
Toward a diffusion model for Internet systems

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Abstract

The world of business is being profoundly transformed by the Internet and electronic commerce. The rapid advancement of Internet technology and its applications holds promise for the expansion of business opportunities in the global digital economy. Internet systems support a world-wide broadcasting capability, a mechanism for information dissemination and a medium for electronic commerce between organizations and customers across countries. Describes research that leads to the derivation of a diffusion model of Internet systems, comprising four key dimensions: external market factors, external technical factors, internal organization factors, and internal systems factors. The intention is for this model to provide a theoretical base for further research on electronic commerce and Internet technology diffusion.

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Introduction

This paper provides a further theoretical foundation for Internet technology diffusion, specifically Web-based shopping systems (WBSS), by reviewing previous research on relevant topics related to ICT diffusion. Recently, information and communication technology (ICT), in particular the Internet and electronic commerce, has been increasingly recognized as a means of positive sustainability for driving global digital economy (OECD, 2000; Howcroft, 2001; Brynjolfsson and Kahin, 2002; Hudson, 2002). In this context, a growing body of literature has noted that Internet technologies play a significant role in radically expanding the volume and scale of a global electronic commerce (Rayport and Jaworski, 2001; Porter, 2001; Feeny, 2001; Looney and Chatterjee, 2002; Chaudhury and Kuilboer, 2002). Among various types of e-businesses, the most well-known model is the so-called dot-com model (Porter, 2001), which incorporates several types of Internet systems applications.

Internet systems are diffusing very rapidly across national boundaries, taking place between organizations and customers, and enterprises and global markets (Korper and Ellis, 2000; Looney and Chatterjee, 2002; Slyke *et al.*, 2002). This global phenomenon of Internet systems diffusion is of particular interest and can be investigated by utilizing the theory of innovation diffusion, because such research seeks to explore and explain why particular new technologies do diffuse quickly and widely, while others do not (Newell *et al.*, 2000, p. 242). Indeed, diffusion theory has been frequently used to explain the complex nature of new ICT diffusion and appropriation (e.g. Zmud, 1982; Liang, 1986; Brancheau and Wetherbe, 1990; Krcmar and Lucas, 1991; Bouchard, 1993; Kettinger and Grover, 1997; Westland *et al.*, 1998; Standing and Vasudavan, 2000) but, as yet, less attention has been paid to Internet technology – WBSS in particular.

Hence, this paper reviews two categories of ICT diffusion research: a general review of ICT diffusion and a review of Internet systems diffusion more specifically. This is done in the belief that such a review will assist in achieving a sound grasp of the fundamental characteristics of Internet systems diffusion among several domains of ICT diffusion research.

Previous studies of ICT innovation diffusion

The most common dimension of innovation diffusion is the source of the newness, such as the



organization, the market, the technology, the product and the process (Kamm, 1987). Therefore, innovation diffusion theory has been used in several disparate fields, including economics, policy, sociology, marketing, organization, technology and medicine. Previous innovation diffusion research has been concerned with various issues including the definition of innovation diffusion (Rhodes and Wield, 1994; Afuah, 1998), the generation of innovation diffusion (Forsgren and Johanson, 1992; Nohria and Ghoshal, 1997), innovation diffusion in organizations (Daft, 1986; Damanpour, 1991), innovation diffusion in marketing (Simmonds, 1986), technological innovation diffusion (Howell and Higgins, 1990; Lawless and Anderson, 1996), process innovation diffusion (Davenport, 1993), value innovation diffusion (El Sawy *et al.*, 1999) and innovation diffusion in information systems (Cooper and Zmud, 1990; Swanson, 1994; Allen, 2000). There have been several models that attempt to explain innovation diffusion as a process of logically sequential, interacting and interdependent stages (Rothwell, 1994), but Galliers and Swan (1999, p. 379) suggest a more consistent process arguing that "it may be preferable to consider the process as a whole rather than a series of discrete stages, with innovation being viewed as a complex, iterative, and continuous process".

Among the various innovation diffusions, this study focuses specifically on the innovation diffusion of information and communication technology (ICT), dealing as it does with the Internet and, more specifically, with WBSS. Tornatzky and Fleischer (1990) argue that technology innovation diffusion means "either the process of getting new tools into a given social environment, or the new tools themselves". For example, the Internet technologies may be considered as technology innovation in and of itself (Nambisan and Wang, 1999), as well as being created and adapted to perform Web-based shopping business (Korper and Ellis, 2000; Feeny, 2001; Porter, 2001; Looney and Chatterjee, 2002). A technology usually has two components such as hardware and software. Steele (1988) defined technology innovation diffusion as encompassing three fields of activity:

- (1) Product.
- (2) Process.
- (3) Information technologies.

These three different substantive fields of technology innovation diffusion have different traditions and different educational foundations. This is so because Internet technologies differ from previous ICT, due to their global interactivity and universal connectivity beyond organizations

and individual customers via the Internet in real time without geographical limitation, creating new business models, processes and strategies (Nath *et al.*, 1998; Barua *et al.*, 2000; Timmers, 2000; Feeny, 2001; Porter, 2001). Therefore, we can regard Internet technology as an example of technology innovation (Nambisan and Wang, 1999).

A number of researchers have used the term "ICT innovation diffusion" (e.g. Monk, 1987; Moore and Benbasat, 1991; Prescott and Conger, 1995; Lockett, 1996). Monk (1987) defined ICT innovation diffusion as "a form of technological change that is shaped by the characteristics of information and information processing". Hence, the factors identified for technical innovation diffusion can apply to ICT innovation diffusion (Lockett, 1996).

Technology innovation diffusion theory has helped to explain the adoption and diffusion of different types of new ICT. These include software (Zmud, 1982), decision support systems (Liang, 1986), spreadsheets (Brancheau and Wetherbe, 1990), MRP (Cooper and Zmud, 1990), strategic information systems (Krcmar and Lucas, 1991), DBMS (Grover and Teng, 1992), EDI (Bouchard, 1993; Premkumar *et al.*, 1994; Damsgaard and Lyytinen, 2001), telecommunications (Grover and Goslar, 1993), e-mail (Romm *et al.*, 1996; Kettinger and Grover, 1997), FMS (Belassi and Fadlalla, 1998), ATMs (Santos and Peffers, 1998), expert systems (Shao, 1999), electronic cash (Westland *et al.*, 1998) and the Internet (Press *et al.*, 1998; Charlton *et al.*, 1997; Standing and Vasudavan, 2000). In previous research of ICT diffusion, external factors identified often include compatibility, relative advantage and complexity (Tornatzky and Klein, 1982; Moore and Benbasat, 1991; Rogers, 1995; McMaster *et al.*, 1997).

In order to understand the characteristics of previous ICT diffusion research, an attempt is made here to divide the research into micro and macro level aspects or orientations. Micro level research focuses on ICT diffusion at the level of the individual and the organization. Macro level research takes into account diffusion at the level of the industry and the nation. Table I provides a summary of the two groups for a selection of ICT diffusion studies.

To summarize, as can be seen from Table I, most previous research of ICT diffusion was carried out at the micro level before the Internet and electronic commerce appeared on the commercial scene around the mid 1990s (Ticoll *et al.*, 1998; Timmers, 2000). Most micro level research has sought to identify relevant factors of the ICT diffusion on an organizational basis (e.g. Zmud, 1982; Liang, 1986; Brancheau and

Table I Summary of previous ICT innovation diffusion studies

Level	Author(s) and year	Research ICT	Analysis context	Impact factors
Micro level	Zmud (1982)	Software	Software development group	Innovation process Compatibility Vested interests
	Liang (1986)	DSS	University students	Quality of system Representation format Motivation User attitude
	Lee and Treacy (1988)	General IT	IS Users	Motivation support Information support Resources support
	Brancheau and Wetherbe (1990)	Spreadsheet	End-user computing	Education Opinion leadership Media exposure Internal communication
	Cooper and Zmud (1990)	MRP	Manufacturing organizations	Compatibility Manufacturing methods
	Krcmar and Lucas (1991)	SIS	Bank organization	Cost justification Seizing an opportunity Need for sponsor Marketing the application Customer-oriented view Building on infrastructure
	Grover and Teng (1992)	DBMS	IS organization	Organization size Extent of online processing End-user computing Degree of centralization Size of IS department Environment uncertainty Decentralization of decision making
	Grover and Goslar (1993)	Telecommunication	IS Organization	Business partners Actual businesses Relative advantage Compatibility Costs
	Bouchard (1993)	EDI	Manufacturing organizations	Organizational learning Organizational culture Link between organizational learning and culture
	Premkumar <i>et al.</i> (1994)	EDI	IS manager	Corporate strategy Corporate culture Organization structure Management style Competitive pressure Customer support Internal support Compatibility Resource intensity Benefits of telemedicine Communication channels Organization size Effect of mass-media communication Vendor support Top management support Customer support Effective consultants Greater public access Partnerships Broadcast Task Social communication Communication among industry competitors Marketing efforts by the IT vendors Telecommunication infrastructure National security Markets and choice Financial resources Cultural concerns Commercial use Technology innovation Partnerships Heterogeneous adopters Education and change in payment habits
	Romm <i>et al.</i> (1996)	E-mail	University community	
	Belassi and Fadlalla (1998)	FMS	Manufacturing organization	
	Sheng <i>et al.</i> (1998)	Telemedicine technology	Hospital organization	
	Shao (1999)	Expert system	Banking organization	
	Standing and Vasudavan (2000)	Internet technology	Travel agencies	
	Charlton <i>et al.</i> (1997)	Internet	Communities in UK and Merseyside	
	Kettinger and Grover (1997)	E-mail	Interorganizational context	
	Santos and Peffers (1998)	ATM	Banking industry	
	Press <i>et al.</i> (1998)	Internet	Nation	
	Rai <i>et al.</i> (1998)	Internet	Social level diffusion	
	Westland <i>et al.</i> (1998)	Electronic cash	Nation	

Wetherbe, 1990; Krcmar and Lucas, 1991; Bouchard, 1993; Romm *et al.*, 1996; Belassi and Fadlalla, 1998; Standing and Vasudavan, 2000). These micro level studies have hardly concerned themselves with factors related to the external environment, focusing rather on internal organizational considerations. As mentioned previously, Internet systems are globally oriented media that connect businesses with customers in the global digital economy. Therefore, it would appear that a micro level treatment of the phenomenon might be limited in explaining Internet systems diffusion.

On the other hand, as shown in Table I, there are a growing number of studies of ICT diffusion at the macro level. These reflect the dynamic and global phenomena of Internet systems for commercial purposes, since the Web emerged in the 1990s (Ticoll *et al.*, 1998; Timmers, 2000). Innovative characteristics of Internet technologies are constantly reshaping the business landscape in terms of reducing costs, lowering cycle times across business processes, enhancing customer service, and improving product quality (Nath *et al.*, 1998; El Sawy *et al.*, 1999). This phenomenon is reflected in increased interest in academic research related to electronic commerce (e.g. Charlton *et al.*, 1997; Santos and Peffers, 1998; Rai *et al.*, 1998; Westland *et al.*, 1998). This is because “the micro level of innovation diffusion research cannot account for differences in diffusion patterns due to variances in environmental and institutional factors” (Damsgaard and Lyytinen, 1997). However, it appears that macro level research tends to underestimate the role of Internet technologies, so that it rarely concerns the factors related to Internet technology *per se*. Among the most forceful drivers of social and economic change in recent years is the revolution in communications and information processing brought about by ICT, in particular Internet technology (McKenney, 1996; Feeny, 2001; Porter, 2001). Moreover, “the Internet phenomenon is indeed a paradigm shift governing both business and information systems” (Wigand, 1997, p. 2). On this basis, it would appear necessary to take a balanced view regarding the factors related to both the technical and non-technical issues, in exploring the global phenomenon of Internet systems diffusion.

In addition, there are differences across industry sectors and across countries in the extent of diffusion of ICT (Newell *et al.*, 1998). Therefore, “the most consistent theme found in the ICT innovation research is that research findings have been inconsistent” (Wolfe, 1994, p. 405). It has been suggested that this lack of consistency arises from the complex and contextually-sensitive

nature of innovation processes (Newell *et al.*, 1998). Thus, it would appear that research on ICT innovation diffusion requires a contextual approach related to the social nature of the innovation diffusion process, in order to reflect the global and dynamic nature of ICT innovation diffusion (Newell *et al.*, 1998; Avgerou, 2001). In the light of this observation, this research attempts to investigate the diffusion of WBSS within different national contexts, because “ICT innovation diffusion is heavily dependent on the context of application” (Newell *et al.*, 2000, p. 246). This contextual approach, particularly with respect to different national contexts, may help us more clearly understand the diffusion of WBSS, and may improve the analytical power of WBSS diffusion research.

Previous studies on Internet systems diffusion

To acquire useful insights that may assist in the development of an Internet systems diffusion model, this section reviews previous research related to Internet systems diffusion more specifically. In focusing on Internet systems diffusion specifically, it is hoped to provide valuable insights into, and a foundation for, selecting the fundamental variables of Internet systems diffusion by tracing the factors relevant to the diffusion of Internet systems.

Auger and Gallagher (1997) examine some of the issues associated with the adoption of an Internet-based sales presence by small- to medium-size businesses. Their research identifies six factors that affect the adoption of an Internet-based sales presence:

- (1) Low development and maintenance costs.
- (2) An interest in experimenting with a new marketing tool.
- (3) The desire to promote products and build the company's image.
- (4) Financial considerations.
- (5) Benefits in obtaining and disseminating information.
- (6) Competitive considerations.

They concluded that among these factors, low development and maintenance costs were the most significant.

Loh and Ong (1998) provide a research framework of the adoption and development of a broad-based Internet stock-trading platform. This study reveals that customers' concerns, expectations, perceived ease of use and the real value added by a new system, as well as their trading behaviour, are critical determinants to the

ultimate adoption of Internet stock trading. The results highlighted some interesting findings such as customers' readiness to accept online transactions.

Foo and Hui (1998) propose a framework that evaluates a feature of the functionality of the Internet telephone system. They also suggest a multiplicity of factors that can affect the performance of an Internet telephone system, namely: network performance, computing resource, voice processor, signal acquisition, output transducer, system architecture and methods to establish connection between users. However, the results of this research are limited in generalizability due to the small sample size considered.

Storey *et al.* (2000) investigate Internet banking services in the UK and the USA. They argue that to provide better customer-oriented banking services, it is necessary to offer Internet banking services such as online mortgages and loans, as well as online credit card applications. However, they note that further empirical study is necessary to investigate more comprehensive factors, especially technical variables related to the diffusion of Internet banking systems.

Corbitt (2000) highlighted factors that have been identified as being important in the diffusion of electronic commerce (EC) architecture. Corbitt argues that success in EC diffusion is attributable to a number of factors, namely: organizational commitment, the existence of an executive sponsor, and frequent access by users. However, this research adopts quite a broad approach to the diffusion of electronic commerce architecture, and hence further research will need to focus on a specific domain among several EC applications, such as Internet banking systems, WBSS, supply chain management systems and the like.

Cheung and Lee (2000) investigate the factors impacting on Web-based shopping platforms. Two categories of factors are identified:

- (1) Trustworthiness of Internet vendors.
- (2) The external environment.

However, as this study does not consider market variables and technological factors, and does not address detailed factors associated with the external environment, it would appear appropriate and timely to introduce new research related to e-business, which does address these issues. A summary of Internet systems research is provided in Table II.

Based on the above review of previous research on Internet systems diffusion, it would seem reasonable to classify the variables that have been identified into two groups – internal and external factors – in order to identify meaningful implications. These are summarised in Table III.

As can be seen from Table III, the external variables are different from those identified previously in more general ICT diffusion research. ICT diffusion research frequently investigated the external variables related to the technology itself such as compatibility, relative advantage, complexity, trialability, and observability (Tornatzky and Klein, 1982; Moore and Benbasat, 1991; Rogers, 1995; McMaster *et al.*, 1997). However, in the research on Internet systems, there are many new external factors mentioned, such as customer concerns, frequent access by customers, the promotion of products and company's image, competitive considerations, external environment and so on. It can be seen that these factors are all closely linked with the customer and market. This reflects the point that previous ICT diffusion research focused on the technology itself at an organizational level, while Internet systems studies focus more on aspects of electronic commerce which link organizations, customers, and global electronic markets across national boundaries. Therefore, it would seem that market and customer issues are becoming more crucial in research on Internet systems diffusion. These trends will therefore be incorporated in the design of a diffusion model of Internet systems.

Toward a diffusion model of Internet systems

We have reviewed two categories of ICT diffusion research:

- (1) A general review of ICT diffusion.
- (2) A review of Internet systems diffusion.

Based on this, this paper attempts to explore the conceptual inter-relationship of factors identified in the review of ICT diffusion and Internet systems diffusion (see Tables I and II). This is because, although their technical characteristics are different from Internet systems, the more widespread data of the general ICT diffusion would be able to discover common relationships and categories among them to generate a diffusion model of Internet systems, by refining chosen variables.

With regard to the review of factors affecting ICT diffusion more generally, and Internet systems diffusion more specifically, it can be seen that a wide range of factors appear to influence the diffusion of Internet systems interacting in a global and dynamic fashion. However, in building a diffusion model, we have attempted to focus on certain points passed over by the previous ICT diffusion studies. In other words, we attempt to provide a more balanced view regarding both the

Table II Summary of Internet systems diffusion research

Author(s) and year	Domain of Internet systems	Affecting factors
Auger and Gallagher (1997)	Internet-based sales presence	Low development and maintenance costs Interest in experimenting with a new marketing tool Promote products and build the company's image Benefits in obtaining and disseminating information Competitive considerations Financial considerations
Loh and Ong (1998)	Internet stock-trading platform	Customer concerns Expectations Perceived ease of use Trading behaviour Real value of a new system
Foo and Hui (1998)	Internet telephony systems	Network performance Computing resource Voice processor Signal acquisition Output transducer System architecture and techniques Methods to establish connection between users
Storey <i>et al.</i> (2000)	Internet banking systems	Ability of Internet banking service Availability of Internet payment applications
Corbitt (2000)	Electronic commerce architecture	Frequent access by customers Organizational commitment Existence of an executive sponsor
Cheung and Lee (2000)	Web-based shopping platform	Trustworthiness External environment

Table III Internal and external factors of Internet systems diffusion

Domain	Research variables	Reference
Internal factors	Low development and maintenance costs	Auger and Gallagher (1997)
	Financial considerations	
	Interest in experimenting with a new marketing tool	
	Benefits in obtaining and disseminating information	
	Expectations	Loh and Ong (1998)
	Trading behaviour	
	Real value of a new system	
	Perceived ease of use	
	Computing resource	Foo and Hui (1998)
	Voice processor	
	Signal acquisition	
	System architecture and techniques	
	Output transducer	
	Ability of Internet banking service	Storey <i>et al.</i> (2000)
	Existence of an executive sponsor	Corbitt (2000)
	Organizational commitment	
	Trustworthiness	Cheung and Lee (2000)
External factors	Promote products and build the company's image	Auger and Gallagher (1997)
	Competitive considerations	
	Customer concerns	Loh and Ong (1998)
	Methods to establish connection between users	Foo and Hui (1998)
	Network performance	
	Availability of Internet payment applications	Storey <i>et al.</i> (2000)
	Frequent access by customers	Corbitt (2000)
	External environment	Cheung and Lee (2000)

internal and external factors as well as the technical and non-technical issues.

First, Internet systems are global-oriented network systems that link organizations, customers

and business partners around the world. Business transactions on Internet systems occur between buyer and seller, merchant and customer, and manufacturer and supplier. Therefore, the external

environment of Internet systems diffusion will influence the level of digital transaction in an Internet system with a company's customers (B-to-C) and business partners (B-to-B). Also, internal circumstances of Internet systems diffusion will affect the internal systems integration with other applications, such as the payment system or database system, and the degree of internal usage of Internet systems. Hence, the variables identified from the above review are arranged into two groups: internal factors and external factors, as indicated in Table IV.

Second, as mentioned earlier, information and communication technology (ICT), in particular Internet technologies, has become a major technological force influencing business success, electronic commerce and Internet systems diffusion (Choi and Whinston, 2000; Feeny, 2001; Porter, 2001). Moreover, the Gartner Group estimates that "75 percent of all e-business ventures will fail, due to a lack of technological understanding and poor business planning" (Load, 2000). Hence, the factors related to ICT, in particular Internet technologies, appear to be important with regards to the successful adoption and diffusion of Internet systems (Mahadevan, 2000; Korper and Ellis, 2000; Porter, 2001). On the basis of this observation, we classify the factors identified in previous research into ICT-related factors and non-ICT related factors, as shown in Table V. The factors can be divided into four dimensions:

- (1) Internal factors not related to ICT.
- (2) Internal factors related to ICT.

- (3) External factors not related to ICT.
- (4) External factors related to ICT.

As can be seen from Table V, internal factors not related to ICT include perceived ease of use, organizational commitment, trustworthiness, executive sponsor, internal communication, education, top management support, organization culture, corporate strategy, experimenting with a new marketing tool and so on. Thus, these might be called "internal organization factors". Internal factors related to ICT include the real value of a new system, computing resource, system architecture and techniques, quality of system, building on infrastructure and extent of online-processing. Therefore, these factors may be interpreted as "internal systems factors". External factors not related to ICT are competitive considerations, customer concerns, customer-oriented view, business partner, competitive pressure, customer support, partnerships, commercial use, frequent access by customers, marketing application, and so on. These factors may therefore be labelled as "external market factors". External factors related to ICT include network performance, compatibility, relative advantage, costs, telecommunication infrastructure, vendor support, marketing efforts by IT vendors, technology innovation and availability of Internet payment applications. External factors related to ICT may therefore be called "external technical factors".

Table IV Internal and external factors of previous research variables

Domain	Research variables		Reference
Internal factors	Experimenting with a new marketing tool	Financial considerations	Brancheau and Wetherbe (1990)
	Real value of a new system	Trading behaviour	Liang (1986)
	Perceived ease of use	Computing resource	Krcmar and Lucas (1991)
	System architecture and techniques	Trustworthiness	Grover and Teng (1992)
	Executive sponsor	Organizational commitment	Romm <i>et al.</i> (1996)
	Quality of system	Education	Auger and Gallaughier (1997)
	Internal communication	Building on infrastructure	Belassi and Fadlalla (1998)
	Extent of online-processing	Organization culture	Loh and Ong (1998)
	Top management support	Corporate strategy	Foo and Hui (1998)
			Corbitt (2000)
			Cheung and Lee (2000)
			Standing and Vasudavan (2000)
External factors	Promote products and build the company's image	Competitive considerations	Krcmar and Lucas. (1992)
	Customer concerns	Network performance	Bouchard (1993)
	Availability of Internet payment applications	Compatibility	Premkumar <i>et al.</i> (1994)
	Frequent access by customers	Marketing application	Auger and Gallaughier (1997)
	Customer-oriented view	Business partner	Loh and Ong (1998)
	Relative advantage	Costs	Rai <i>et al.</i> (1998)
	Competitive pressure	Customer support	Press <i>et al.</i> (1998)
	Vendor support	Partnerships	Sheng <i>et al.</i> (1998)
	Telecommunications infrastructure	Commercial use	Storey <i>et al.</i> (2000)
	Marketing efforts by IT vendors	Technology innovation	Corbitt (2000)
			Standing and Vasudavan (2000)

Table V Classification of previous research factors

Domain	Classification	Factors	Reference
Internal	Non-ICT related factors	Financial considerations	Trading behaviour
		Perceived ease of use	Trustworthiness
		Organizational commitment	Executive sponsor
		Internal communication	Education
		Top management support	Corporate strategy
		Organizational culture	
		Experimenting with a new marketing tool	
	ICT related factors	Real value of a new system	
		Computing resource	
		System architecture and techniques	
		Quality of system	
		Building on infrastructure	
		Extent of online processing	
		Promote products and build the company's image	
External	Non-ICT related factors	Competitive considerations	Customer concerns
		Customer-oriented view	Business partner
		Competitive pressure	Customer support
		Partnerships	Commercial use
		Frequent access by customers	Marketing application
		Promote products and build the company's image	
		Network performance	
	ICT related factors	Relative advantage	
		Telecommunication infrastructure	
		Marketing efforts by IT vendors	
		Availability of Internet payment applications	

To summarise, we dealt with a review of studies related to Internet systems diffusion. We have arranged the factors that appear to be closely relevant to Internet systems diffusion research into four categories:

- (1) Internal organization factors.
- (2) Internal systems factors.
- (3) External market factors.
- (4) External technical factors.

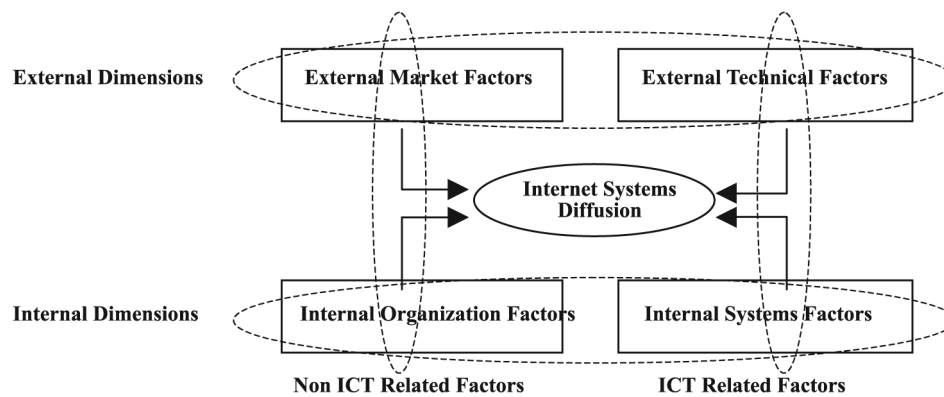
As a result of this, a conceptual inter-relationship of the four categories can be proposed and is shown in Figure 1. This represents a diffusion model of Internet systems and offers a theoretical background for further research on ICT diffusion and electronic commerce applications. The conceptual model comprises five key dimensions: the four clusters identified previously, together with a fifth, concerned with the extent of Internet systems diffusion *per se*. The five dimensions are illustrated as being organically connected with each other.

Application, discussion and conclusion

We examined the overall trends of ICT diffusion and provided a summary of the two groups from

the macro and micro level aspects. Based on a wide-ranging review of the literature, it appeared that the theory related to the micro level was limited in explaining the global phenomenon of Internet systems diffusion. This is because, at the micro level, factors related to external market issues were hardly considered, with the majority of prior studies focusing on internal organizational factors. On the other hand, the research relevant to the macro level tended to underestimate the role of Internet technologies, and rarely concerned the factors related to the Internet technology *per se*. On this basis, it appears necessary to present a balanced view regarding the factors related to both the internal and external factors as well as the technical and non-technical issues, in exploring the global phenomenon of Internet systems diffusion. This investigation led to the development of an Internet systems diffusion model that incorporates both the internal organizational factors and external market issues as well as ICT related and non-ICT related factors (see Figure 1). On this basis, it would be meaningful to apply the diffusion model of Internet systems can be applied and tested in a practical setting. This could assist in verifying whether the model is a reasonable framework for describing Internet systems and e-commerce

Figure 1 Diffusion model of Internet systems



diffusion. In order to do this, we attempt to review the major issues in relation to the diffusion model of Internet systems by looking at the most well-known Internet systems diffusion case, Amazon.com (www.Amazon.com).

In 1994, Jeff Bezos, the founder and chief executive officer of Amazon.com, became intrigued by the rapid growth of the Internet. As an example of technological innovation that facilitates new and innovative activity at the individual, organizational and social level, Bezos realized that this was a new business opportunity based on the characteristics of Internet technologies such as interactivity, connectivity, feasibility and so on. After some intense analysis to capitalize on this new business channel, he started Amazon.com, offering books via the global electronic market. He believed that consumers would feel less need to actually touch and feel a book before buying it and no physical bookstore could stock more than a small percentage of the available titles. The comparative dynamic of the book publishing, distributing, and retailing industry were also favorable (Turban *et al.*, 2002; Dutta and Segev, 2001; Laudon and Traver, 2001).

In developing the largest online bookstore in the world, Amazon.com provides a lower cost structure than traditional book stores. It does not need the expense of an actual and extensive inventory, since it relies in large part on book distributors. Key features of the Amazon.com systems are easy browsing and searching, broad product and customer database, one-click order technology, e-mail and telephone customer support system, secure payment system, efficient order fulfillment system and shipping information system. Amazon is recognized as an online leader in creating sales through customer relationship management (CRM) by creating informative front-end systems and efficient back-end systems. Its business strategy is to become the best place to buy, find, and discover products or services

available on the Internet (www.Amazon.com) (Turban *et al.*, 2002; Laudon and Traver, 2001).

According to the case analysis of Amazon.com addressed above, we present an expanded model that substantiates the diffusion model of Internet systems (see Figure 1). This is illustrated in Figure 2.

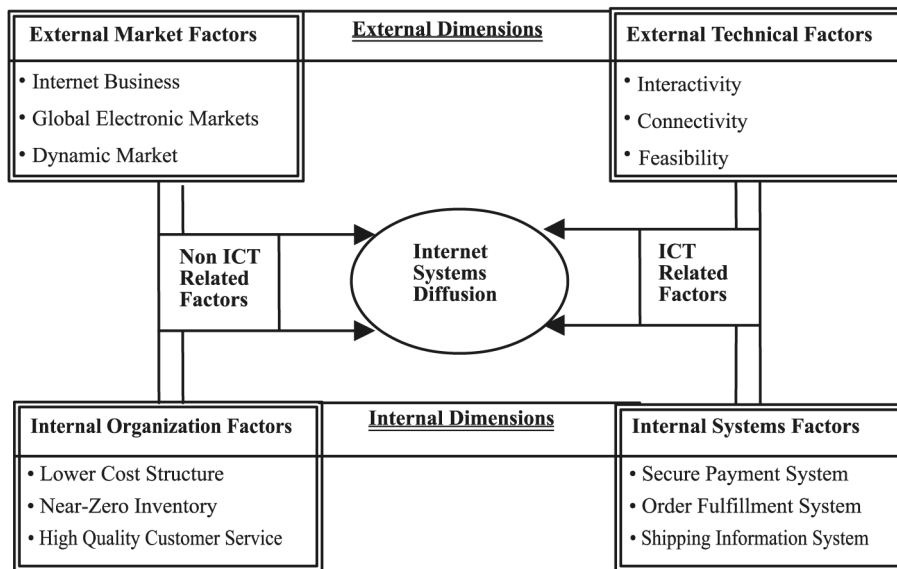
To sum up, based on the comparative review of previous ICT and Internet systems diffusion research, this paper has described the development of a conceptual diffusion model, comprising four categories:

- (1) External market factors.
- (2) External technical factors.
- (3) Internal organization factors.
- (4) Internal systems factors.

The detailed conceptual inter-relationships of the four categories are described in Figure 2. For instance, the external market factors and external technical factors are both external dimensions that can affect the internal organization and internal systems domains in an organization. The internal organization factors and internal systems factors are both internal dimensions that affect the diffusion of Internet systems. Furthermore, among ICT-oriented and non ICT-oriented factors, external technical factors and internal systems factors are the major driving forces of Internet systems diffusion as ICT-related factors. In relation to the non ICT-oriented factors, Internet systems diffusion is also influenced by internal organizational and external market factors. These five dimensions are not independent and cannot therefore be addressed independently as each affects the diffusion of Internet systems and each reacts to Internet systems diffusion. According to the discussion, the Internet systems diffusion appears to be influenced by these four groups of key impact factors.

This conceptual diffusion model provides a theoretical foundation for further research of

Figure 2 An expanded model of Internet systems diffusion



Internet systems and electronic commerce diffusion. In particular, further study will attempt to test the theoretical implications, while considering external market, external technical, internal organization, and internal systems factors. That is, it will be meaningful for future research to investigate further what variables within each of the four group factors are associated with Internet systems and e-commerce diffusion (see Figure 2). Hence, the four categories could be used in the further research, in the context of a more detailed consideration of the objective focus and design of the research.

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