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Electronic Commerce Technologies Adoption by SMEs: A Conceptual Study

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Abstract

The use of Electronic Commerce (EC) technologies enables Small-to-Medium sized Enterprises (SMEs) to improve their efficiency and competitive position. However, there is a lack of a comprehensive framework that gives a multi-faceted account for the phenomenon of EC technologies adoption by SMEs. This paper therefore develops a theoretical framework of EC technologies adoption which is composed of four dimensions: perceived organisational readiness (micro level), perceived industry readiness (meso level), perceived national readiness (macro level) and the perceived environmental pressure. The proposed framework is then used to develop a more specific research model to guide future study in exploring EC technologies adoption by SMEs. The proposed framework and research model will be empirically validated by administering a survey questionnaire among SMEs in a number of developing countries.

Keywords

E-commerce, Adoption, SMEs, Readiness

INTRODUCTION

The emergence of electronic commerce (EC) technologies has affected many industries and organisations. EC is defined as the process of buying, selling, transferring or exchanging products, services and/or information via computer networks, including the Internet (Turban et al. 2008). Regardless of organisational size, EC offers enormous opportunities and benefits to improve business performance. Small-to-Medium sized Enterprises (SMEs) are increasingly realising the potential benefits of EC technologies (Amit and Zott 2001). The definition of SMEs varies in different countries and studies but is usually based on employment, assets, or a combination of the two. For simplicity, and the purposes of this paper, SMEs are defined as organisations with less than 251 employees (Seyal et al. 2004).

The importance of SMEs has increasingly grown over the years and they have become the backbone of any country's economy and especially in developing countries. SMEs represent approximately 90% of the total number of firms across the world and they have a significant role in creating employment opportunities (Hall 2002). In 2006, there were about 140 million SMEs around the world employing at least 60 percent of the total work force (Kotelnikov 2007). SMEs are generally considered to be flexible, adaptive and innovative firms and these characteristics, in turn, make them a good fit for EC (Al-Qirim 2004; Liu, Chen and Liao 2005). SMEs may use EC technologies in a variety of ways, including: to communicate with customers and suppliers, collect market research data, promote goods and services, provide detailed information about products and services, support online ordering of goods and services and offer after sales support and assistance (Doherty and Ellis-Chadwick 2003). Furthermore, research also indicates that SMEs can take advantage of EC technologies in expanding their business (MacGregor et al. 2002). Thus, the use of EC technologies enables SMEs to improve their efficiency and competitive position in the marketplace.

Although EC technologies are widely adopted by large companies and organisations across the world, the deployment of EC in SMEs is considered somewhat lagging behind. A number of studies (e.g. Lee and Xia 2006; Lee and Runge 2001) indicate that SMEs have been generally slow in adopting EC, particularly those related to inter-organisational systems due to their size and limited resources. There are a number of factors that make the adoption slow such as: shortage of technologies tailored to SMEs needs and financial abilities, technology literacy, unavailability of good communication and legal infrastructures, short term perspectives, and shortage of in-house skills and expertises (Kotelnikov 2007; Lee and Xia 2006). Therefore, the adoption of EC technologies by SMEs may be different from the adoption of these technologies by large organisations (Sarosa and Underwood 2005). The position of SMEs in developing countries in terms of EC adoption is even lagging behind SMEs in developed countries (Kartiwi 2006). For example, Kartiwi and MacGregor (2007) have found that organisational barriers were the main inhibitors to EC adoption by SMEs in Indonesia. This may in turn

suggest that adoption of EC technologies by SMEs in developing countries may be different from the adoption of these technologies by SMEs in developed countries too. One of the reasons for this difference may stem from the cultural differences between developing and developed countries (Sarosa and Underwood 2005).

Although researchers have been increasingly exploring and predicting EC adoption among SMEs in both developed and developing countries (e.g. Nasco et al. 2008; Al-Qirim 2007; Kendall et al. 2001; Sathye and Beal 2001), there is still a limited understanding of the behaviour of SMEs, particularly in developing countries towards EC technologies adoption. A recent review by Parker and Castleman (2007) highlights the need for more research on EC adoption by SMEs in developing countries to better understand the potential and relevance of EC. Most of these factors that have been investigated in prior literature can actually be aggregated to form the three types of readiness: organisational, industrial and national readiness. Hence, it is suggested that SMEs' decision to adopt EC technologies will be based on how they perceive their readiness to adopt EC technologies (e-readiness). The majority of prior research on EC technologies adoption by SMEs has been concentrated towards ascertaining the organisational e-readiness (e.g. Grandon and Pearson 2004; Tsao et al. 2004; Jeon et al. 2006; Kendall et al. 2001). In addition, there has been little research that investigates the national e-readiness and industry readiness from the perspective of SMEs, especially in developing countries (e.g. Huy and Filiatrault 2006). Furthermore, little is known whether or not the various factors explored in previous studies have the same impact on the adoption of different EC technologies since each study considers a different set of factors and different EC technologies.

Therefore, the purpose of this study is to develop a comprehensive theoretical framework that comprises the three types of readiness (organisational, industry and national) alongside the environmental pressure that can be applied in any contexts. Guided by this framework, we then synthesized EC adoption factors under each level of readiness that could potentially determine and predict various EC technologies adoption by SMEs and propose a research model to guide studies of EC adoption by SMEs. The technologies considered in the research model include e-mail, Internet, Intranet, Extranet, Electronic Data Interchange (EDI), Electronic Funds Transfer (EFT) and Barcode since these are the basic EC technologies that are most likely relevant for SMEs. The adoption of EC technologies will be measured by whether or not the participating organisation uses any of these technologies in carrying out their business operations. This is the first step in a series of research projects that aim at understanding and predicting the adoption of EC technologies in SMEs especially in developing countries. The remainder of this paper is organised as follows: firstly, a literature review on the EC technologies adoption research is presented. Secondly, a discussion of the development of the framework, research model and hypotheses to be tested for further empirical studies. Finally, we conclude the paper and highlight areas for future research.

LITRATURE REVIEW AND THE FRAMEWORK DEVELOPMENT

For the purpose this study, an extensive literature review of EC technologies adoption by SMEs in both developed and developing countries was undertaken to review commonly used theories and frameworks in EC adoption studies and to identify their limitations. This literature review is by no means exhaustive. This literature review identifies many models and frameworks that have been developed and used as a basis to investigate adoption of EC technologies by SMEs such as Rogers's Innovation Diffusion Model (Rogers 2005), Technology acceptance Model (TAM) (McCoy 2001), Theory of Planned Behaviour (TPB) (Chau and Hu 2001), Perceived eReadiness Model (Tan, Tyler and Manica 2007), and Technological, Organisational and Environmental Framework (TOE) (Kuan and Chau 2001). Most of these models and frameworks have not given a comprehensive account for the phenomena of EC technologies adoption. For example, Looi (2005) has pointed out the limitations of TAM and TPB as they tend to overlook internal and external factors that may influence the adoption decision such as cost and environmental pressure. Looi (2005) has also concluded that Rogers's Diffusion Model is generally inadequate in explaining the factors influencing EC adoption by SMEs in Brunei. Other models and frameworks such as Perceived eReadiness Model and TOE have also overlooked and/or overlapped industrial readiness with other external factors.

Another dominant trend that we observed from the literature review is that the literature on adoption of EC technologies by SMEs generally establishes prior assumptions related to inhibitors and drivers of EC technologies and then assesses the relevance of each barrier and driver in a given context. For example, Looi (2005) has pointed out that lack of IT knowledge and lack of trust have been explored as inhibitors to EC adoption. However, this approach of investigating EC adoption on the basis of prior assumptions of drivers and inhibitors has several limitations:

- The terminology used to describe these factors is inconsistent in the literature (Wymer and Regan 2005). For example, researchers have used different terms to refer to the "cost factor" such as adoption cost (Al-Qirim 2007; Jeon et al. 2006), financial resources (Zhu et al. 2003; Sarosa and Underwood 2005), financial commitment (Zhu and Kraemer 2005; Kaynak et al. 2005). Thus, when the cost factor is expressed as 'adoption cost', it is considered as a barrier, but when it is expressed as 'financial

commitment', it is considered as a driver. When the 'financial resource' term is used, it is considered a neutral factor (neither a driver nor an inhibitor).

- The findings resulted from investigating these factors (as drivers and inhibitors) are also inconsistent in the literature (Wymer and Regan 2005). For example, adoption cost was found to be significant in one study (Jeon et al. 2006) and insignificant in another (Al-Qirim 2007).
- Since the adoption factors can serve as drivers and inhibitors at the same time in different contexts, the prior assumptions about a factor being an inhibitor or driver may lead to misleading conclusions regarding the validity of the conceptualised models that use these factors. For example, a researcher may conceptualise and explore a factor as an inhibitor to EC adoption in a specific context, and this factor might not be found as an inhibitor. In this case then the researcher has to reject the initial proposed hypothesis concerning this factor. In contrast, the perception of this factor might change in the future and further study is needed again to test if the initial proposed hypothesis is confirmed.

Therefore, it is important to deal with these factors as neutral factors without making prior assumption (neither drivers nor inhibitors) to identify the exact influence of these factors on EC technologies adoption about each factor. In this respect, although using prior assumptions of drivers and inhibitors may help in clarifying and understanding the phenomenon of EC adoption, this trend only highlights the importance of these factors in accelerating or slowing the adoption but it does not take into account the importance of these factors in predicting the EC technologies adoption. For example, we can identify a factor as an inhibitor to the adoption of EC technologies such as lack of IT knowledge among managers of SMEs, but we cannot identify whether this factor can predict the adoption if their knowledge is increased in the future. More recently, some scholars have applied this neutral approach (e.g. Wymer and Regan 2005) to overcome the limitations of other studies.

Based on the literature review, and in order to fill the gap in the literature, we have developed a framework that gives a comprehensive view of EC technologies adoption as a guide in this study and subsequent research. The framework is presented in Figure 1. The framework serves the following purposes (i) it provides a holistic view of potential factors that may influence the adoption of EC technologies at three levels of readiness, macro (national), meso (industrial) and micro (organisational) in addition to the environmental pressure, (ii) it links the adoption of various EC technologies with those factors influencing EC technology adoption to identify the best technologies that suit the context of organisations, (iii) it provides a way to assess the e-readiness of organisations, particularly their preparedness for EC and whether it determines the adoption decision of EC technologies, (iv) it provides a systematic approach to investigating EC technologies adoption within each level of readiness in-depth, and (v) it helps researchers aggregate adoption factors within each level of readiness that are suitable for a particular context. For example, in this paper, guided by this framework, we further develop a research model for EC adoption by SMEs by identifying factors influencing EC technologies adoption by SMEs and test these factors in the future work through empirical studies conducted in a number of developing countries.

Figure 1: The proposed EC technologies adoption framework

The framework is composed of perceived organisational readiness (micro level), perceived industry readiness (meso level), perceived national readiness (macro level) alongside the perceived environmental pressure. National readiness (macro level) refers to the top managers' perceptions of the availability of supporting services that promote the adoption of EC technologies. These supporting services may come from government and non-government bodies. For any country to realise the true potential of EC there has to be certain measures undertaken at the core operational level of the country's infrastructure. These measures can be attributed to the human and physical capital development, political freedom, autonomous economic institutions, high spending on research and development, foreign direct investment, and so forth. All these determinants interplay with each other to cultivate an environment conducive for a country's well-being and economic growth. Having a clear policy regarding the attainment of these crucial macro-economic objectives is a stepping stone towards extending the impact of EC and reaping the benefits. This is especially true in the case of developing countries, where the main inhibitor of successful technology adoption is the under-developed core operational infrastructure. Unless there are measures adopted to redress the core operational infrastructure, technology adoption failures are likely to happen. In this regards, studies indicate that national non-readiness is the major inhibitor stalling the uptake of EC in developing countries (e.g. Kshetri and Dholakia 2002; Tigre 2003]. This assertion is supported by the fact that many developing countries lack adequate technological, social, cultural,

legal, logistical, and financial infrastructure needed to effectively adopt and implement EC technologies. This viewpoint considers the conditions of the external environment, or the macro level, as the major determinant of EC technologies adoption at the enterprise level. Therefore, perceived national readiness is included in the research framework as one of the main factors for EC adoption.

Organisational readiness (micro level) refers to the top managers' perceptions of EC technologies and their perceptions of the availability of resources, rules and procedures within the organisation that promotes adoption of these technologies. Generally, there has been a tendency to consider EC applications as trivial appliances, rather than as complex processes of inter-networking made possible by a series of inter-linked computer networks, a compendium of hardware and software, data flows, and human agents (Pare 2003). Failure to consider processes and rules that mobilise EC within the context of an organisation is of enormous importance. Therefore, organisational readiness (micro level) has been recognised as an important factor for EC adoption (Grandon and Pearson 2004; Seyal et al. 2004).

In addition to the macro and micro levels, there is a middle (meso) level which signifies the readiness of industry in fostering EC technologies (Damsgaard and Lyytinen 1998). Industrial readiness refers to the top managers' perceptions of industry standards, and readiness of trading partners that promotes adoption of EC technologies. The industry level readiness also concentrates on inter-organisational nature of EC use. This level is dealing with interactions between adopting organisations and external institutions, their mutual dependencies and power relationships, which are generally concerned with the industry structure (Damsgaard and Lyytinen 1998). Important characteristics at this level reflect on the industry structure, industry-wide standard of electronic data transfer, presence of coordinating bodies, level of trust among industry players, and so forth. The importance of this level cannot be undermined because it forms the glue that holds the macro and micro level together. Therefore, perceived industrial readiness is included in the research framework as one of the main factors for EC adoption.

Besides the three levels of readiness, environmental pressure also plays a critical role in the adoption of EC technologies and provides the impetus for complying to be ready (Ali et al. 2008; Damsgaard and Lyytinen 1998). Such pressure is exhibited in the shape of customer, supplier, government, and market pressure or changes in external environmental which undermine the competitive position or value proposition, and organisational actions for pursuing business excellence and following innovative technology to remain ahead of competition. Therefore, environmental pressure to adopt EC technologies is an additional factor in the research framework that should be included in any study investigating the adoption of EC technologies.

In light of the above and in order to apply the above framework to the context of SMEs, we have identified all adoption factors that have been studied in developed and developing countries. We then classified each factor according to the dimensions in the framework (e.g. organisation, industrial, national or environmental pressure) and identified which one was found to be significant or insignificant in determining the adoption of EC technologies (see Table 1). The highlighted parts of Table 1 mean that the factors have been investigated in developed countries but not in developing countries. References related to developing countries are shown in boldface in Table 1.

Table 1. Determinants of EC technologies adoption and use by SMEs identified in the literature

#	Factors	Developed and **Developing** Countries	
		Significant	Insignificant
Organisational Readiness			
	A. Perception of Technology		
1	Relative advantage/ EC benefits	Kuan and Chau (2001), Beatty et al. (2001), Riemenschneider et al. (2003), Mirchandani and Motwani (2001), Mehrtens et al. (2001), Chwelos et al. (2001), Doolin et al. (2003), Macgregor and Vrazlaic (2003), Al-Qirim (2007), Sparling et al. (2007), Ching and Ellis (2004), Wymer and Regan (2005), Scupola (2003), **Grandon and Pearson (2004), Teo and Ranganathan (2004), Kendall et al. (2001), Thong (1999), Huy and Filiatrault (2006), Jeon et al.(2006), Looi (2005), Seyal et al. (2004), Kaynak et al. (2005)**	**Tsao et al. (2004)**
2	Compatibility	Beatty et al. (2001), Mirchandani and Motwani (2001), , Sparling et al. (2007), Ching and Ellis (2004), **Teo and Ranganathan (2004), Kendall et al. (2001), Thong (1999), Huy and Filiatrault (2006), Jeon et al.(2006)**	Al-Qirim (2007)
3	Complexity	Riemenschneider et al. (2003), **Huy and Filiatrault (2006), Jeon et al. (2006)**	**Grandon and Pearson (2004)**
4	Trialability	**Kendall et al. (2001)**	
5	Security issues	Wymer and Regan (2005), **Looi (2005)**	
6	EC barriers (limitations)	Scupola (2003)	**Kaynak et al. (2005)**
7	Technological opportunism	Srinivasan et al. (2002), Wu et al. (2003), Sparling et al. (2007)	
8	Perceived need for change and technology	Wymer and Regan (2005)	
9	Reliability of technology	Wymer and Regan (2005)	
10	Models of successful use	Wymer and Regan (2005)	

Table 1. Determinants of EC technologies adoption and use by SMEs identified in the literature (cont.)

#	Factors	Developed and **Developing** Countries Significant	Insignificant
	B. Organisation Resources		
1	Organisational readiness (defined as cost/financial and technical resources)/ (defined as both technology and financial resources)/ Organisation resources	Kuan and Chau (2001), Mirchandani and Motwani (2001), Mehrtens et al. (2001), Chwelos et al. (2001), Zhu et al. (2003), Doolin et al. (2003), Macgregor and Vrazlaic (2005), **Grandon and Pearson (2004), Tsao et al. (2004), Yeh and Chang (2007), Huy and Filiatrault (2006)**	Mirchandani and Motwani (2001), Scupola (2003), **Sarosa and Underwood (2005)**
2	Organisational size & business category	Ling (2001), Zhu et al. (2003), Zhu and Kraemer (2005), **Huy and Filiatrault (2006)**	Al-Qirim (2007), Sparling et al. (2007), Chuang et al. (2007), **Jeon et al.(2006)**
3	Employees' knowledge of IT e-commerce/ Technology competence	Michandani and Motwani (2001), Scupola (2003), Zhu and Kraemer (2005), Zhu et al. (2003), **Huy and Filiatrault (2006), Jeon et al. (2006)**	**Sarosa and Underwood (2005)**
4	Technological readiness/ e-business technology	Srinivasan et al. (2002), Sparling et al. (2007), **Jeon et al. (2006)**	
5	Adoption cost/ Financial commitment/ Financial resources/ implementation cost	Wymer and Regan (2005), Zhu and Kraemer (2005), Zhu et al. (2003), **Jeon et al.(2006), Kaynak et al. (2005)**	Al-Qirim (2007), Scupola (2003), **Sarosa and Underwood (2005)**
6	Business age	**Hinson and Abor (2005)**	Chuang et al. (2007)
7	Staff resistance	**Tsao et al. (2004)**	
8	Relative strength of SME in the industry		**Kaynak et al. (2005)**
9	Type of SME's ownership		**Hinson and Abor (2005)**
10	Firm Scope	Zhu et al. (2003)	
11	SME's prior experience	Wymer and Regan (2005)	
12	Managerial time		Mirchandani and Motwani (2001)
13	Business type		Chuang et al. (2007)
	C. Governance		
1	Information intensity and product characteristics	Doolin et al. (2003), Al-Qirim (2007),	Mirchandani and Motwani (2001), **Teo and Ranganathan (2004)**
2	Organisation strategic (globalisation) orientation/International experience of the company	**Huy and Filiatrault (2006), Jeon et al.(2006)**	**Kaynak et al. (2005)**
3	Organisational culture	**Seyal et al. (2004)**	
4	Task variety	**Seyal et al. (2004)**	
5	Integration with marketing strategy	**Tsao et al. (2004)**	
6	IS/IT investment evaluation	**Tsao et al. (2004)**	
7	Export volumes		**Hinson and Abor (2005)**
8	Priority (of IT project)	Wymer and Regan (2005)	
	D. Top management Support		
1	Top management support	Mirchandani and Motwani (2001), **Tsao et al. (2004)**	**Seyal et al. (2004)**
2	Organisational support (support within the organisation)	Sparling et al. (2007), Wu, Mahajan, and Balasubramanian (2003), Zhuang and Lederer (2004), **Lertwongsatien and Wongpinunwatana (2003), Tsao et al. (2004)**	
3	CEO's innovativeness/ Innovation champion	Al-Qirim (2007), Wymer and Regan (2005), Scupola (2003), **Huy and Filiatrault (2006), Jeon et al.(2006)**	
4	CEO's involvement		Al-Qirim (2007)
	Industrial Readiness		
1	Technology intensiveness of the industry		**Kaynak et al. (2005)**
2	Lack of trading partner readiness	Zhu et al. (2003)	
3	Availability of partners	Wymer and Regan (2005)	
	National Readiness		
1	Degree of support of the government	Wymer and Regan (2005), **Huy and Filiatrault (2006), Jeon et al.(2006), Seyal et al. (2004), Looi (2005)**	**Tsao et al. (2004)**
2	Availability of and Support from technology vendors	Doolin et al. (2003), Wymer and Regan (2005), **Sarosa and Underwood (2005)**	Al-Qirim (2007)
3	Availability of EC-related technologies	Scupola (2003), Wymer and Regan (2005), **Sarosa and Underwood (2005)**	
4	National infrastructure	**Huy and Filiatrault (2006), Sarosa and Underwood (2005)**	
5	Regulatory environment/ Regulatory support	Zhu et al. (2003), Zhu and Kraemer (2005), Wymer and Regan (2005)	
6	Public administration	Scupola (2003)	
7	Support for the importance of technology readiness	Zhu et al. (2003)	
	Environmental Pressure		
1	External pressure [Industry, competition, Government, buyers/ Consumer readiness, Institutional, suppliers]	Kuan and Chau (2001), Chang and Cheung (2001), Mehrtens et al. (2001), Chwelos et al. (2001), Zhu et al. (2003), Doolin et al. (2003), Al-Qirim (2007), Scupola (2003)**,** Zhu and Kraemer (2005), Wymer and Regan (2005), Ling (2001), **Grandon and Pearson (2004), Nasco et al. (2008), Huy and Filiatrault (2006), Looi (2005), Sarosa and Underwood (2005)**	Mirchandani and Motwani (2001), Sparling et al. (2007), **Kula and Tatoglu (2003), Teo and Ranganathan (2004), Jeon et al. (2006), Sarosa and Underwood (2005), Kaynak et al. (2005)**

Table 1. Determinants of EC technologies adoption and use by SMEs identified in the literature (cont.)

#	Factors	Developed and **Developing** Countries Significant	Insignificant
Personal Characteristics			
1	Owner characteristics (owner experience with computers)	Sparling et al. (2007), Ching and Ellis (2004), Croteau and Li (2003), Zhuang and Lederer (2004), **Thong (1999), Tsao et al. (2004)**	
2	Owner/manager's Managerial & (IT) experience	Wymer and Regan (2005)	Chuang et al. (2007), **Sarosa and Underwood (2005)**
3	Managers' knowledge of the new technologies and of e-commerce	**Huy and Filiatrault (2006), Jeon et al.(2006), Looi (2005)**	
4	Subjective norm and attitude	**Nasco et al. (2008)**	**Sarosa and Underwood (2005)**
5	Manager' decision making style for IT adoption		**Sarosa and Underwood (2005)**
6	Perceived behavioural control		**Nasco et al. (2008)**
7	Owner/manager gender, age and educational level		Chuang et al. (2007)

As shown in Table 1, although most studies have investigated factors that form the organisational readiness, a holistic view of these factors is still lacking. Also, in spite of the importance of national readiness in supporting and enabling EC technologies adoption by SMEs especially in developing countries, little research has explored factors that affect the establishment of national readiness. Moreover, existing studies have only considered the external pressures that come from the environment of a firm and little is known about the influence of internal pressure which arises from the firm itself. Furthermore, industry readiness has hardly been explored in prior literature as shown in Table 1.

Based on the literature review, the proposed framework (Figure 1) and Table 1, we develop a research model (see Figure 2) that captures the potential factors that influence EC technologies adoption by SMEs. This model is composed of first order factors for each of the four dimensions shown in the theoretical framework. A more detailed list of second order factors that are included in the model is shown in Table 2. It also shows which of the first and second order factors have and have not been investigated in the existing literature. A discussion on each construct in the proposed research model is presented in next sections.
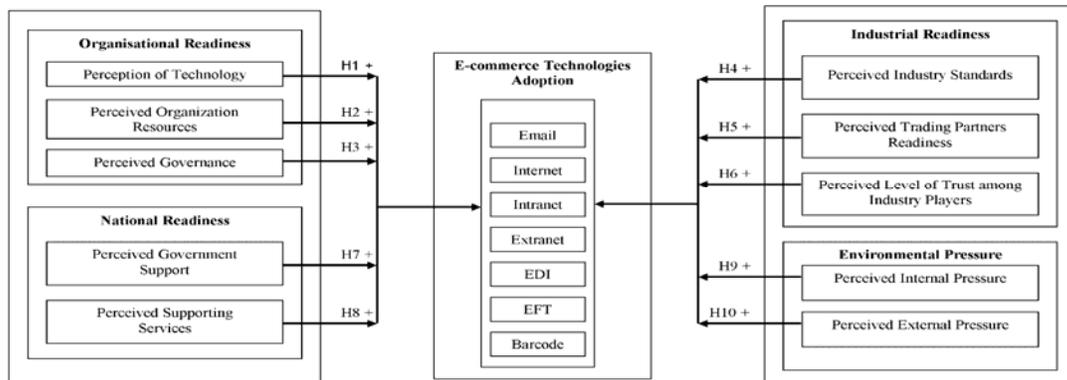
Figure 2: The proposed research model of EC technologies adoption by SMEs

ORGANISATIONAL READINESS

As this research will investigate the perceptions of SMEs' Managers and Owners, top management support is not included in the organisational readiness. The existing studies of SMEs adoption (e.g. Yeh and Chang 2007; Macgregor and Vrazlaic 2005; Kuan and Chau 2001) have defined organisational readiness as the availability of financial and technological resources in the SMEs, while some other studies relate organisational readiness to factors such as: organisational culture (Seyal et al. 2004), organisational resources (Huy and Filiatrault 2006), management support (Tsao et al. 2004), firm size (Kuan and Chau 2001), compatibility (Sparling et al. 2007; Teo and Ranganathan 2004), perceived benefits (Jeon et al. 2006; Scupola 2003) and employees' knowledge of IT (Scupola 2003). In this study, we only consider three first order factors that comprise the organisational readiness: perception of technology, perceived organisation resources and perceived governance.

Perception of Technology

One of the major parts that form the organisational readiness is perception of technology. This includes the identification of the traits of the innovation (Rogers 1995) which compel the adoption process, namely: relative advantage, compatibility, complexity, trialability, and observability. It is worth noting here that some studies (e.g. Chwelos et al. 2001; Chong and Bauer 2000) have regarded perception of technology as an independent

variable impacting the adoption process. However, other studies (e.g. Gibbs and Kraemer 2004) also have termed perception of technology as organisational characteristics, since such technology attributes are not inherent in the innovation per se but relate to how an organisation perceives these attributes. In this paper, we regard perception of technology as part of organisational readiness.

Table 2. First and second order determinants of EC technologies adoption by SMEs

Dimension of the Framework	1st Order Factor	2nd Order Factor
Organisational Readiness	Perception of Technology	Perceived benefits, Compatibility, Complexity, Trialability, observability, Security, Reliability, Perceived need for technology, Technological opportunism, Models of successful use, Perceived barriers and limitations, Perceived risks and opportunities
	Perceived Organisation Resources	Human resources, Financial resources, Technical and Technological resources
	Perceived Governance	Organisational culture, Task variety, Integration with marketing strategy, Organisation strategic orientation, **Having clearly defined roles, responsibilities and accountability, Having systematic process for managing change issues**
	Perceived Management Support	Top management support, Support within the organisation, Innovativeness, Innovation champion
Industrial Readiness	**Perceived Industry Standards**	**Availability of standards**, **Availability of coordinating bodies**, **Availability of online resources, databases and portals**
	Perceived Trading Partners Readiness	Availability of trading partners and dominant players in the industry who are ready to adopt technology, Technology intensiveness of the industry, **Compatibility and collaboration between trading partners within the industry**, **Availability of Communicative relationships**
	Perceived Level of Trust among Industry Players	Have a strong and trustful relationship with trading partners, **Trading partners collaborate with each other and share data and information**
National Readiness	Perceived Government Support	Availability of regulatory and legal environment and support, Government support and commitment, Availability of ICT policy and action plan, Support for the importance of technology readiness, Availability of national infrastructure, **Availability of logistics and transport infrastructure**
	Perceived Supporting Services	Availability of and Support from technology vendors, Availability of EC-related technologies, **Availability of capable technology and telecommunication infrastructure**, **Availability and support of skilled labour**
Environmental Pressure	**Perceived Internal Pressure**	**Passion for business excellence, Setting pioneering trends in process and product innovation, Following innovative technology to remain ahead of competition**
	Perceived External Pressure	Pressure from business partners and/or competitors, Customer pressure, supplier pressure, Government pressure, market pressure

Note: Factors in boldface have not been investigated before in the context of SMEs

Perceived benefits (relative advantage) were the most investigated EC technologies trait that promotes the adoption of these technologies (e.g. Jeon et al. 2006; Seyal et al. 2004). Perceived benefits are defined by a set of anticipated advantages that innovation can provide the organisation (Seyal et al. 2004). Perceived benefits describe how a particular technology is perceived as providing benefits to an organisation. A number of studies have shown that perceived benefits as a determinant of technology adoption (e.g. Al-Qirim 2007; Sparling et al. 2007; Jeon et al. 2006; Kaynak et al. 2005). However, Tsao et al. (2004) have found that perceived benefits were insignificant contributor to EC adoption. This may due to the fact that most of the managers in developing countries are not sure about the benefits that can be derived from EC, and lack adequate skill or knowledge about what technology can provide.

Another attribute of Rogers Model (Rogers 1995) is organisational compatibility, which refers to the extent to which a technological innovation is compatible with the way the organisation works, in terms of its values and beliefs, previously introduced ideas, and needs. According to Gibbs and Kramer (2004), lack of organisational compatibility may impose constraints on the level of ecommerce use. A number of studies have also shown that compatibility as one of most influential determinants of technology adoption (e.g. Teo and Ranganathan 2004; Kendall et al. 2001; Huy and Filiatrault 2006). With respect to other innovation attributes, studies have found significant relationship between complexity (e.g. Huy and Filiatrault 2006; Jeon et al. 2006), trialability (e.g. Kendall et al. 2001) and observability (e.g. Seyal and Rahman 2003) and EC technologies adoption and insignificant relation in some other cases with regards to complexity (Grandon and Pearson 2004). Therefore, we hypothesise that *the more positive SMEs perceive EC technologies, the more likely they will adopt these technologies* (Hypothesis 1).

Perceived Organisation Resources

Another major aspect of organisational readiness is related to perceived organisation resources. Organisation resources are the SMEs' perception of the availability of human, financial, and technological resources of a firm (Tan et al. 2007). Human resources are concerned with the availability of technical-savvy workforce with adequate know-how to implement EC initiatives. Technological resources are concerned with the level of sophistication of IT usage in an organisation. Financial resources refer to the availability of capital to carry EC activity without any financial burden. This includes installation costs, software and hardware procurement costs, consulting costs, ongoing maintenance and so forth. Intertwined with this concept of organisation resources, firm size has also been established as an important predictor of IT adoption (Zhu et al. 2003; Doolin et al. 2003; Grandon and Pearson 2004). In terms of human resources, Mehrtens et al. (2001) advocates that knowledge

among non-IT professionals is a very significant factor for Internet adoption. A number of studies also shown that organisational resources, financial and technical resources determine the adoption of EC technologies (e.g. Tsao et al. 2004; Kuan and Chau 2001; Huy and Filiatrault 2006). On the other hand, a number of studies have found that some factors related to organisational resources are insignificant in determining EC technologies adoption (e.g. Jeon et al. 2006; Sarosa and Underwood 2005). Accordingly, we would like to explore the influence of this factor further and hypothesise that *the higher SMEs perceive their organisational resources, the more likely they will adopt EC technologies* (Hypothesis 2)

Perceived Governance

Governance encompasses strategic, tactical, and operational models that define the way organisations are structured to establish objectives, allocate resources, and make decisions (Tan et al. 2007). Research has shown that there is a relation between EC technologies adoption and a number of factors such as organisation culture and task variety (e.g. Seyal et al. 2004), organisation strategic orientation (e.g. Huy and Filiatrault 2006; Jeon et al. 2006), integration with marketing strategy (e.g. Tsao et al. 2004). Teo and Ranganathan (2004) in their study also found that 54.4% of EC adopters in Singapore had a formal plan and a task force dedicated to deploying EC. In contrast, some other studies have found that this variable is insignificant in influencing EC technologies adoption (e.g. Kaynak et al. 2005; Teo and Ranganathan; Hinson and Abor 2005). Accordingly for further investigation, we hypothesise that *the higher SMEs perceive their organisation governance, the more likely they will adopt EC technologies* (Hypothesis 3).

INDUSTRIAL READINESS

Few studies on EC technologies adoption by SMEs have explored variables that are related to the industrial readiness (meso level) such as: lack of trading partner readiness (Zhu et al. 2003), availability of partners (Wymer and Regan 2005) and technology intensiveness of the industry (Kaynak et al. 2005). In this study, we consider three first order factors that comprise the industrial readiness in the context of SMEs: industry standards, readiness of trading partners and level of trust among industry players.

Perceived Industry Standards

One of the major parts that form the industrial readiness is perception of the availability of industry standards that organise the work of the firms. The perceived industry standards refer to the perception of the availability of standards, coordinating bodies, and online resources necessary for EC adoption. If the industry as a whole decides and agrees on a single standard of electronic data transfer, the chances of rapid uptake of technology are exponentially amplified. Successful EC adoption requires that various sectors and segments of the industry work systematically through coordinating bodies to resolve their concerns and project their demands (Gregor and Johnston 2000). In concert with the standardisation of electronic data transfer, interconnectivity of EC hardware and software also acts as a major impetus for EC surge (Gregor and Johnston 2000). If industry partners' EC applications can easily forward and relay electronic messages back and forth without any difficulty, there is an increment in acceptance of EC. Consequently, we hypothesise that *the higher SMEs perceive the availability of industry standards, the more likely they will adopt EC technologies* (Hypothesis 4).

Perceived Trading Partners Readiness

Firms can influence the behaviour of other firms by threats or sanctions. Especially, if there are some dominant players in the industry who enjoy a lot of power, they can force other weaker entities to follow their suit. In addition, power structure in the industry is also crucial in technology adoption. If the industry is characterized by a duopoly or oligopoly then any technology initiative by one player will be closely matched and emulated by the other. On the flip side, if the industry is monopolistic and lacks perfect competition, urgency to thrive for business excellence and constricting competition's profits through technological innovations might not be at the top of the agenda. Recently, a number of studies have appeared that discuss how interactions with both other organisations and customers in a global economy have enforced these SMEs to adopt EC technologies (e.g. Hinson and Sorensen 2006; Jaw and Chen 2006; Hinson and Abor 2005; Nirjar and Tylecote 2005; Sarosa and Underwood 2005). In addition, relationships between industry partners also affect the overall industry structure (Gregor and Johnston 2000). For instance, trading relationships deal with adding value to the focal product of the industry and making it more value-intensive. Communicative relationships describe the exchange of actual or planned data and events to other industry partner to coordinate production activities. All these relationships determine the extent of competition and rivalry in the industry and play a crucial role in technology adoption. Little research has explored this variable (e.g. Wymer and Regan 2005; Zhu et al. 2003). Thus, we hypothesise that *the higher SMEs perceive trading partners' readiness, the more likely they will adopt EC technologies* (Hypothesis 5).

Perceived Level of Trust Among Industry Players

Industry readiness is also affected by the existence of trustful relationships among firms. At least some form of trust is required in all business transactions. A trustful relationship, one in which a firm is confident that its partner will perform as expected, is particularly important in ecommerce activities. If the industry relationships are built on trust, then the chances for greater penetration of ecommerce are higher. Byrant and Colledge (2002) also espouse the above assertion by stating that trust is an important consideration in the development and fostering of ecommerce relationships in the context of the knowledge-based economy. The promotion of trust, through appropriate relational contracting models that foster collaboration and cooperation, will facilitate the achievement of strategic ecommerce objectives. It is also the extent of compatibility and collaboration between trading partners within the industry. If the industry trading partners collaborate and are compatible, then it would facilitate EC technologies adoption (Kurnia and Johnston 2003). Consequently, we hypothesise that *the higher SMEs perceive the existence of trustful relationships within the industry, the more likely they will adopt EC technologies* (Hypothesis 6).

NATIONAL READINESS

The existing studies on SMEs adoption have independently explored a number of variables that are related to the national readiness (macro level) such as: regulatory environment and support (Zhu et al. 2003), support from technology vendors (Kendall et al. 2001; Doolin et al. 2003), degree of support of the government (Jeon et al. 2006) and national infrastructure (Huy and Filiatrault 2006). However, little research has investigated such factors in developing countries (e.g. Jeon et al. 2006; Huy and Filiatrault 2006; Seyal et al. 2004). In this study, national readiness in the context of SMEs comprises two first order factors: perceived supporting services and perceived government support.

Perceived Government Support

One of the major parts that form the national readiness is the perception of government support for using EC technologies. A number of studies have investigated the available legal/regulatory environment, government support and commitment, and government pressure as factors that determine the EC technologies adoption by SMEs (e.g. Jeon et al. 2006; Chang and Cheung 2001; Grandon and Pearson 2004; Zhu and Kraemer 2005). Government has a considerable impact on Internet use through direct interventions. Government can also support the spread of the Internet by switching to online services for its own transactions. Government support and readiness can also be manifested by having a clear Information and Communication Technology (ICT) policy and action plan for extending ICT benefits across the board, providing equal access to information, and improving existing ICT services. A certain minimum legal framework is required for the provision of electronic commerce. The existing rules and legislations have also to be augmented to apply to the Internet and ecommerce. The importance of a full-fledged logistics infrastructure cannot be undermined. For the sale of physical goods, there should be reliable shipping and delivery services to enable the rapid delivery of goods to consumers or business partners worldwide. Travica (2002) asserts that transportation infrastructure is one of the major bottlenecks in the growth of ecommerce in Costa Rica. Logistics Infrastructure includes underdeveloped transportation infrastructure, limited state-run postal services, and lack of absolute/current building addresses. The logistics infrastructure should encompass express shipping and handling from any remote part of the country. Consequently, we hypothesise that *the higher SMEs perceive the existence of government support, the more likely they will adopt EC technologies* (Hypothesis 7).

Perceived Supporting Services

Supporting services refers to SMEs' perception of the availability of supporting services in the country that promote the adoption of EC technologies. A number of studies have investigated the availability of capable technology infrastructure and availability and support of skilled labour and software/hardware vendors as factors that determine the EC technologies adoption in SMEs (e.g. Doolin et al. 2003; Srinivasan et al. 2002). In this regard, poor telecommunications limits the growth of EC. Required telecommunication facilities include transmission facilities connecting a country's domestic network to the Internet. Technology Infrastructure readiness emphasises the availability of resources in the area of ICT within the country, community or region. Specifically, a well-rounded technology infrastructure entails abundance of software and hardware vendors and distributors dealing in web servers, databases, operating systems, web authoring tools, and so forth. Similarly, presence of big multinational companies such as Compaq and Microsoft can also spur the uptake of EC by providing reliable products and fostering indigenous ICT community and enriching them with technical expertise. Additionally, a large pool of trained human resources in the field of ICT acts as the propellant for more EC activity. Easy and cheap access to skilful individuals provides the much-needed boost to incite the EC uptake especially in small business enterprises. Therefore, we hypothesise that *the higher SMEs perceive the availability of supporting services, the more likely they will adopt EC technologies* (Hypothesis 8).

ENVIRONMENTAL PRESSURE

Environmental pressure in the context of SMEs may stem from the firm internally or from external parties. A firm may feel pressure when it sees more and more companies in the industry adopting the technology and therefore feels the need to adopt in order to remain competitive (Kuan and Chau 2001). Tarafdar and Vaidya (2004) believe that another environmental pressure linked to readiness and propagation towards EC adoption is passion for business excellence. This force is reflected in having a proactive stance towards pursuance of business excellence irrespective of any external pressure by setting pioneering trends in process and product innovation. Accordingly, we hypothesise that *the higher SMEs perceive the existence of internal pressure, the more likely they will adopt EC technologies* (Hypothesis 9).

In other many cases, a company may adopt a technology due to influences exerted by its business partners and/or competitors (Kuan and Chau 2001). A firm may feel pressure to adopt the technology if its business partners request or recommend it to do so. Multinational corporations, in the past, have created coercive pressures on their subsidiaries and suppliers by requiring them to use EC technologies to link to global production networks (Gibbs and Kraemer 2004). Chong and Bauer (2000) assert that critical mass or externalities also contribute as an seminal factor for any organisation trying to adopt new technology. The usefulness of a personal computer depends on the number of people who use computers and the wide range of available software. Applying this principle of network externalities, the argument holds true for EC as well. Furthermore, Kuan and Chau (2001) also note that another driving force for small businesses to adopt IT comes from government policies. For example, within the Malaysian shipping industry, the Electronic Data Interchange (EDI) usage is high because shippers and forwarders are forced to transact with Customs Department electronically for duty payments and import/export declaration (Ang, Tahar et al. 2003). Therefore, we hypothesise that *the higher SMEs perceive external pressure, the more likely they will adopt EC technologies* (Hypothesis 10).

CONCLUSION AND FUTURE RESEARCH

Based on an extensive literature review of EC technologies adoption in both developed and developing countries, a number of issues have been identified in the existing models and frameworks used for exploring EC adoption by SMEs. In particular, our review shows that there is a lack of a comprehensive framework that gives a multi-faceted account to the phenomenon of EC technologies adoption. This paper therefore develops a theoretical framework of EC technologies adoption which is composed of four dimensions: perceived organisational readiness (micro level), perceived industry readiness (meso level), perceived national readiness (macro level) and the perceived environmental pressure. This framework can be used to serve various purposes including creating specific research models of EC technologies adoption in a given context by aggregating potential factors that influence EC technologies adoption under each dimension in the framework. These dimensions can be investigated independently or together in order to portray a more complete picture of the phenomenon of EC technologies adoption.

In this paper, we have further used the proposed framework to develop a more specific research model to guide future study in exploring EC technologies adoption by SMEs. This model is composed of first and second order factors that comprise the four dimensions in the proposed framework and determine EC technologies adoption by SMEs. The research model is novel for the following reasons. First, it provides a holistic view of potential factors that may influence the adoption of EC technologies by SMEs. This integrated view would help in explaining the adoption or non-adoption of EC technologies by SMEs. Second, this model includes a number of first and second order factors (e.g. perceived industry standards, perceived internal pressure) that have been overlooked by most researchers that influence the EC technologies adoption by SMEs. For example, EC adoption studies need to consider the industry level because the industry plays a major role in shaping the ability of individual organisations to adopt EC technologies. Third, this model expands the definition of perceived organisation readiness to include the perception of technology, human, financial and technological resources, the internal technological infrastructure and governance, whereas previous studies have defined organisation readiness as the availability of financial and technological resources only. As the next step, the proposed research model will be empirically validated by administering a survey questionnaire among SMEs in various industries in a number of developing countries in the Asia Pacific region.

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