“E-business adoption among SMEs in Malaysia: investigation from the supply chain perspective”

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SECTION 2. Management in firms and organizations

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E-business adoption among SMEs in Malaysia: investigation from the supply chain perspective

Abstract

The objective of this paper is to examine the Malaysian small and medium enterprises (SMEs) participation in the e-business as it is difficult to understand the key factors contributing to their low participation in the e-business. A questionnaire was distributed to 200 Malaysian SMEs with a response rate of 68 percent. In this study, the independent variables are technological characteristics, environmental characteristics and organizational characteristics. The adoption of e-business among SMEs in Malaysia is used as the dependent variable. The findings created an understanding of what attributes influence the adoption of e-business in the supply chain. In terms of theoretical contributions, this study has extended previous researches conducted in Western countries and provides great potential by advancing the understanding of the association between adoption factors and e-business adoption in Malaysian SMEs. SMEs planning to adopt e-business in their supply chain would be able to apply strategies based on the findings from this research.

Keywords: e-business, small and medium-sized enterprises, Malaysia.
JEL Classification: L81, M15.

Introduction

"In order to compete in the international market, small and medium companies must participate in the Global Supply Chain Management Network for online and real-time procurement, production and logistics management. To use this network, small and medium companies need to utilize internet-based common order code, to communicate directly with global suppliers." Former Prime Minister of Malaysia, *Budget Speech, 19th October 2001*.

Economic forces and technological advances have combined over the past 20 years to increase the importance of the supply chain for company profitability and long-term business success. In the early 1980s, Oliver and Webber (1982) discussed the potential benefits of integrating the internal business functions of purchasing, manufacturing, sales, and distribution. Then, more attention was placed on the concept of supply chain management, which reflected the management of money, material gain and information throughout the supply pipeline. Accordingly, globalization is considered as a huge unstoppable wave sweeping through the world, in which the information system is rapidly becoming a business determinant for inter-enterprise trade. Information system in supply chain management (SCM) has gained its importance recently due to its ability to reduce costs and increasing responsiveness in the supply chain (Mc Laren et al., 2004; Chopra & Meindl, 2001; Dagenais & Gaustchi, 2002; Lee, 2000; Ndubisi & Jantan, 2003). A more evident fact is based on financial excerpts of Proctor and Gamble, according to which, the company gained USD325 million savings annually through the usage of SCM system (P&G, 2001). During the past decades, information systems have enabled many organizations, such as Dell and Hewlett Packard, to successfully operate solid collaborative supply networks (Scott, 1993). Thus, organizations increasingly find that they must rely on effective supply chains systems to successfully compete in the global market and networked economy.

Many researchers have given a lot of definitions of SCM. Among the popular ones would be that by Lambert et al. (1998); in Global Supply Chain Forum mentioned that SCM is the integration of key business processes from end user through original suppliers which aim to add value and services to customers and stakeholders. The other definition that could be also stated here is that by Hanfield and Nicholas (1999): SCM is the integration of activities, through improved supply chain relationship, aiming to achieve sustainable advantage. It is widely accepted in the literature that SCM is important for material and information flows relating to the transformation of the materials into value added products, and the delivery of the finished products through appropriate channels to customers and markets so as to maximize customer value and satisfaction. However, the introduction of information system by a firm for SCM could lead to better efficiency and effectiveness (Goldhar & Lei, 1991; Sullivan, 1985). For example, the members of

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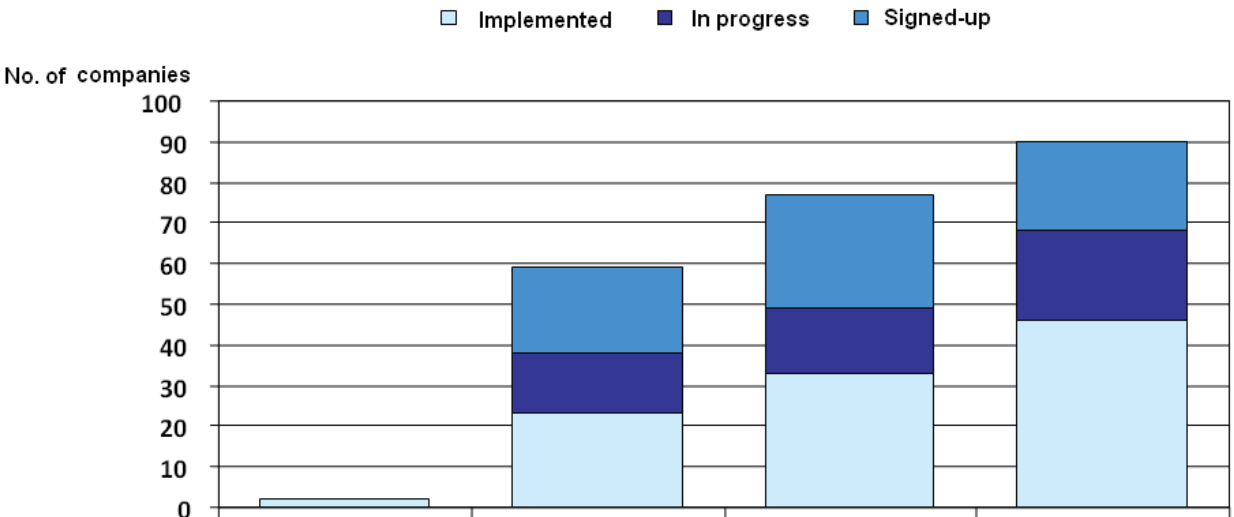
the chain can share the database for supply that enables the company to identify optimal inventory levels, reduce warehouse space, and increase inventory turnover (Kaeli, 1990). As John Gossman, vice-president of materials management at Allied Signal, recently noted: "competition is no longer company to company, but supply chain to supply chain." His statement emphasizes the strategic benefits of supply chain management. As a consequence, Bowersox and Daugherty (1995) claimed that the benefit of such supply chain management can be attained through electronic linkage among various supply chain activities utilizing information systems. There is strong evidence in the literature on the benefits of different systems developed for supply chain management.

1. Research background

Traditionally, companies in a supply network concentrate on the inputs and outputs of the processes, with little concern for the internal capabilities even though the internal capabilities are known to impact local firm performance. This is consistent with the resource-based theory (Corner & Prahalad, 1996), which argues that a firm's internal resources and capabilities represent the foundation for the creation of value. Tracey et al. (2005) suggest that those companies have organized functionally, actually generating barriers to the creation of value. This means that top management must identify and acknowledge all the underlying capabilities to create the value, even if customers are aware or not being interested (Bechtel & Jayaram, 1997). A research by Sharma et al. (2006) revealed that 210 SMEs in India understand and acknowledge the importance of IS in their day-to-day operations in the present dynamic and heterogeneous business environment and need to exploite them in the formal and professional manner to drive maximum business gains. For them, the ability to deliver innovative solutions on a sustainable basis requires strategic internal capabilities optimized for business growth.

According to Zeng and Pathak (2003) and Ho (2009), benefits of e-business in supply chain management include improvements in speed of response; cost savings; improvements in communications, information and knowledge sharing; reductions in inventory; improvements in efficiency and productivity; harmonization and standardization of procedures; and better transfer of best practices. Due to these advantages e-business offers, businesses worldwide have begun to recognize the importance of automating and tightening their supply chains through electronic mechanisms. Alam and Ahsan (2007), however, claim, although the adoption of e-business in the supply chain brings many benefits to companies, recent studies have shown that many SMEs in Malaysia are still not implementing e-business. SMEs are considered to be a vital component of the country's economic development (Saleh & Ndubisi, 2006). According to SMIDEC (2008), SMEs represent the largest percentage of establishments in Malaysia, at 99.2 percent. In terms of their economic contribution, SMEs contribute 32 percent to gross domestic product, 56.4 percent to total workforce and 19 percent to total exports of the country. However, SMEs in Malaysia are also facing competitive pressure from various countries such as China, India and Vietnam. Companies in these countries have lower labor costs when compared to companies in Malaysia. Therefore, in order to compete with companies from these countries, Malaysian SMEs have to be able to work efficiently. One way to achieve this is to have an efficient supply chain through the implementation of e-business technologies (Hsieh & Lin, 1998).

Many researchers have recognized supply chain systems as a new organization form, using terms such as Electronic Data Interchange (EDI), Electronic Marketplace or Enterprise Resource Planning (ERP) and Materials Requirement Planning (MRP). A variety of systems have been designed and implemented for different supply chain activities and strategic purposes. Some of the most commonly implemented systems are used to support the operations of planning, scheduling and distributing the materials. In the case of systematic implementation of these systems, RosettaNet is responsible for assisting the implementation of these systems. RosettaNet is an independent, non-profit consortium dedicated to the collaborative development and rapid deployment of open, Internet-based business standards that align processes within the global high-technology trading network. More than 450 companies representing over $1 trillion in annual information technology, electronic components and semiconductor manufacturing revenues currently participate in RosettaNet's systems development, strategy and implementation activities. RosettaNet aids significantly in decision making related to the planning, assessment, and control of supply chain activities. In general, RosettaNet is a Malaysian-made international standard in an effort to encourage the mass global small medium industries (SMI) community to automate their procurement processes for a more conducive global e-commerce business environment. However, it is sad to say that SMEs seem not to take this opportunity to set up or to take advantage on this effort (Figure 1). In spite of the availability of innovative products and excellent support in the development, management and administration of e-business activities, SMEs' involvement in e-business is still below expectated level.



	2004	2005	2006	Jan' 07
Signed-up		21	28	22
In progress		15	16	22
Implemented	12	23	33	46

Fig. 1. RosettaNet adoption in Malaysia

Notes: Implemented − SMEs in Malaysia who have gone with at least one system implementation.
In Progress − SMEs in Malaysia who have started the process by buying software, hardware etc. SMEs in Malaysia with approved RosettaNet Grant application.
Signed up − SMEs in Malaysia who have applied the RosettaNet Grant. SMEs who have signed agreement with Solution Providers.

Although many multinational companies in Malaysia have implemented e-business in their supply chain, many Malaysian SMEs are still not embracing e-business technology. Only 30 percent of SMEs in Malaysia employed basic information and communication technology (ICT) (Microsoft Corporation, 2008). SMEs have found to be different from larger companies in the context of IT adoptions (Thong et al., 1996; Lee et al., 2005). Given that they have fewer resources compared to larger organizations, they have to incur higher risks when it comes to adopting ITs such as e-business. Past studies such as Iacovou et al. (1995) and Kuan and Chau (2001) have analyzed the adoption of technologies such as electronic data interchange (EDI) among SMEs. However, these studies have mainly focused on western countries such as the USA and the UK. Accordingly, this research attempts to bridge the gap in existing literatures by studying whether technological, environmental and organization factors will influence the adoption of e-business in the supply chain among SMEs. The organization of the paper is as follows. The next section presents a review of existing literature on e-business adoption. Next, the research model and the hypotheses are described. The research method, data analysis and results are then presented. The research findings are considered and the paper concludes with discussions of the study's limitations, its managerial and theoretical contributions as well as future research that could be undertaken.

2. Literature review

2.1. E-business adoption theories. This research aims to study the adoption of E-business in the supply chain among Malaysian SMEs. The application of ITs in the supply chain ranged from manufacturing resource planning (MRP) to EDI and e-business applications such as business-to-business (B2B) and collaborative commerce (c-commerce) (Chou et al., 2004). There have been various literatures focused on the study of EDI and e-commerce adoptions based on innovation adoption theories such as Rogers' (1995) Diffusion of Innovation Theory and Tornatzky and Fleischer's (1990) technology-organization-environment (TOE) model (Premkumar et al., 1994; Iacovou et al., 1995; Kuan and Chau, 2001; Ngai and Gunasekaran, 2004; To and Ngai, 2006). Rogers's Diffusion of Innovation Theory proposed that the decision to adopt an innovation is based on five factors: relative advantage, compatibility, complexity, trialability and observability. Relative advantage is the degree to which an innovation is perceived to be better than the innovation it is replacing. Compatibility is whether the innovation is compatible to the potential adopters' values, needs and experiences. Complexity is the extent to which the innovation is perceived to be difficult to use or understand. Trialability is whether the innovation can be

experimented before committing to the full deployment of the innovation. Finally, observability is whether the benefits of the innovation are visible.

TOE model is based on adoption factors such as organization, technological and external environment. Organization factor includes organization attributes such as its size, centralization, formalization, quality of its human resources, amount of slack resources available internally and complexity of the organization's managerial structure (Shen et al., 2004). Technological context looks into the internal and external technologies that are relevant to the organization. External environment includes the industry an organization is in, its competitors, and accessibility to the resources supplied by others (Shen et al., 2004). Even for studies that have focused on SMEs' adoption of technologies such as EDI (Kuan & Chau, 2001; Iacovou et al., 1995), e-commerce (Mirchandani & Motwani, 2000; Scupola, 2003; Fillis et al., 2004), web sites (Raymond, 2001) have found that these adoption factors can be summarized into technology, organization and environment factors. Recent studies have also stated that there is a need to shift the study of IT adoption from traditional models such as DOI and TOE to other emerging areas (Parker & Castleman, 2006; Chong & Ooi, 2008; Ratnasingam, 2001).

E-business adoption has more emphasis on the relationship between the business partners given that they have to jointly adopt the technology. Lin (2008) stated that e-business technologies differed from adoption of traditional information systems as 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" (Lin, 2008, p. 62). The current e-business adoption in supply chain requires the co-adoption of two or more organizations. Many of these organizations are adopting e-business based on the relationships instead of factors from TOE and DOI models. For example, existing adoption factors such as compatibility and complexity will not be an adoption barriers in many e-business applications as many current e-business systems use internet connections and technologies such as XML which is easily understood and solves the problem with compatibility. Furthermore, although literatures tend to focus on cost issues when it comes to technology adoption among SMEs, it should be noted that e-business has lower cost when compared to existing technologies such as EDI. Generally, based on SMIDEC (2007) definitions on SMEs, two broad categories are defined:

1. Manufacturing, Manufacturing-Related Services and Agro-based industries

"Small and medium enterprises in the manufacturing, manufacturing related services and agro-based industries are enterprises with full-time employees not exceeding 150 OR with annual sales turnover not exceeding RM25 million".

2. Services, Primary Agriculture and Information & Communication Technology (ICT)

"Small and medium enterprises in the services, primary agriculture and Information & Communication Technology (ICT) sectors are enterprises with full-time employees not exceeding 50 OR with annual sales turnover not exceeding RM5 million".

2.2. Theoretical foundation. After carefully reviewing the literature, the study found that the technology-organization-environment (TOE) framework developed by Tornatzky and Fleischer (1990) is a suitable framework for the study of factors influencing the adoption of information system. The TOE framework has been examined in a number of empirical studies on various information system adoptions. In addition, Scupola (2003) used TOE to explain the adoption of Internet commerce. Moreover, Ramamurthy et. al. (1999) tested the impact of electronic data interchange (EDI) on firm performance as the consequence of technological factors characteristics (compatibility of EDI with existing infrastructure), organizational characteristics (internal management support and EDI resources), and environmental characteristics (customer expertise and competitive pressure). Based on several literature reviews, the study decided to use TOE framework. These studies provided consistent empirical support for the TOE framework, although specific features identified within the three contexts may vary across different studies. Drawing upon the empirical researches combined with the literature review and theoretical perspectives, we adopted this framework and extended it to the area of the adoption of e-business among SMEs.

The TOE framework identifies three aspects of a firm's context that influence the process by which it adopts and implements a technological innovation such as technological characteristics, environmental characteristics and organizational characteristics. In this study we use technological characteristics, environmental characteristics and organizational characteristics as independent variables. The dependent variable is the adoption

of e-business among SMEs in Malaysia. Technological characteristics describe both the internal and external technologies relevant to the firm. These include existing technologies inside the firm, as well as the pool of available technologies in the market. Environmental characteristics are the area in which a firm conducts its business – its industry, competitors, access to resources supplied by others and customers' pressure (Tornatzky & Fleischer, 1990). Organizational characteristics are defined in terms of several descriptive measures, for example: management support, human resources; and the amount of slack resources available internally.

2.3. Research model. Based on the TOE framework, a research model consists of two TOE factors under each variable which is reflecting the adoption of e-business among SMEs. The study hypothesizes how these factors influence the adoption of e-business among SMEs.

2.3.1. Technological characteristics. Myers and Marquis (1969) defined innovation as "A complex activity which proceeds from conceptualization of a new idea to solution of the problem and then to the actual utilization of economic or social value". Tornatzky and Fleischer (1990), Chau and Tam (1997) conducted research on the adoption of information system in the organization and they found that the decision to adopt a technology depends not only on what is available on the market, but also on how such technologies fit with the technologies that a firm already possesses. In addition, Tsai and Ghoshal (1998) described that an organization will have higher innovative capability when knowledge can be shared more easily within the organization. Technological innovation can be advanced when the technology has higher transferability and explicitness. Transferability of technology is determined by the explicitness of technology. It is more easy to transfer or share technological knowledge with higher explicitness (Grant, 1996; Teece, 1996).

Empirical study of Teece (1996) concluded that the cumulative nature of technologies will influence the innovation in technologies. An organization with high experiences in the application or adoption of related technologies will have higher ability in technological innovation (Grant, 1996; Simonin, 1999). The firm's existing productivity toward innovativeness may influence further innovation in adoption of information system. In this study, administrative innovation involves changes in structure and managerial processes. Based on Kaplan et al. (1999), there are four determinants of innovation adoption which are the characteristics of the innovation, the characteristics of the organization, the environmental context and the characteristics of the individual decision makers.

Meanwhile Rogers (1962) examined the factors such as the elements of the innovation, environment and the adopting unit that affect the adoption decision. He proposed a model of the diffusion of innovations that consists of five product or service characteristics postulated to influence consumer acceptance of new products or services: compatibility, complexity, relative advantage, trialability and observability. Out of these attributes, relative advantage has been found to influence significantly the adoption of information systems at an organizational level (Beatty, 2001). Rogers (1962) defined relative advantage as the degree to which consumers perceive a new product or service as better than its substitutes. The construct of relative advantage is highly domain specific, although dimensions that are found to have some generality include reduced costs and greater convenience. Therefore, the following hypotheses are proposed:

H1a: Innovation does significantly influence the adoption of e-business among SMEs.

H1b: Relative advantage does significantly influence the adoption of e-business among SMEs.

2.3.2. Environmental characteristics. External environment characteristics that may influence the adoption of e-business include competitive pressure, support from technology vendors, pressure from buyers and suppliers (Premkumar & Roberts, 1999). The characteristics of the individual decision maker, such as age, experience and psychological traits, have also been found to influence the adoption (Rogers, 1995). Additional external forces, such as competition, changing customer needs, government regulations and changing technologies, cause the pressure to the firm (Ungan, 2004). Moreover, Goel and Rich (1997) found that the innovation effort and adoption of new procedures and new technologies may increase competitiveness in some organizations. Zhu, Xu and Dedrick (2003) in their study of the drivers of e-business value concluded that competitive pressure often drives the firms to adopt e-business.

In addition, competitive pressure is an important factor driving firms to adopt a new technology in order to avoid competitive decline (Iocovou et al., 1995). Benchmarking is a tool in meeting the challenges that an organization's environment possesses (Brah et al., 2000; Underdown & Talluri, 2002). It is reasonable to assume that the more a company feels a pressure in its operating environment, the more likely it will adopt a best

practice. Ungan (2004) found that the competitive pressures forced companies to look for new ways to stay ahead or to just keep up with competition. In some instances, these pressures force companies to look for best practices in the future. It is quite logical to take whatever steps necessary to adopt information system that could attract more customers and maintain their loyalty by making their experience with firm more convenient and less waiting time. Peters and Waterman (1982) identified staying close to customers, learning their preferences and catering to their needs as critical success factors for the organization. Therefore, the following hypotheses are proposed:

H2a: Competitive edge does significantly influence the adoption of e-business among SMEs.

H2b: Customers' pressure does significantly influence the adoption of e-business among SMEs.

2.3.3. Organizational characteristics. Kwon and Zmud (1987) studied the implementation of information system and concluded that organizational characteristics influencing information system adoption include top management support, quality of IS, user involvement, product champion and resources. In addition, Amabile (1988) suggested that management skills, organizational encouragement for innovation, and support of innovation resources would help the improvement of organization innovation. Tornatsky and Fleischer (1990) mentioned that informal linkages among employees, human resource quality, top manager's leadership behavior and the amount of internal slack resources would significantly influence the adoption of technological innovation. A firm with higher quality of human resources, such as better education or training, will have higher ability in technological innovation. Several studies have brought mixed results with regard to the impact of this variable on the adoption decision of the information system. Moreover, Teo and Lim (1998) have measured the top management support and found that it was a significant predictor of the internet adoption.

Actually knowledge levels certainly play an important role in information system adoption. Knowledge level refers to the familiarity of firms' employee with a technology. Managers can formulate knowledge base role, activities and process, such as highly learning, teamwork, knowledge sharing and innovation, to increase employees involvement in IS innovation (Zack & McKenney, 1995). In fact, organizations, which are able to improve the knowledge of their human capital, are much more prepared to cope with today's rapid changes in environment and to innovate in the domain where they decide to invest and to compete. If firms' employees are knowledgeable regarding a new technology, they are likely to be better capable of dealing with technology adoption (Lin, 2005).

Previous research indicated that employee's IS knowledge (Thong, 1999), and company size (Palvia, 1999) do influence the adoption of IS. Managers should have IT knowledge to decide whether to adopt information system or not. Jantan et al. (2001) studied the CEOs and advanced manufacturing technology (AMT) adoption in SMEs and arrived at a conclusion that the characteristics of CEOs play a significant role in making technology adoption decision. Also, they have tested the relationship between the environmental factors and CEOs characteristics and found that CEOs characteristics have positive influence on the adoption of AMT. Moreover, Hayes and Abernathy (1980) described that technological trends of a manager's knowledge are also important if the manager is more experienced about information system, the more he invests in the innovation in IS. Qirim (2003) identified that top management support can lead to the adoption of e-business and the eagerness of top management level. He also found that CEO (usually an owner as well) is positively related to the guarantee of e-business adoption. Therefore, the following hypotheses are formulated:

H3a: Top management support does significantly influence the adoption of e-business among SMEs.

H3b: Employees' information system (IS) knowledge does significantly influence the adoption of e-business among SMEs.

This study investigates the relationship between technological, environmental and organizational characteristics and the adoption of e-business among SMEs. According to the theoretical framework, adoption of e-business among SMEs depends on the technological, environmental and organizational characteristics. Thus, independent variables in this study are technological characteristics, environmental characteristics and organizational characteristics, and adoption of e-business among SMEs is the dependent variable.

3. Research methodology

This study adopts a survey method by using structured questionnaire. Malaysian SMEs were the sample population used in this study. Since this study seeks to examine the factors influencing the adoption of e-business among SMEs, the expected respondents are General Managers of each company, Managers that have profound knowledge

regarding the process of information system adoption. Basically from the total population of 2224 SMEs in Malaysia, the study targeted 200 SMEs. Population frame used for this study was obtained from the SMIDEC directory (2008). This study is considered to be purposive sampling, which is non-probability design under which the required information is gathered from specific targets or groups on some rational basis (Sekaran, 2000).

3.1. Questionnaire design. The questionnaire was developed based on the examples from previous literature. It consists of four sections: section A examines the background of the companies. Section B assesses the e-business adoption. In section C, the questions are set to measure the factors influencing the adoption of e-business, and section D examines the demographic factors of the respondents. For all independent variables in this study, the response format was based on the 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). A 5-point Likert scale is used for items in section B and section C, and the overall layout of the questionnaire is as described in the following subsections.

3.1.1. Technological characteristics. In this study, technology characteristics were measured by five-item scale that evaluated the innovation at the SME in terms of new innovation in products/services by competitors, employees innovation in information system, up to date information system, reward system, allocated time, and budget for information system innovation. Moreover, technological characteristics were also measured by the five-item scale that evaluated the relative advantage in terms of the owners/partners perceived information system as easy to use, meeting the needs of firms, being secure and reliable. Five-point scale measurements for the technological characteristics were adopted from the study by Igbaria et al. (1995), Catella (1981), and Soon (1989).

3.1.2. Environmental characteristics. In this study, environmental characteristics were measured by competitive edge and customer's pressure. Competitive edge was measured by five items in terms of firm's ability to improve its financial growth, to compete with other firms, to focus on competitors. Five-point scale measurements for the competitive edge were adopted from the study by Banerjee and Golhar (1994). These five-point scale measurements for the customer's pressure were adopted from the study by Premkumar and Roberts (1999).

3.1.3. Organizational characteristics. Organizational characteristics were measured by the employee's information system knowledge and top management support. Consequently employee's information system knowledge was measured by five items in terms of employees that had a broad knowledge and understanding of information system based applications and employees having specific skills in information system based applications, systems, design and development. Five-point scale measurements for the employee's information system were adopted from the study by Cragg and King (1993). Moreover, top management support was measured by five items in terms of sufficient funding and resources for information system development, participation in planning process, in information system operation, priority of information system implementation and operation, effective management control for information system development and priority of information system implementation project. Five-point scale measurements for the organization characteristics were adopted from the study by Premkumar and Roberts (1999).

3.1.4. Adoption of e-business. This variable was measured based on five-point scale in terms of usage of electronic purchasing, electronic billing and electronic ordering. This measurement was adopted from the study by Goldschmidt (2005).

4. Data analysis and results

Out of the 200 questionnaires distributed, 60 were collected back. 6 questionnaires were found to be incomplete due to missing data and invalid responses. Therefore, only 54 questionnaires were usable giving a response rate of almost 30%. The results showed that 44% of the respondents were IT managers, whereas 25.9% of the respondents were administration managers. 3.7% of the respondents were the chief executive officers. Therefore, majority of the respondents were working in the IT field, that allowed us to feel that they possessed good enough knowledge to answer the questionnaire. Moreover, 42.6% of the respondents were working with the firm from 1 to 5 years. The results also showed that 57.4% of the respondents were males whereas 42.6% were females. 38.9% of the respondents were in 45-55 years old whilst 35.2% were at the age less than 35 years. Only 7.4% of the respondents fell into the 56 and above category. The results showed that majority of the respondents were holding Master in IT degree (29.6%) and 24.1% were IT diploma holders followed by other qualifications, such as Master in Business Administration, Master in Human Resource Management etc. (18.5%).

Results from the analysis of respondents' firms profile showed that most of the respondents' firms were located in Perak state (18.5%). It was followed

by the firms situated in Selangor (16.7%) and Penang Island (14.8%). Minority of the respondents' firms were located in Johor Bahru, Melaka (5.6%) and Kelantan (1.9%). It showed that the firms located in Perak, Selangor and Penang were really interested in the research topic which is important for the firms. The results indicated that majority of the SMEs in Malaysia were practicing e-business. Majority of the firms have been engaged in e-business from 5 to 10 years (38%) followed by those engaging in e-business from 1 to 5 years (36%). Only 2% of the firms have been engaged in information system less than 1 year. In terms of the purpose of adoption system, all the firms adopted the e-business in order to improve the reliability of operation and to better response time (refer Table 1).

Table 1. Purposes of the e-business adoption

Items	Reason for adoption of e-business	Frequency	%
	To improve reliability of operation	43	86
	To improve response time	43	86
	To improve firm image	39	78
	To reduce errors in service	39	78
	To improve the process	38	76
	To improve competitiveness	37	74
	To improve decision-making	37	74
	To get greater customer loyalty	35	70
	To achieve cost saving	33	66
10.	Pressure from customers	30	60

4.2. Factor analysis of technological characteristics. The first independent variable, technological characteristic, comprises two dimensions (Innovation & Relative Advantage) with total 10 items. All 10 items were subjected to varimax rotated principal components factor analysis. When extracting with criterion of eigenvalue-greater-than-one, three-factor solution, which explained 76.72% of variance, was derived. The retention decision of each item was based on factor loadings greater than or equal to 0.50 and cross-loading with the other factors generally smaller than 0.35 (Igbaria, Iivari, & Maraga, 1995). Questions 6 and 8 were eliminated due to strong cross loading. The remaining items were retested with factor and reliability analysis, which resulted in a three-factor solution shown in Table 2.

The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.70 and the Bartlett's test of sphericity (Chi-square = 169.47, $p<.01$) was found to be significant. The diagonal entries of the anti-image correlation matrix ranged from 0.57 to 0.83. All of the anti-image values were greater than 0.50, indicating sufficient correlations among the items. Original two-dimension variable was increased to three dimensions. Factor 1 and factor 2 consisted of 3 items and factor 3 obtained two items. Subsequently, the factors were labeled as Administrative innovation, System innovation and Usage of e-business, respectively.

Table 2. Results of the factor analysis for technological characteristics

	Factors		
	1	2	3
The reward system in our firm encourages innovation.	**.89**	.19	.19
Our firm recognizes the employees who are innovative in e-business.	**.81**	.22	-.27
Our firm allocates time, budget and other resources in considering e-business based innovation for the firm.	**.76**	.05	.35
Our firm actively keeps abreast of new and innovative products/ service by competitors.	.18	**.86**	.10
Overall, I believe that e-business will be easy to use.	.05	**.84**	.33
Our innovation towards e-business is always up to date.	.32	**.63**	-.03
I have seen what others do using e-business in their firms.	-.09	.09	**.82**
Using e-business fits our work style.	.29	.26	**.78**
Eigenvalue	3.53	1.50	1.10
% of variance	44.10	18.80	13.82
Kaiser-Meyer-Olkin measure of sampling adequacy		0.70	
Bartlett's test of sphericity (Chi-square)		169.47	

Note: F1 = Administrative innovation, F2 = System innovation, F3 = Usage of IS.

4.3. Factor analysis of environmental characteristics. The third independent variable, environmental characteristic, comprises two dimensions (Competitive Pressure and Customers Pressure) with total 12 items. All 12 items were subjected to varimax rotated principal components factor analysis. When extracting with criterion of eigenvalue-greater-than-one, two-factor solution, which explained 74.40% of total variance, was derived. The retention decision of each item was based on factor loadings that were greater than or equal to 0.50 and cross-loading with the other

factors generally smaller than 0.35 (Igbaria, Iivari, & Maraghh, 1995). Questions 4, 5, 8, 9 and 12 were eliminated due to strong cross loading. The remaining items were retested with factor and reliability analysis, which resulted in a two-factor solution shown in Table 3. Factor 1 consisted of five items and was renamed as External Pressure, and factor 2 obtained only two items and was still under the same dimension (Customers Pressure). The Kaiser Meyer-Olkin measure of sampling adequacy was 0.69 and the Bartlett's test of sphericity (Chi-square = 187.73, p<0.01) was found to be significant. The diagonal entries of the anti-image correlation matrix ranged from 0.48 to 0.79. Except the questions 20 and 21, all of the anti-image values were greater than 0.50, therefore, indicating insufficient correlations among the items.

Table 3. Results of the factor analysis for environmental characteristics

	Factors	
	1	2
There is a need for our firm to improve its financial growth relative to other firms.	**.86**	-.25
There is a need for our firm to gain a competitive edge relative to other firms.	**.84**	-.09
There is a need for our firm to compete with other firms in terms of service quality.	**.80**	-.37
Customers are demanding for faster delivery of service.	**.79**	.23
Customers are demanding for better quality service.	**.77**	.32
Customers are demanding for reliable operations.	.03	**.85**
Customers are demanding for error free service.	-.11	**.85**
Eigenvalue	3.34	1.87
% of variance	47.70	26.68
Kaiser-Meyer-Olkin measure of sampling adequacy	0.69	
Bartlett's test of sphericity (Chi-square)	187.73	

Note: F1 = External Pressure, F2 = Customers Pressure.

4.4. Factor analysis of organizational characteristics. A varimax rotated principal components analysis was performed to two dimensions (Employees' IS knowledge & Top Management Support) on the 13 items scale measuring the organizational characteristics (third independent variable). When extracting with criterion of eigenvalue-greater-than-one, two-factor solution, which explained 73.13% of variance, was derived. The retention decision of each item was based on factor loadings that were greater than or equal to 0.50 and cross-loading with the other factors generally smaller than 035 (Igbaria, Iivari, & Maraghh, 1995). Questions 1, 3, 6, 7, 9 and 13 were eliminated due to strong cross loading. Factor 1 consisted of three items which were still under the same dimension (Top Management Support) and factor 2 retained four items which were renamed as Knowledge Sources. All those items were retested with factor and reliability analysis, which resulted in a two-factor solution shown in Table 4. The Kaiser Meyer-Olkin measure of sampling adequacy was 0.82 and the Bartlett's test of sphericity (Chi-square = 178.18, p<.01) was found to be significant. The diagonal entries of the anti-image correlation matrix ranged from 0.75 to 0.89. All of the anti-image values were greater than 0.50, indicating sufficient correlations among the items.

Table 4. Results of the factor analysis for organizational characteristics

	Factors	
	1	2
Top management has taken an active role in deciding the priority of e-business operation in our firm.	**.93**	.08
Top management emphasizes the effective management and control for the e-business development in our firm	**.85**	.29
Top management emphasizes the effective management and control for the e-business operation in our firm.	**.78**	.33
Employees are willing to participate in the e-business project of our firm.	.04	**.88**
Employees in our firm have skills in e-business based applications relevant to their functions.	.27	**.78**
Top management is participating actively in planning process of e-business operation in our firm.	.34	**.68**
Employees have skills in e-business based design and development relevant to their functions.	.35	**.56**

Table 4 (cont.). Results of the factor analysis for organizational characteristics

	Factors	
Eigenvalue	4.02	1.09
% of variance	57.48	15.65
Kaiser-Meyer-Olkin measure of sampling adequacy	0.82	
Bartlett's test of sphericity (Chi-square)	178.18	

Note: F1 = Top Management Support, F2 = Knowledge Sources.

4.5. Factor analysis of the adoption of e-business. Adoption of e-business consisted of three dimensions (electronic purchasing, electronic billing and electronic ordering) with 3 items that were subjected to varimax rotated principal components analysis. As shown in Table 5, The Kaiser Meyer-Olkin measure of sampling adequacy was 0.78 and the Bartlett's test of sphericity (Chi-square = 155.83, $p<0.01$) was found to be significant. The diagonal entries of the anti-image correlation matrix ranged from 0.75 to 0.81, all the values were greater than 0.50, indicating sufficient correlations among the items. There was one factor which emerged with the eigenvalues greater than one. For these three items, no items were omitted as there was no significant cross-loading.

Table 5. Principal component analysis for the extent of e-business adoption

	Factor
Electronic purchasing	0.91
Electronic billing	0.80
Electronic ordering	0.72
Eigenvalue	3.43
% of variance	68.68
Kaiser-Meyer-Olkin measure of sampling adequacy	0.78
Bartlett's test of sphericity	155.83
Cronbach's alpha	0.87

4.6. Modified theoretical framework. After factor analysis, some of elements were eliminated due to high cross loading among major factors. Therefore, we have to modify the Theoretical framework (Figure 2) to reflect these changes.

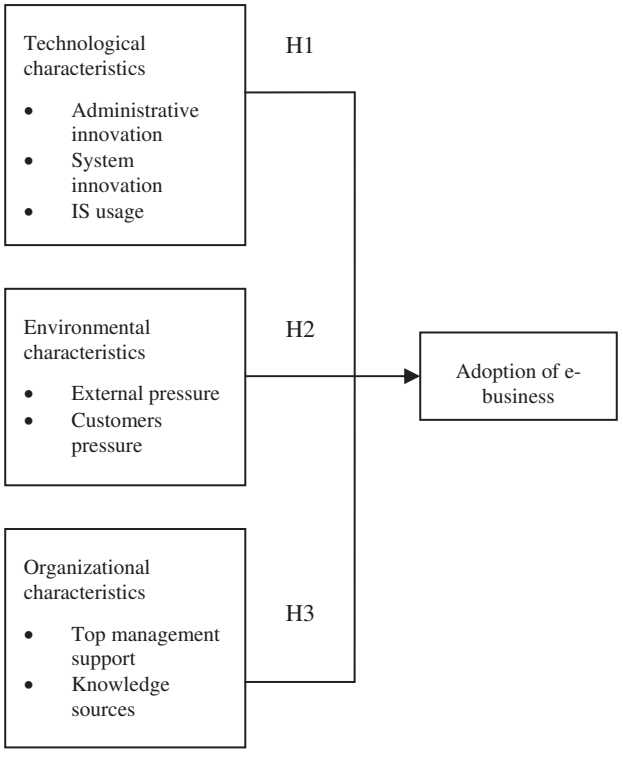


Fig. 2. Modified theoretical framework

As a result of this modified theoretical framework, some of the hypotheses were restated to reflect the new framework. Therefore, the following hypotheses are proposed:

H1a: Administrative innovation does significantly influence the adoption of e-business among SMEs.

H1b: System innovation does significantly influence the adoption of e-business among SMEs.

H1c: IS usage does significantly influence the adoption of e-business among SMEs.

H2a: External pressure does significantly influence the adoption of e-business among SMEs.

H2b: Customers pressure does significantly influence the adoption of e-business among SMEs.

H3a: Top management support does significantly influence the adoption of e-business among SMEs.

H3b: Knowledge source does significantly influence the adoption of e-business among SMEs.

4.7. Descriptive statistics of variables. The descriptive analysis was done to measure the independent variables and the dependent variable. Measurements for all variables were based on 5-point Likert scale. Table 6 summarizes the mean and standard deviation of each of the variable.

Table 6. Descriptive statistics of the study variables

Variables	Mean	Std. deviation
Administrative innovation	3.90	0.75
System innovation	3.93	0.68
IS usage	3.91	0.66
Top management support	3.96	0.67
Knowledge sources	3.81	0.59
External pressure	3.98	0.71
Customers pressure	3.90	0.59
E-business adoption	3.91	0.86

All variables have minimum and maximum values corresponding to the extreme scales indicating a good spread of the responses. As shown in Table 6, the means of the adoption of e-business among SMEs and IS usage were 3.91 each. The external pressure shows the highest mean of 3.98 whereas administrative innovation and customers' pressure were 3.90 each. Moreover, the system innovation recorded the mean of 3.93. The means of top management support and knowledge sources were 3.96 and 3.81, respectively. All of the variables were nearly 4 indicating that most respondents agreed that the items corresponded to the variables. Pearson's correlation was run to show the inter-correlation of independent variables in terms of technological characteristics, environmental characteristics, organizational characteristics and dependent variables which means the adoption of e-business among SMEs.

Table 7. Correlations and Cronbach's alpha for all variables (Pearson's correlation)

Items	Factors	1	2	3	4	5	6	7	8
1	Administrative innovation	.81							
2	System innovation	.49**	.76						
3	IS usage	.30*	.37**	.58					
4	Top management support	0.12	.56**	.44**	.89				
5	Knowledge sources	.52**	.66**	.22	.61**	.80			
6	External pressure	-.00	.30*	.74**	.46**	.23	.87		
7	Customers pressure	.48**	.53**	.00	.34*	.59**	-.07	.72	
8	E-business adoption	.45**	.52**	.08	.35*	.64*	.04	.62**	.87

Notes: ** $p < 0.01$, * $p < 0.05$. Underlined diagonal entries are the Cronbach's alpha.

Administrative innovation and external pressure showed negative correlation (r = -.001) whereas external pressure was also negatively correlated with customers pressure (r = -.073). As Table 6 indicates, some of the variables were found to be positively correlated with the dependent variables. The Cronbach's alpha values of all the study variables were presented in Table 7. The alpha coefficients ranged from 0.58 to 0.89. All the values are reasonably high at the acceptable level of 0.50 (Hair, 1998).

4.8. Regression analysis. In this study, regression analysis was used to analyze the relationships between different variables as postulated in the hypothesis. A linear regression analysis was performed to test the relationship between technological characteristics, environmental characteristics, organizational characteristics and adoption of E-business. Number of beds entered as a control variable for all hypotheses. Adoption of e-business (dependent variable) was run together with administrative innovation, system innovation, IS usage, top management support, knowledge sources, external pressure and customers pressure (independent variables). The basic assumptions underlying linear regression

analyses were inspected, to ascertain the requirements were fulfilled. The regression results are presented in Table 8. This explains the hypotheses H1a, H1b, H1c, H2a, H2b, H3a and H3b. The bell shape histogram indicates that the data were normally distributed. The normal p-p plot shows that the values fall along the diagonal with no extreme substantial or systematic departures, hence, the residuals are considered to represent a normal distribution. Scatter plot showed that data were scattered and there was no constant variance problem. The tolerance value for all variables was within the acceptable range of 0.1 to 1 and the variance inflation factors (VIF) were less than 10. Hence, it shows there is no multicollinearity problem for this model.

Table 8. Regression results for hypotheses H1a, H1b, H1c, H2a, H2b, H3a and H3b

Step	Variables	Adoption of e-business			
		Beta	Sig	R^2	F change
1	**Main effects**			.55	5.32
	Administrative innovation	.09	.57		
	System innovation	-.02	.90		
	IS usage	-.10	.62		
	Top management support	.06	.73		
	Knowledge sources	.39	**.04***		
	External pressure	-.06	.72		
	Customers' pressure	.25	.09		

Note: N = 50, * $p < .05$, ** $p < .01$.

The summary of Table 8 shows that the R square was 55%. There is 55% variation in the adoption of e-business (dependent variable) that can be explained by independent variables which are administrative innovation, system innovation, IS usage, top management support, knowledge sources, external pressure and customers' pressure. On the other hand, 45% variation of the adoption of E-business was not explained in this regression model. It is considered as high response rate, which is above 50% and indicates that the research topic is attractive to most of the SMEs and is also hot issue currently in Malaysians' perspective. The result of the R square showed that the TOE model is good for this study. The results showed that administrative innovation (β = .09, t = .58, p<.10), system innovation (β = -.02, t = -.12, p<.10), and usage of IS (β = -.10, t = -.49, p<.10) were not significant to the adoption of e-business. Moreover, top management support (β = .06, t = .34, p<.10), external pressure (β = -.06, t = -.35, p<.10) and customers pressure (β = .25, t = 1.71, p<.10) were also not significant to the adoption of e-business. The result only explained that the knowledge sources (β = .39, t = 2.07, p<.05) was significant to the adoption of e-business. Thus, hypotheses H1a, H1b, H1c, H2a, H2b and H3a were negatively related to the adoption of e-business whereas H3b (knowledge sources) was positively related to the adoption of e-business among SMEs in Malaysia.

Discussion and conclusion

This study has shown that technology-organization-environment (TOE) framework developed by Tornatzky and Fleischer (1990) is suitable for the understanding of the factors that influence the adoption of e-business among SMEs in Malaysia. A total of 3 factors have been considered in this study as the ones that influence the adoption of e-business. The modified framework was applied to the administrative innovation, system innovation, information system usage, top management support, knowledge sources, external pressure and customers' pressure in deciding to adopt e-business.

This study identified the factors influencing the adoption of e-business among SMEs in Malaysia. The study found that Administrative innovation and System innovation do not significantly influence the adoption of e-business among SMEs in Malaysia. This is because SMEs are not interested in improving their e-business innovation at the administration department. They are interested in improving basic operation to the customers. Perhaps customized information system is available and it acts as an alternative instead of innovating new administrative systems that may take longer time to develop and cost much to the firm. Moreover, Damanpour (1988) reported that opportunities for adoption of information system may be limited in some of the firms if organizational structure is very flat and decision making is centralized, owner-manager's decision making will lead to the adoption activities according to their needs.

Likewise, e-business may seem not to be useful to certain employees in SMEs. Especially, if the firm size is small, they might prefer manual (paper work) of doing things at the work place. This is consistent with Jungwoo (2004), who found that information system usage is not significant in the adoption of

information system. In fact, some of the organizations do not think about the advantages offered by the information system. The study found that external pressure does not influence the adoption of e-business. There might be some other than the external pressures which can influence the adoption of e-business, and which were not included in this study, such as government support, trading partners etc. Beside that, customers were found not to be significant in the adoption of e-business. Premkumar (1999) found that customer pressure negatively influences making adoption decision in some organizations.

The top management support was also found not to be significant for private firms in deciding to adopt e-business. This could be due to the fact that the top management of those private firms might have faced other organizational factors which were not included in this study, such as financial resources and perceived usefulness that contributed to the adoption decision indirectly. This is consistent with Chau and Jim (2002) who suggested that sometimes the type of information system helps to explain the insignificant top management attitude and support.

The empirical test results affirmed that knowledge sources do positively influence the adoption of e-business. Knowledge sources can be the employees' experience in clinical management, knowledge networks, and electronic networks in the firms. It seems that firms with greater e-business knowledge tend to adopt e-business more rapidly compared with firms deficient in e-business knowledge. This finding is in line with Chau and Jim (2002), indicating that the e-business knowledge sources are one of the significant variables that determine the adoption of e-business.

Conclusion

After factor analysis, five new independent variables have resulted such as administrative innovation, system innovation, information system usage, knowledge sources, and external pressure. In addition, administrative innovation, defined as a firm's ability to devise new organizational forms and processes, enhances its ability to exploit new opportunities internally, such as technological advancement, and externally, such as new or expanding markets (Damanpour, 1991). Likewise, system innovation refers to the form of new system offering and the development of new operation system. Information system usage indicates that users/operators are using the information system for gathering information and placing routine orders. Knowledge sources refer to the employees' knowledge and experience in clinical management, knowledge networks, and electronic network in the firms. Moreover, external pressure is defined as the factor outside the control of organization and business owners, and includes government, economic and political factors, and customers' and suppliers' pressure. The study has conducted various analyses and presented empirical data on varying relationship between the TOE factors and IS adoption that could be used in further researches.

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