H3a, c*, knowledge dissemination has significant and positive paths to e-business initiation (path coefficient = 0.167, $p < 0.05$), implementation (path coefficient = 0.159, $p < 0.05$) and assimilation (path coefficient = 0.168, $p < 0.01$). Knowledge protection has no significant paths to e-business initiation and e-business implementation, contrary to *H4a, b*. Knowledge protection has significant and positive path to e-business assimilation (path coefficient = 0.176, $p < 0.10$), providing support *H4c*.

Within the partnership attributes, this study finds significant and positive paths from partner interdependence to e-business initiation (path coefficient = 0.234, $p < 0.001$), implementation (path coefficient = 0.138, $p < 0.05$) and assimilation (path coefficient = 0.354, $p < 0.001$), as expected in *H5a-c*. All three paths associated with partner trust and e-business diffusion stages are significant (initiation: path coefficient = 0.125, $p < 0.05$; implementation: path coefficient = 0.120, $p < 0.005$; assimilation: path coefficient = 0.158, $p < 0.01$), so the results support *H6a-c*. Partner commitment has significant and positive paths to e-business initiation (path coefficient = 0.085, $p < 0.10$), implementation (path coefficient = 0.139, $p < 0.05$), and assimilation (path coefficient = 0.093, $p < 0.001$). Thus, the results support *H7a-c*. Overall, the variables examined in this study accounted for 47 percent of the variance in e-business initiation, 21 percent of the variance in e-business implementation, and 68 percent of the variance in e-business assimilation. These explained variances were higher than the recommended value of 10 percent (Falk and Miller, 1992), suggesting that the research variables could adequately predict the stage-based e-business diffusion.

Finally, of the control variables, industry type has no significant effect on three stages of e-business diffusion. A possible explanation is that the level of e-business diffusion across all the firms was high, so that the industry effect was not apparent.

The results also indicate that firm size has a significant and positive path to e-business assimilation. These results were not surprising because of the following reasons. First, larger firms possess greater resources and knowledge available to invest in and implement technology effectively as well as economies of scale to realize the benefits of e-business. Second, although large firms are more bureaucratic and less flexible, and have higher structural inertia. Since the evolution of e-business involves technological and business innovations, large firms would expect competitive advantages to be more significant than structural inertia. Thus, they are more likely to succeed in effectively assimilating e-business.

Discussion

This study examined the effects of two contextual factors (e.g. KM capabilities and partnership attributes) on three stages of e-business diffusion. The empirical results have revealed several factors with differential effects at different e-business diffusion stages and discussed below.

Among the four KM capabilities in the research model, only knowledge dissemination was found to have a significant influence on all of three e-business diffusion stages. This finding is consistent with Liebowitz (2002) conceptualization of knowledge sharing culture as the facilitator of successful IT adoption. Specifically, e-business diffusion differs from many previously studied areas of IT adoption because they integrate intra- and interorganizational business processes. Knowledge dissemination can be considered as an important business process both within and outside the organization, because it is a fundamental to generating new ideas and developing new business opportunities through socialization and learning process of knowledge workers, which are crucial for e-business evolution. Consequently, in the context of e-business, it is critical to note that managers should encourage employees to actively communicate with colleagues (i.e. donate knowledge), and actively consult with colleagues to learn from them (i.e. collect knowledge).

With respect to the effects of knowledge acquisition, the results show that knowledge acquisition only significantly impacts on e-business assimilation stage. Contrary to our expectation, knowledge acquisition does not have strong effects on all of the three stages. One possible explanation for this result is that knowledge acquisition had more indirect than direct influence on organizational innovation capability through powerful organizational learning experiences (Lai *et al.*, 2010). Since organizational deployment of organizational learning climate remains immature during the early stage of e-business, namely the initial stage, high absorptive capacity, and knowledge acquisition capabilities are not yet well established. That is, a better level of knowledge acquisition capability can stimulate creative and innovative thoughts (higher education, employee development, and innovation tendency) that may eventually facilitate the extension of e-business into deeper levels of organizations.

Knowledge storage had a significant impact on e-business initiation and implementation, but not on e-business assimilation. This phenomenon may be explained by the fact that while e-business diffusion progresses at a more advanced level, organizations frequently face various tasks and problems, and thus must generate innovative solutions to those problems. Although access to and reuse of existing knowledge (i.e. stocks of organizational knowledge) may enable companies to facilitate the e-business diffusion during its early stages, the success of e-business assimilation depends heavily on dynamic knowledge creation and flow. The results also found that knowledge protection positively affects e-business diffusion,

particularly its assimilation stage. This finding can be explained by the inherent difficulty of protecting knowledge assets such as intellectual property. Especially in Taiwan, even though the government and industry have realized the importance of knowledge assets protection, Taiwanese organizations still lack planning experience regarding the development of protocols and policy guidelines that recognize and promote knowledge rights during the earlier e-business stages.

Additionally, the results reveal that three partnership attributes (e.g. partner interdependence, partner trust, and partner commitment) are positively correlated with all of three e-business diffusion stages. The reasons for these results may be explained as below. Consistent with previous studies suggesting that interorganizational dependence is more crucial to the success of IS implementation, and that interdependence motivates collaboration among trading partners (Ranganathan *et al.*, 2004; Sheu *et al.*, 2006). That is, the more mutual dependence between firms and trading partners tends to have stronger motivation to facilitate the e-business implementation and realize its value. Partner trust can upgrade a simple short-term exchange relationship into a more mature long-term association, which is mutually beneficial to suppliers and customers (Warrington *et al.*, 2000). Furthermore, an undertaking of the integrity and confidentiality transaction is crucial to organizations wishing to meet their e-business goals. To summarize, high partner trust results in more mature e-business diffusion stages.

Finally, the mutual commitment in interorganizational relationships is more conducive to e-business diffusion, in which the objective is forging alliances with trading partners, facilitating interorganizational collaboration, and reducing uncertainty between trading partners. Therefore, partner commitment is a key driver of three e-business diffusion stages. Similarly, other researchers assert that partner commitment has a positive effect on internet-based IS implementation success (Lee and Lim, 2003; MacDonald and Smith, 2004).

Conclusions

Research implications

The primary contributions of this research are numerous. First, this study contributes to the e-business literature by building a theoretical model to understand what factors influence e-business diffusion. To our knowledge, this is the first study to theoretically specify or empirically test the role of KM capabilities (e.g. knowledge acquisition, knowledge storage, knowledge dissemination, and knowledge protection) and partnership attributes (e.g. partner interdependence, partner trust, and partner commitment) in three stages of e-business diffusion. Second, the result support the knowledge-based view of the firm, so that KM capability can be regarded as an independent managerial practice, as well as a central a mechanism that facilitates the wider evolution of e-business. KM capabilities serve as a key leverage point within the e-business context. Further, knowledge dissemination plays an important role in impacting all three stages of e-business diffusion. That is, if organizational KM processes highlight the importance of a knowledge sharing culture, firms are more likely to achieve increased levels of e-business diffusion. Third, this study, using social exchange theory, confirms the importance of partnership attributes as significant determinants of the whole e-business diffusion process. Consistent with the recommendations of several organizational theorists (Lee and Lim, 2003; Son *et al.*, 2005), this study help us understand that stage-based e-business diffusion is required to enhance social aspects of interorganizational relations. Finally, as Fichman (2000)

observed, the same factors may play different roles at different diffusion stages, it is worth investigating the casual relationship in the future. The results identified significant factors shaping the e-business diffusion, and revealed their differential effects across different stages (including e-business initiation, implementation, and assimilation). The present study supports the Fichman's (2000) claim and represents a significant theoretical and empirical advancement to the literature.

More broadly, this study offered several contributions relevant to future research. First, this study develops a comprehensive model that features KM capabilities and partnership attributes as antecedents of stage-based e-business diffusion. As the results show the utility of the proposed model, which is potentially a theoretical framework for studying other technological innovations such as radio frequency identification and cloud computing services. Additionally, by advancing the case for studying antecedents of stage-based e-business diffusion, this study helps focus future researcher attention on factors more commonly associated with the study and planning of e-business diffusion. Finally, instruments used in this study passed various reliability and validity tests, thus, they could be used in future studies.

Practical implications

This research can contribute to practitioners, since it provides organizations with new insights and findings which managers can translate into their own companies. First, concerning KM capabilities, knowledge dissemination is an important enabler during the whole e-business evolution process. Managers should focus on personalization of KM capabilities (encourage the person-to-person sharing of knowledge) to cultivate KM as a core organizational competency when the organizational goal is to facilitate the evolution of e-business implementation. In the context of e-business, knowledge dissemination activities occur not only within firms, but also between firms and their business partners. Knowledge dissemination enables employees develop novel solutions to problems that significantly improve on current practices. Hence, the increasing importance of the field of knowledge dissemination is primarily attributed to promotion of successful e-business activities and increased levels of e-business implementation.

A second point for managers to note is that technology-oriented KM capabilities (such as knowledge storage and retrieval mechanisms) are preconditions for initiating successful e-business diffusion. Managers should try to enhance knowledge storage capabilities, for example by providing knowledge repositories or data warehouses (used to store and retrieve knowledge) and knowledge maps (used to organize and catalog knowledge held by individual employees), thus facilitating the handling of varied knowledge from diverse sources and enabling its easy access in the e-business context. Such efforts can facilitate the adoption and implementation of e-business initiatives.

Third, this study found that e-business diffusion requires managers to invest time and effort in maintaining an appropriate balance between knowledge protection and leverage, since knowledge protection is important to protect the creativity and interests of knowledge-owners. Managers thus should try to build a strong knowledge protection (appropriability) mechanism that allows their firm to decide when to execute protective power and when to use appropriate regimes to control rather than block knowledge flows. Maximizing success in e-business assimilation requires smoothly integrating both intra- and interorganizational business processes as well as

with intra- and interorganizational governance mechanisms. Firms that fail to prevent inappropriate use of knowledge may have difficulty in ensuring the success of final e-business assimilation.

Finally, since the future of most e-business settings depends on high liquidity and trade volume, maintaining existing partner relationships has become increasingly important. This study found that firms foster the diffusion of e-business solutions under conditions of high mutual dependence between firms and trading partners. Therefore, the results provide evidence to managers of the value of building mutually beneficial partnerships and long-term cooperation with trading partners, resulting in superior e-business implementation and performance. Additionally, this study illustrates that successful e-business diffusion is based on high trust and strong commitment among trading partners. Both trust and commitment stimulate a relational bond between firms and trading partners that facilitates a smooth digital transformation and deep assimilation of e-business. As trust among trading partners grows, so too does commitment between firms and trading partners, and thus firm willingness to implement e-business and successfully realize its value. Thus, managers must acknowledge that the role of partner trust and commitment is crucial for the successful stage-based e-business diffusion.

Limitations and future research

There are several limitations of this study that need to be addressed. First, a cross-validation between the perceptive measure and the objective measure is necessary. Although this study has conducted many validity assessments, including convergent and discriminant validities, these validation assessments are based only on a self-reported survey. Objective measures, such as volume, frequency, or extent of e-business diffusion, were not incorporated into the instrument validation of this study. Therefore, future research should employ both objective and subjective measures, and examine the antecedents of stage-based e-business diffusion through structured interviews and case studies. Second, this study focussed on two important contextual factors (e.g. KM capabilities and partnership attributes) influencing the stage-based e-business diffusion that could serve as a potential limitation to this study. Future studies can test whether some other factors also influence the various stages of e-business diffusion. The research model could act as a theoretical basis for studying further sources of value creation from IT investments. Third, owing to budgetary constraints, this study uses a single respondent from each target firm. In examining organizational phenomena, researchers frequently seek response data from informants within organizations. The use of multiple informants from the same firm improves both data quality and findings validity (Van Bruggen *et al.*, 2002). Future efforts should attempt to survey multiple informants from each responding organization. Fourth, this study only focussed on the single relationship between independent and dependent variables. The interrelationship among the independent variables and possible mediating effects (e.g. partner trust may mediate the effects of KM capabilities on the stage-based e-business diffusion) were not analyzed in this study. Future research can simultaneously examine a series of variable influences and relationships. Finally, the sample was drawn from Taiwanese IS managers. Hence, the research model should be tested further using samples from other countries, since the findings may be influenced by cultural differences between Taiwan and other countries, and further testing thus would provide a more robust test of the hypotheses.

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Further reading

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Constructs	Indicators	Literature support
<i>KM capabilities</i>		
Knowledge acquisition	Our company ... 1. has processes for generating new knowledge from existing knowledge (1-5) 2. has processes for distributing knowledge throughout the organization (1-5) 3. has processes for acquiring knowledge about new products or services within our industry (1-5)	Becerra-Fernandez and Sabherwal (2001), Gold <i>et al.</i> (2001)
Knowledge storage	Our company ... 1. has processes for codifying knowledge (1-5) 2. has processes for organizing knowledge (1-5) 3. has processes for assessing knowledge (1-5) 4. has processes for integrating different sources and types of knowledge (1-5)	Alavi and Leidner (2001), Gold <i>et al.</i> (2001)
Knowledge dissemination	Our company ... 1. has a process for distributing knowledge throughout the organization (1-5) 2. has a process for distributing knowledge among our trading partners (1-5) 3. has processes for transferring organizational knowledge to solve new problems (1-5)	Gold <i>et al.</i> (2001)
Knowledge protection	Our company ... 1. has processes to protect knowledge from inappropriate use inside the organization (1-5) 2. has processes to protect knowledge from inappropriate use outside the organization (1-5) 3. has incentives that encourage the protection of knowledge (1-5) 4. has extensive policies and procedures for protecting organizational knowledge (1-5)	Gold <i>et al.</i> (2001)
<i>Partnership attributes</i>		
Partner interdependence	1. Our company and trading partners both recognized that we need each other to accomplish our objectives (1-5) 2. Our company and trading partners are both dependent on the other to be successful (1-5) 3. The possibility of changing the representative trading partner with others by our company is low (1-5)	Smith (1997), Lee and Lim (2003)

Table AI.
Measurement items for
key research constructs

(continued)

Constructs	Indicators	Literature support
Partner trust	<ol style="list-style-type: none"> 4. The possibility of changing our company with others by the representative trading partner is low (1-5) 1. Our company and trading partners always aim to achieve mutual benefit (1-5) 2. Our company highly trusts its trading partners (1-5) 3. Our company expects a fair deal from trading partners (1-5) 4. Our trading partners are sincere at all times (1-5) 	Lee and Kim (1999)
Partner commitment	<ol style="list-style-type: none"> 1. Our company and trading partners always try to keep promises made to each other (1-5) 2. Our trading partners perform specified agreements very well (1-5) 3. Our company strongly desires to continue its relationship with trading partners (1-5) 4. Our trading partners strongly desire to continue the relationship with our company (1-5) 5. Our trading partners are worthy of us spending maximum effort possible to maintain e-business initiatives (1-5) 	Lee and Kim (1999), Lee and Lim (2003)
<i>E-business diffusion</i> E-business initiation	<p>At the time your organization was considering to adopt e-business, to what extent the following potential benefits of e-business was rated?</p> <ol style="list-style-type: none"> 1. To facilitate information sharing within the firm (1-5) 2. To facilitate information sharing with trading partners (1-5) 3. To provide better products or services (1-5) 4. To expand market for existing products or services (1-5) 5. To improve customer services (1-5) 6. To gain competitive advantages (1-5) 	Ramamurthy and Premkumar (1995), Zhu (2004)
E-business implementation	<p>Check the box to ensure that appropriate Internet-based technologies are implemented in your value chain processes (#):</p> <ol style="list-style-type: none"> 1. <i>Upstream activities</i> <ol style="list-style-type: none"> 1-1. Exchanging operational data with upstream suppliers (Y/N) 1-2. Making purchases online (Y/N) 2. <i>Downstream activities</i> <ol style="list-style-type: none"> 2-1. Exchanging operational data with downstream carrier partners and customers (Y/N) 2-2. Electronically integrating business processes with carrier partners (Y/N) 	Li <i>et al.</i> (2010), Zhu <i>et al.</i> (2006)

(continued)

Table AI.

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Constructs	Indicators	Literature support
	3. <i>Marketing and sales</i> 3-1. Online marketing and advertising (Y/N) 3-2. Making sales online (Y/N)	
	4. <i>After-sales services</i> 4-1. Providing after-sales customer service and support (Y/N)	
E-business assimilation	1-2. Making purchases online (Y/N) After the implementation of e-business, your organization has improved its ability to ... 1. Increase sales revenue (1-5) 2. Increase staff productivity (1-5) 3. Decrease logistics cost (1-5) 4. Improve overall organizational effectiveness (1-5)	Ramamurthy <i>et al.</i> (1999)

Notes: Coding in parentheses is as follows: #, continuous variable; Y/N, dummy variable; 1-5, five-point Likert scale

Table AI.

About the author

Hsiu-Fen Lin is a Professor in the Department of Shipping and Transportation Management, National Taiwan Ocean University. She received her PhD degree in Information Management from National Taiwan University of Science and Technology, Taiwan. Her research interests include electronic commerce, knowledge management and organizational impact of information technology. Her research has appeared in *Internet Research*, *Information and Management*, *International Journal of Information Management*, *Journal of Information Science*, *Technovation*, and several conference proceedings. Hsiu-Fen Lin can be contacted at: hflin@mail.ntou.edu.tw

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