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Empirically testing innovation characteristics and organizational learning capabilities in e-business implementation success

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# Empirically testing innovation characteristics and organizational learning capabilities in e-business implementation success

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## Abstract

**Purpose** – Based on the innovation diffusion theory and organizational learning literature, the purpose of this paper is to develop a research model to examine innovation characteristics and organizational learning capabilities as the determinants of e-business implementation success.

**Design/methodology/approach** – Survey data from 163 IS (information system) managers in large Taiwanese firms were collected and used to test the research model.

**Findings** – The results showed that two innovation characteristics (perceived relative advantage and compatibility) and four organizational learning capabilities (managerial commitment, systems orientation, knowledge acquisition, and knowledge dissemination) have a significant effect on e-business implementation success.

**Research limitations/implications** – Some factors, other than the innovation characteristics and organizational learning capabilities included in this study, may also influence e-business implementation. The research model could act as a theoretical basis for studying further sources of value creation from technology innovations.

**Practical implications** – Results from this study suggest that, to achieve successful e-business implementation, managers should pay more attention to cultivating a climate where learning is valued and supported, develop systematic perspectives of various activities and events, and establish mechanisms that facilitate effective learning environments.

**Originality/value** – This study is significant for at least two reasons: first, it contributes to e-business research that technological innovation can be better understood by including both innovation characteristics and organizational learning capabilities, while earlier literature has traditionally treated the two separately and, second, it provides valuable guidelines to policy-makers and practitioners in implementing e-business and accelerating e-business development.

**Keywords** Innovation, Workplace training, Electronic commerce, Taiwan

**Paper type** Research paper

## Introduction

Many contemporary firms evolve in a complex business environment, characterized by globalization, internationalization of markets and the requirement for greater efficiency, effectiveness and competitiveness based on innovation and knowledge. In order to increase productivity and quality and facilitate exploitation of resources



within and across firms, many of these firms scan the technological environment and assess investment decisions in implementing Internet-based technologies as the infrastructure for e-business applications (Kauffman and Walden, 2001; Lee *et al.*, 2005; Lesjak and Vehovar, 2005). E-business represents a new way to manage businesses and relationships with trading partners and reflects a firm's strategic intention to use the Internet to share information, facilitate transactions, improve customer service and strengthen back-office integration (Zhu, 2004).

Although e-business has technical components, management issues must be addressed regarding changes in organizational processes and interaction both within a firm and among firms (Ash and Burn, 2003). E-business can be treated as a technological innovation (Kendall *et al.*, 2001; Jackson and Harris, 2003; Patterson *et al.*, 2003) owing to its ability to integrate Internet-based information system (IS) with core business, potentially influencing the whole business, and significant improvements in both operational and strategic aspects. The importance of innovations' attributes (such as relative advantage, complexity, and compatibility) has also been documented in the literature (Rogers, 1995). Several studies indicated user perceptions of the innovation influencing information technology (IT) implementation success (e.g. Moore and Benbasat, 1991; Agarwal and Prasad, 1997; Kendall *et al.*, 2001; Van Slyke *et al.*, 2005). Moreover, firms might confront significant barriers in conducting e-business, such as lack of learning capacity among knowledge workers (Lin and Lee, 2005). For example, firms must undergo an intensive learning process to bridge the gap between what they currently know and what the new technology requires them to know. Hence, the effectiveness of the organizational learning process plays an essential role in shaping IT implementation. However, innovation characteristics and organizational learning capabilities that influence the extent of internal integration and external diffusion of e-business have seldom been addressed, to the best of our knowledge.

Motivated by these issues, based on the innovation diffusion theory and organizational learning literature, this study develops a research model to study the determinants of e-business implementation success. The research model examines three innovation characteristics (perceived relative advantage, complexity, and compatibility) and four organizational learning capabilities (managerial commitment, systems orientation, knowledge acquisition, and knowledge dissemination) as the determinants of implementation success (in terms of internal integration and external diffusion) of e-business. The findings of this study contribute to e-business research in that technological innovation can be better understood by including both innovation characteristics and organizational learning capabilities, while earlier literature has traditionally treated the two separately. 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 development.

### Conceptual framework

Successfully adopting IT depends on user acceptance and actual usage of the system (DeLone and McLean, 2003). E-business implementation refers to the application of Internet-based computing and communications to manage intra- and inter-organizational business processes. It is not only rapidly changing the way that companies buy, sell and deal with customers, but also becoming a more integral part of its business strategies (Abu-Musa, 2004).

Effective adoption and diffusion of e-business differs from adoption of traditional IS (e.g. management IS, end-user computing) in at least two ways. First, e-business is complex, emerging technologies that can provide a wide range of functionality ranging from developing online business processes to facilitating cooperation with customers and business partners. IS researchers have proposed that e-business can be considered as one of the most significant technological innovation (Kendall *et al.*, 2001; Jackson and Harris, 2003; Patterson *et al.*, 2003), which has operational, managerial and strategic advantages including greater internal and external process integration, and closer links with customers and business partners (Jeffcoate *et al.*, 2002; Ash and Burn, 2003.). E-business enables the firm to execute electronic transactions with any business partners along the value chain. E-business thus significantly impacts business process change, diffusion innovation, and even business transformation.

Innovation diffusion theory (Rogers, 1995) posits that perceived innovation characteristics (like relative advantage in innovation theory) influence organizational usage of an innovation. IT innovations have been studied using this perspective (e.g., Moore and Benbasat, 1991; Agarwal and Prasad, 1997; Kendall *et al.*, 2001; Van Slyke *et al.*, 2005). E-business may have new features compared to previous generations of technology innovations, however, the effects of innovation characteristics deserve attention have not been fully understood in the e-business diffusion (Zhu *et al.*, 2006).

Second, researchers studying organizational adoption of complex innovations or innovations with higher user interdependencies have been advised to include organizational capabilities, especially in terms of adopting innovation technologies and processes (Fichman and Kemerer, 1997). Caloghirou *et al.* (2004) also emphasized the significance of organizational capabilities for innovations, and define it as a dynamic process of creation, acquisition and integration of knowledge aimed at the development of resources and capabilities that continuously facilitate IT diffusion and performance of a firm on a basis. Part of these organizational capabilities result from organizational learning culture and knowledge accumulation within firms, and form what has been described as the firm "absorptive capacity" (Cohen and Levinthal, 1990; Jantunen, 2005). Martin and Matlay (2003) also argued that developing organizational learning and knowledge management strategies has been considered an effective and efficient means of successful technological innovation. Moreover, when e-business is first introduced, firms impose a substantial burden on the adopter in terms of the knowledge required to understand and use it effectively (Purvis *et al.*, 2001; Gibbs and Kraemer, 2004). Organizational learning plays an essential role in explaining and resolving the problems of adopting and implementing new IT in firms. This perspective has been strengthened by several recent studies (Raymond and Blili, 2000; Ke and Wei, 2006). However, although links between organizational learning and e-business implementation have often been assumed, little empirical evidence is available to support this perspective.

Therefore, innovations characteristics and organizational learning capabilities affecting e-business implementation success need to be identified and examined. Some other organizational factors/capabilities might affect a firm's decision to adopt and implement a particular technology (Kwon and Zmud, 1987); however, it was necessary to limit the research model so that this study could offer empirical evidence for our arguments. This study focuses on perceived innovation characteristics and organizational learning capabilities as explanatory and predictive variables for

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e-business implementation. All variables hypothesized in this study and natures of their expected relationship with e-business implementation are discussed next.

*E-business implementation success*

This study broadly defines e-business implementation as an Internet-based IS used by a firm to integrate internal business activities, processes, and IS and conducting business transactions with trading partners. Researchers focused on Internet-based IS and e-business have differentiated internal and external diffusion, concentrating on the permeation of the diffusion process in extended firm value chain (Gonsalves *et al.*, 1999; Ranganathan *et al.*, 2004; Zhu and Kraemer, 2005). Gibbs and Kraemer (2004) also argued that the scope of e-business use includes a number of different activities in the value chain, from advertising and marketing to sales, procurement, service and support, data exchange with suppliers and customers, and integration of business processes. Thus, the success of e-business implementation refers to the extent of e-business implementation as represented by internal integration and external diffusion. The discussion in this study operationally defines internal integration of e-business as the extent to which e-business is integrated with key internal organizational activities and IS applications. Meanwhile, external diffusion of e-business refers to the extent to which the firm integrates its trading partners and transactions with them through the e-business.

*Innovation characteristics*

The innovation diffusion theory provides a set of innovation characteristics that may affect adoption decisions (Rogers, 1995). These innovation characteristics include relative advantage (the degree which an innovation can bring benefits to the organization), complexity (the degree to which an innovation is difficult to use), compatibility (the degree to which an innovation is consistent with existing organizational values, beliefs and experiences), observability (the degree to which an innovation is visible in the organization), and trialability (the degree to which an innovation may be experimented with) (Rogers, 1995). Among these characteristics, relative advantage, complexity, and compatibility were found to be the most frequently identified factors for IT-based innovation diffusion (Thong, 1999; Kendall *et al.*, 2001; Verhoef and Langerak, 2001). Hence, this study examines the extent to which these three perceived innovation characteristics can predict e-business implementation success.

Relative advantage refers to the degree to which an innovation provides more benefits than its precursor. Relative advantages manifests as increased efficiency and effectiveness, economic benefits, and enhanced status (Rogers, 1995). Moore and Benbasat (1991) found that perceived relative advantage of an innovation is positively related to the rate of adoption. Correspondingly, the potential of e-business reported obvious benefits such as making internal processes more efficient, improving customer services, and enhancing coordination with suppliers (Zhu and Kraemer, 2002). In general, when decision makers perceive clear overall organizational benefits of e-business, they are more likely to achieve successful e-business implementation and to realize more e-business value. The following hypothesis thus is proposed.

- H1. Perceived relative advantage positively correlates with e-business implementation success.

Complexity is the degree to which an innovation is perceived to be difficult to understand and implement (Rogers, 1995). E-business has been perceived as a complex innovation, since it is a hybrid innovation with administrative (e.g. changes in organizational processes and interaction both within a firm and among firms) and technological (e.g. adopting the Internet platform in conjunction with existing IT infrastructure) implications. Previous studies have indicated that a complex innovation requires greater resources and skills to adopt, and requires increased cognitive effort on the potential adopter, thus reducing the likelihood of adoption (Verhoef and Langerak, 2001; Sia *et al.*, 2004). Generally, complexity is widely recognized as a key barrier to IS adoption (Thong, 1999). Hence, the following hypothesis is proposed:

*H2.* Perceived complexity negatively correlates with e-business implementation success.

Compatibility is the degree to which an innovation fits to the existing organizational values, previous experiences and current needs (Rogers, 1995). Greater compatibility between company's business processes and technological innovation is preferable, because it allows innovation to be interpreted in a more familiar context (Premkumar *et al.*, 1994). Moreover, if conducting transactions over the Internet is compatible with existing processes and systems, then companies would incur lower efforts to deal with incompatibility, and are thus likely to integrate e-business with internal IS applications, and to be linked to a greater proportion of trading partners and business transactions (Chatterjee *et al.*, 2002). The following hypothesis is proposed:

*H3.* Perceived compatibility positively correlates with e-business implementation success.

#### *Organizational learning capabilities*

E-business, more than just establishing an Internet presence or conducting e-commerce transactions, concerns redefining old business models and maximizing business value (Kalakota and Robinson, 1999). Simply adopting and installing an e-business system is not sufficient to leverage its business value of e-business. Hence, employees and organizations as a whole have to learn how to apply the technology effectively while they are implementing the e-business (Fichman and Kemerer, 1997; Purvis *et al.*, 2001). A firm with high organizational learning capabilities has been identified as a necessary and essential component of its new technical innovation (Venkatesh and Speier, 2000; Ke and Wei, 2006).

Organizational learning refers to the capacity or processes within a firm enabling the acquisition of, access to and revision of organizational memory, thereby providing directions for organizational action (Robey *et al.*, 2002). Integrating prior works from the theory of organizational learning, knowledge management, and technology adoption and implementation (Hult and Ferrell, 1997; Gold *et al.*, 2001; Jerez-Gomez *et al.*, 2005; Lin and Lee, 2005; Teo *et al.*, 2006; Lee and Kim, 2007), this study identifies four factors reflecting the construct of organizational learning capabilities in a technology diffusion context: managerial commitment, system orientation, knowledge acquisition, and knowledge dissemination. The relationships between these four factors and e-business implementation are described in the following paragraphs.

Management should recognize the relevance of learning, thus developing a culture that encourages the acquisition, creation and transfer of knowledge as fundamental

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sources of innovation (Quinn, 1985; Nonaka and Takeuchi, 1995). Management should ensure that the firm's employees understand the importance of learning, and become involved in its achievement, considering it an active component of the diffusion of complex technological innovations (Fichman and Kemerer, 1997; Williams, 2001). IS implementation research has also argued that successful introduction of new or different systems is less likely without management support (Ives and Olson, 1984). Consequently, this study expects that management commitment could help and facilitate extensive the use of e-business within and outside the firm. The following hypothesis was therefore formulated:

*H4.* Managerial commitment positively correlates with e-business implementation success.

Systems orientation is defined as the degree to which various individuals, departments, and areas of a firm have a clear view of the organizational objectives and understand how they can help in their development (Hult and Ferrell, 1997; Lei *et al.*, 1999). Systems orientation can guide an organization beyond adaptive learning to generative learning, where the assumptions, beliefs, and knowledge bases of an organization are transformed (Senge, 1990). Teo *et al.* (2006) argued that organizations with systems orientation would be more appreciative of how features of a new technology could add value to individual organizational processes and members, and to the entire organization, than those without it. Organizational decision makers operating within an organizational environment that emphasizes a systems orientation would subsequently be more likely to achieve a greater extent of e-business diffusion. The following hypothesis is proposed:

*H5.* Organizations with systems orientation positively correlates with e-business implementation success.

Knowledge acquisition is defined as the business processes that use existing knowledge and capture new knowledge. Administrator and technical innovations require concerted effort and experience in recognizing and capturing new knowledge (Drucker, 1993). Moreover, Darroch and McNaughton (2002) examined the link between knowledge management practices and innovation types, and found that the likelihood of effective firm innovation increases with the extent of knowledge acquisition. E-business infrastructure involves not only e-commerce initiatives but also is driven by acquisition knowledge and skills (Moodley, 2003). Relationships between knowledge acquisitions capabilities thus are expect to be positively related to e-business usage. The following hypothesis is proposed:

*H6.* Knowledge acquisition positively correlates with e-business implementation success.

Knowledge dissemination is defined as the business processes that distribute knowledge among all individuals participating in process activities. The literature on the organizational effectiveness of IS emphasizes that a knowledge sharing culture is the main organizational condition for successful knowledge management and exploitation (Damodaran and Olpher, 2000). According to the survey of Caloghirou *et al.* (2004), openness towards knowledge dissemination is important for improving innovative performance. Additionally, knowledge dissemination is important in

innovation processes in the e-business context (Liebowitz, 2002; Nah *et al.*, 2002). Thus, knowledge dissemination processes are expected to be positively associated with e-business implementation success. The following hypothesis is proposed:

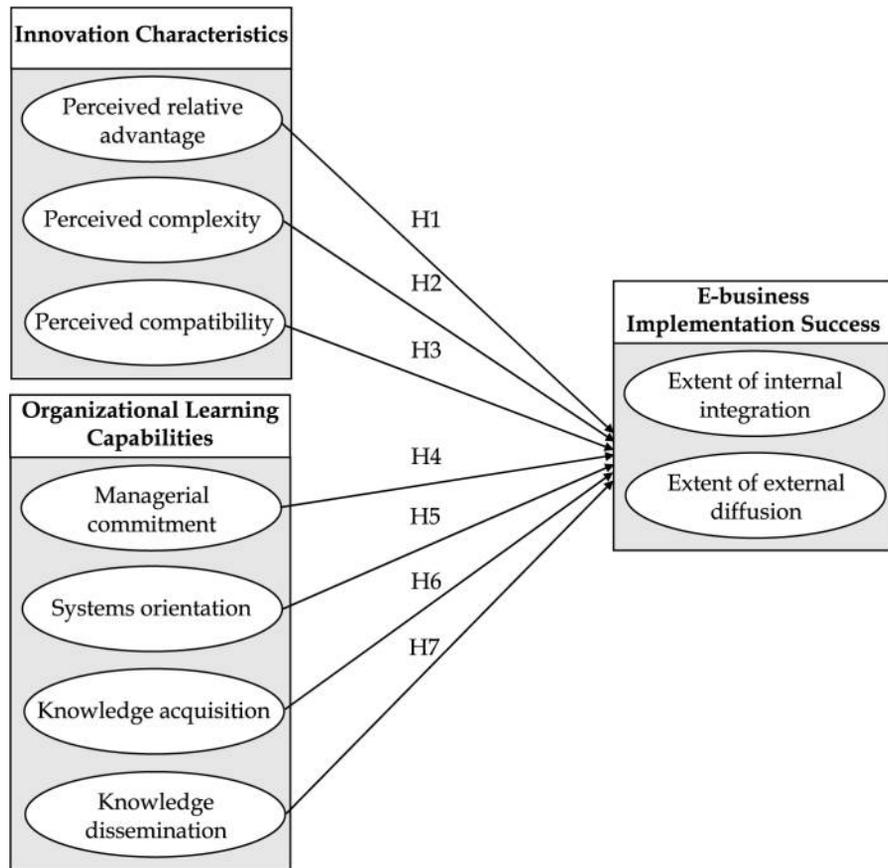
*H7.* Knowledge dissemination positively correlates with e-business implementation success.

In summary, three innovation characteristics (perceived relative advantage, complexity, and compatibility) and four organizational learning capabilities (managerial commitment, systems orientation, knowledge acquisition, and knowledge dissemination) were included in this study to investigate determinants of e-business implementation success. The research model is presented in Figure 1.

**Research methodology**

*Data collection*

To empirically test the research model, a sample is selected from China Credit Information Service, Ltd. in 2005 that were listed in a database published by the 1000 largest firms in



**Figure 1.**  
Research model

Taiwan. To ensure that IS managers received the questionnaire and maximize the response rate, four research assistants spent one month telephoning these 1000 firms; they asked the target firms whether they adopted e-business and asked for the name of the CIO, CTO or most senior IS managers. Firms that were not adopters of e-business were removed from the list. This process produced a sample of 732 firms in several different industries. The final questionnaires were mailed to the 732 IS managers in the summer of 2006. 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.

### *Measures*

Measurement items used in this study were adapted from previously validated measure or were developed on the basis of a literature review. A pretest of the questionnaire was performed using five professors in the IS area to assess its logical consistencies, ease of understanding, sequence of items, and contextual relevance. Moreover, a pilot study was conducted involving eight IS managers who are generally very knowledgeable regarding e-business in their companies. Comments and suggestions on the items contents and structure of the instrument were solicited. All items were measured using a five-point Likert-type scale (ranging from 1 = strongly disagree to 5 = strongly agree). Appendix lists all of the survey items used to measure each construct.

*Innovation characteristics.* Perceived relative advantage was measured by whether e-business implementation could provide better products or services, enhance business efficiency and staff productivity, and improve coordination with trading partners. Perceived complexity was measured by whether e-business implementation would increase difficulty for a firm in controlling work quality, integrating the overall business process, protecting the security of data and transactions over the Internet, and building long-term relationships between firms and trading partners. Perceived compatibility was measured according to its acceptability to corporate culture and value system, consistency with current internal IS applications, and supported by the existing IS infrastructure and IT human resources, when the firm adopts the e-business.

*Organizational learning capabilities.* Managerial commitment, assessed by using four items derived from Jerez-Gomez *et al.* (2005). Systems orientation was operationalized to reflect awareness of the interconnectedness and interdependency of organizational activities and processed. Four items were adapted from Hult and Ferrell (1997). Knowledge acquisition and knowledge dissemination were measured using eight items, derived from those proposed by Gold *et al.* (2001).

*E-business implementation success.* Two variables, internal integration and external diffusion of e-business, were used to measure the e-business implementation success. Internal integration was assessed by the level of integration of e-business in four major IS applications, namely accounting and financial management, material and inventory control, order processing and fulfillment, and sales force automation (Ramamurthy *et al.*, 1999). External diffusion was measured using four items asking respondents about the extent to which e-business achieves electronic integration with suppliers and customers. These items were adapted from Ramamurthy and Premkumar (1995) and Zhu (2004).

### *Sample characteristics*

Of the 732 distributed, 163 completed and usable questionnaires were returned, representing a response rate of 22.3 per cent. All respondents were CIO, CTO, or IS

managers who had worked in the IS field for an average of 9.7 years. The majority of respondents were from manufactures, representing 37.8 per cent of the sample. The next highest were from banking, finance and insurance entities, representing 21.4 per cent of the sample. The remaining categories exhibit a modest range of representation from a minimum of 0.9 per cent (foods) to a maximum of 9.2 per cent (wholesale). The sample was split between 0-1000 employees (60.2 per cent) and greater than 1000 employees (39.8 per cent). A comparative analysis of three descriptive variables (industry type, total assets and employee numbers) was conducted in order to see if responding firms have significantly different characteristics from non-respondents. The chi-square test results provide evidence that there was no response bias problem in the sample ( $p$ -values are 0.124, 0.359, and 0.109). Moreover, a sample size exceeding 160 is acceptable since sample sizes ranging from 150 to 200 (Anderson and Gerbing, 1988) are already sufficient to generate statistically reliable estimates of the casual paths among constructs.

## Results

### *Validity and reliability of measures*

To empirically assess the construct reliability and validity, this study conducted the confirmatory factor analysis (CFA) in LISREL 8.8. The measurement properties are reported in Table I. For a measurement model to have sufficiently good model fit, the chi-square value normalized by degrees of freedom ( $\chi^2/\text{df}$ ) should not exceed 3 (Bagozzi and Yi, 1988), Non-Normed Fit Index (NNFI) and Comparative Fit Index (CFI) should exceed 0.9, and the Root Mean Square Error of Approximation (RMSEA) should not exceed 0.10 (Chau and Hu, 2001). For the current CFA model,  $\chi^2/\text{df}$  was 1.95 ( $\chi^2 = 1090.12$ ;  $\text{df} = 558$ ), NNFI was 0.95, CFI was 0.95, and RMSEA was 0.077, suggesting adequate model fit.

The composite reliability assessed the internal consistency of the scales. From Table I, the composite reliability of all constructs exceeded the benchmark of 0.6 recommended by Bagozzi and Yi (1988). Additionally, convergent validity refers to the extent to which multiple measures of a construct agree with one another. Bagozzi and Yi (1988) suggest that weak evidence of convergent validity exists when item factor loading is significant. Moreover, strong evidence exists when the factor loading exceeds 0.7. From Table I, the factor loading for all items exceeds the recommended level of 0.7, and all factor loadings are statistically significant at  $p < 0.001$ . Therefore, all scales for construct reliability and validity were met.

### *Test of hypotheses*

Correlation tests were used to find out the relationships among the variables in the model. Table II shows the results of correlation test among innovation characteristics, organizational learning capabilities and the major variables of e-business implementation success. Given the exploratory nature of this study and the small size of the sample, the results should be interpreted with caution. The results corroborate some of the hypotheses as follows.

All the hypothesized paths, with the exception of that linking perceived complexity and e-business implementation success ( $H2$ ), were significant ( $p < 0.001$ ). Perceived relative advantage and compatibility were significantly and positively correlated with e-business implementation success. As expected, four organizational learning

Constructs	Items	Standardized factor loadings	Convergent validity ( <i>t</i> -statistic)	Composite reliability	Innovation characteristics
<i>Perceived relative advantage</i>	RA1	0.84	11.98	0.92	<hr/> <b>69</b> <hr/>
	RA2	0.84	11.88		
	RA3	0.92	13.67		
	RA4	0.86	12.41		
<i>Perceived complexity</i>	CX1	0.75	10.11	0.92	
	CX2	0.90	13.28		
	CX3	0.91	13.31		
	CX4	0.87	12.53		
<i>Perceived compatibility</i>	CA1	0.93	14.42	0.97	
	CA2	0.93	14.44		
	CA3	0.95	14.84		
	CA4	0.95	14.80		
<i>Managerial commitment</i>	MC1	0.90	13.45	0.93	
	MC2	0.77	10.54		
	MC3	0.91	13.49		
	MC4	0.90	13.28		
<i>Systems orientation</i>	SO1	0.71	8.78	0.82	
	SO2	0.76	9.49		
	SO3	0.70	8.63		
	SO4	0.73	9.05		
<i>Knowledge acquisition</i>	KA1	0.91	13.22	0.90	
	KA2	0.87	12.43		
	KA3	0.80	10.92		
	KA4	0.75	10.03		
<i>Knowledge dissemination</i>	KD1	0.87	12.58	0.88	
	KD2	0.90	13.17		
	KD3	0.71	9.46		
	KD4	0.73	9.73		
<i>Extent of internal integration</i>	II1	0.92	13.94	0.92	
	II2	0.88	12.86		
	II3	0.76	10.39		
	II4	0.89	13.00		
<i>Extent of external diffusion</i>	ED1	0.93	14.18	0.96	
	ED2	0.95	14.76		
	ED3	0.89	13.15		
	ED4	0.91	13.79		

**Notes:** All *t*-values are significant at  $p < 0.001$

**Table I.**  
Results of confirmatory factor analysis

variables (managerial commitment, systems orientation, knowledge acquisition, and knowledge dissemination) were found to positively influence e-business implementation success.

## Discussion and implications

### *Summary of results*

This study develops a research model that draws upon the innovation diffusion theory and organizational learning literature. This is different from most related studies,

**Table II.**

Results of correlation test

	E-business implementation success	
	Extent of internal integration	Extent of external diffusion
<i>Innovation characteristics</i>		
Perceived relative advantage	0.55 *	0.61 *
Perceived complexity	-0.21	-0.08
Perceived compatibility	0.71 *	0.80 *
<i>Organizational learning capabilities</i>		
Managerial commitment	0.56 *	0.67 *
Systems orientation	0.41 *	0.32 *
Knowledge acquisition	0.52 *	0.42 *
Knowledge dissemination	0.70 *	0.67 *

**Note:** \*Correlation is significant at the 0.001 level (two-tailed)

which have focused on either innovation characteristics or organizational learning factors, but not on both. Using e-business as an example of more general technology innovations, this study fills a theoretical gap by developing the research model and evaluating it via 163 IS managers in large Taiwanese firms.

Perceptions of relative advantage, which assesses the extent to which users feel e-business can bring benefits to the organization, is significantly related to e-business implementation success in terms of internal integration and external diffusion. The result also shows that greater compatibility between e-business systems and existing IT environments (including hardware, software, and human resources) is more likely to facilitate e-business diffuse. Our findings confirm that perceived relative advantage and compatibility are significant predictors of both internal integration and external diffusion in the e-business implementation. However, perceived complexity has a negative but insignificant influence on e-business implementation success, despite numerous innovation studies indicating a negative association between complexity and IS implementation (Grover, 1993; Thong, 1999). A plausible explanation could be that many respondents did not perceive complexity to be the major barrier to e-business implementation. This contention could be explored in future research.

Managerial commitment correlates positively and significantly with e-business implementation success, it can be concluded that managerial commitment is needed to overcome suspicions, break down any resistance, and obtain effective e-business diffusion. This is consistent with the fact that lack of top management support and understanding has even caused major IS implementation failures (Nath *et al.*, 1998). Furthermore, a significant correlation is observed between systems orientation and e-business implementation success, which implies that lack of knowledge and understanding of all the disparate functions within the firm results in reluctant participation and delays in IS adoption, and reduces the effectiveness of the solution (Raman *et al.*, 2006). In other words, organizational decision makers operating within an organizational environment that emphasizes a systems orientation are likely to facilitate the integration and utilization of e-business. Finally, the result shows that knowledge acquisition and dissemination correlate positively and significantly with e-business implementation success. This finding is consistent with Bose's (2003) view that knowledge management capabilities help improve e-business competitiveness.

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*Managerial implications*

The results of this study have several important implications for management. First, managers can draw upon the research model to assess conditions for e-business implementation (in terms of internal integration and external diffusion). The research model includes the important characteristics describing the nature of e-business innovation, which may be useful for managers to evaluate e-business initiatives in terms of relative advantage and compatibility. The research model also covers a series of organizational learning capabilities, including managerial commitment, systems orientation, knowledge acquisition, and knowledge dissemination. Managers need to consider these organizational learning capabilities to ensure effective adoption and diffusion of e-business. Second, since relative advantage and compatibility are important predictors of e-business implementation success, managers should expand organizational resources on making the benefits of e-business apparent through initiatives such as training programs and provision of work that takes meaningful advantage of the e-business system. Furthermore, our results underscore the crucial importance of a fit between e-business systems and existing IT environments; otherwise it will be difficult to integrate new IT with retained systems. Third, the development of organizational learning capabilities provides a novel architecture for enterprises, which contributes significantly to understanding and facilitating the e-business transformation of operational processes. Results from this study suggest that to achieve successful e-business implementation, managers should pay more attention to cultivating a climate where learning is valued and supported, develop systematic perspectives of various activities and events, and establish mechanisms that facilitate effective learning environments. Therefore, a firm with higher learning capabilities is more likely to facilitate extensive use of e-business within and outside the firm, and increase the level of successful e-business diffusion. Finally, e-businesses differ from other previously studied areas of IT applications because they integrate intra- and inter-organizational business processes. Knowledge accumulation enables employees to both use existing knowledge and create new knowledge, both of which are crucial for internal integration and external diffusion of e-business. Furthermore, 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 understand integration and management of intra- and inter-organizational business processes, and develop novel solutions to problems that significantly improve on current practices. Consequently, knowledge management is an emerging capability that can facilitate extensive use of e-business within and outside the firm. That is, successful e-business implementation increasingly depends on the ability to acquire, develop and share knowledge.

*Limitations and future research*

The study suffers some important limitations. First, owing to budgetary constraints, this study uses a single respondent from each target firm. Although IS managers are expected to be knowledgeable with expertise in e-business implementation, a lack of further respondents from the same firm exist and do not allow evaluating the e-business perceptions of the entire group. Future research should attempt to collect responses from several knowledgeable responses from the same organization to capture the notion of collectively held e-business implementation. Second, since the

sample population for this research was restricted to firms using e-business, the results can only be generalized for firms that have implemented e-business. Further research can be performed on non-adopters to determine the differences in innovation characteristics of the e-business between adopters and non-adopters. Third, other than the innovation characteristics and organizational learning capabilities included in this study, some other factors may also influence e-business implementation. The research model could act as a theoretical basis for studying further sources of value creation from technology innovations. Fourth, 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. Finally, the longitudinal study of Bergeron *et al.* (1997) showed that the electronic data interchange (EDI) implementation process (such as the planning of EDI adoption, testing and evaluation of initial transactions) does not exert a long-term influence on EDI advantage, but is positively associated with EDI advantage in the short term. It would be interesting to examine how the impact of various contextual factors on the implementation success of e-business changes over time. Future studies can gather longitudinal data to examine the causality and interrelationships between variables that are important to diffuse e-business innovation.

### Conclusions

This study develops a research model to examine the influence of innovation characteristics and organizational learning capabilities on e-business implementation success (in terms of internal integration and external diffusion). The results indicate that various factors shape e-business diffusion and contribute to the technological innovation literature in two ways.

First, a limitation of most previous research in e-business is its failure to address diffusion from both internal and external perspectives. Unlike previous literature which examined IT diffusion in terms of adoption versus non-adoption measures (Fichman, 2000), this current paper focuses on internal integration and external diffusion of e-business. This study emphasizes that firms must pay as much attention to the integration of e-business in internal organizational activities and IS applications as to the interorganizational diffusion of Internet with their trading partners. Second, this study demonstrates the usefulness of combining the innovation diffusion theory and the organizational learning literature for understanding technological innovation. To our knowledge, most research has focused on either the innovation diffusion theory or organizational learning factors, but not on both. Hence, this study demonstrates the combined explanatory power of the two perspectives. Moreover, this study develops a comprehensive model that features innovation characteristics and organizational learning capabilities as determinants of e-business implementation. As the results show the utility of the proposed model, which is potentially a theoretical framework for studying other technological innovations such as wireless technologies and radio frequency identification (RFID).

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#### **Appendix. Questionnaire items**

##### *Perceived relative advantage*

Following implementation of e-business, my firm will . . .

- RA1: provide better products or services.
- RA2: enhance business efficiency.
- RA3: enhance staff productivity.
- RA4: improve coordination with trading partners.

##### *Perceived complexity*

Implementation of e-business will lead to difficulties in . . .

- CX1: controlling work quality.
- CX2: integrating the overall business process.
- CX3: protecting the security of data and transactions over the Internet.
- CX4: building long-term relationships between my firm and trading partners.

*Perceived compatibility*

Implementation of e-business ...

- CA1: is acceptable to corporate culture and value system.
- CA2: does not contradict the current internal IS applications.
- CA3: is supported by the existing IS infrastructure.
- CA4: is supported by the organizational IT human resources.

*Managerial commitment*

- MC1: My firm views employee training as an investment, not an expense.
- MC2: Managers frequently involve their staff in important decision-making processes.
- MC3: Employee learning capability is considered as a key factor in my firm.
- MC4: Innovation ideas that work are rewarded in my firm.

*Systems orientation*

- SO1: All employees have generalized knowledge of my firm's objectives.
- SO2: All activities that occur in business transaction processes are clearly defined.
- SO3: All parts that make up my firm (departments, sections, work teams, and individuals) are well aware of their contribution to achieving the overall objectives.
- SO4: All parts that make up my firm are interconnected, working together in a coordinated manner.

*Knowledge acquisition*

My firm ...

- KA1: has a process for generating new knowledge based on existing knowledge.
- KA2: has a process for acquiring knowledge on developing new products/services.
- KA3: has a process for integrating different sources and types of knowledge.
- KA4: has a process for applying knowledge to solve new problems.

*Knowledge dissemination*

My firm ...

- KD1: has a process for transferring organizational knowledge to employees.
- KD2: has a process for distributing knowledge throughout the organization.
- KD3: has a process for distributing knowledge among our business partners.
- KD4: has a standardized reward system for sharing knowledge.

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INTR  
18,1

*Extent of internal integration*

My organization integrates the e-business with ...

- II1: accounting and financial management.
- II2: material and inventory control.
- II3: order processing and fulfillment.
- II4: sales force automation.

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*Extent of external diffusion*

Implementation of e-business ...

- ED1: enables the exchange of operational data with suppliers.
- ED2: enables the exchange of operational data with business customers.
- ED3: facilitates shipment and logistics management with suppliers.
- ED4: facilitates the customer service support.

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