



OpenAIR@RGU

The Open Access Institutional Repository at The Robert Gordon University

<http://openair.rgu.ac.uk>

This is an author produced version of a paper published in

Technovation (ISSN 0166-4972)

This version may not include final proof corrections and does not include published layout or pagination.

Citation Details

Citation for the version of the work held in 'OpenAIR@RGU':

OH, K-Y., CRUICKSHANK, D. and ANDERSON, A. R., 2009. The adoption of e-trade innovations by Korean small and medium sized firms. Available from *OpenAIR@RGU*. [online]. Available from: <http://openair.rgu.ac.uk>

Citation for the publisher's version:

OH, K-Y., CRUICKSHANK, D. and ANDERSON, A. R., 2009. The adoption of e-trade innovations by Korean small and medium sized firms. *Technovation*, 29 (2), pp. 110-121

Copyright

Items in 'OpenAIR@RGU', The Robert Gordon University Open Access Institutional Repository, are protected by copyright and intellectual property law. If you believe that any material held in 'OpenAIR@RGU' infringes copyright, please contact openair-help@rgu.ac.uk with details. The item will be removed from the repository while the claim is investigated.

Keywords: e-trade; small-medium sized enterprises (SMEs); diffusion; technology adoption; South Korea.

The adoption of e-trade innovations by Korean small and medium sized firms

1. Introduction

The internationalisation of trade has brought both opportunities and challenges, especially for smaller companies (Saarenketo et al, 2008) Amongst the opportunities is the potential utility of employing ICT innovations for conducting international trade. Many larger companies have seized the chance to operate online businesses and have had some success in reducing costs in their business process. Fathian et al (2008) argue that the potential contribution of ICT for SMEs has long been recognised (Bayo-Moriones and Lera-López, 2007). In particular, business to business e-commerce has been identified as an emerging trend. Both buyers and sellers can benefit from the productivity and profitability improvements associated with e-commerce (Deeter-Schmelz et al. 2001). With a relatively small investment, companies can achieve remarkable benefits. Indeed, the leaders in e-commerce have achieved a 41% improvement in cycle times; ten percent reductions in staff costs and increased returns on investment of up to thirteen-fold (Kearney, 2002). Although e-commerce appears to be an attractive option for both large and small companies, the take up by smaller companies has been much more limited (Fillis and Wagner, 2005; Quale, 2002). Indeed, both Houghton and Winklhofer (2004) and Morgan et al (2006) suggest that e-commerce adoption is actually declining within smaller companies. Thus it appears that adoption of e-commerce may present specific challenges for smaller companies but this is not well researched (Redoli et al, 2008; Bruque and Moyano, 2007). This seems to be particularly so for e-trade, the aspect of business to business e-commerce which involves international transactions. E-trade, compared to e-commerce, involves considerably increased paper work and more complex processes and consequently appears to offer considerable advantages for adoption of ICT. Despite these advantages, e-trade has not been broadly adopted by smaller companies. Consequently the objective of this study is to examine what factors are associated with the adoption of e-trade by Korean SMEs.

Table 1 indicates the adoption of e-trade by larger companies and SMEs in Korea. It is clear that fewer SME's have taken up e-trade than their larger counterparts. Most noticeable is the degree of difference in applications at the contract and post contract stages. SME's appear to have seen the benefits in the early stages of trade, but are clearly less inclined to employ ICT in the final stages. It is interesting that the pre-contract stages have been more readily adopted by SMEs and

this fits well with models that suggest stages of adoption (Redoli et al, 2008; Daniel et al, 2002). Conceptually this distinction has been explored by Gefen and Staub (2000) in their work using the TAM model. They propose, following Davis' (1989) pioneering work, that the information seeking aspects, what we call pre-contract, are "intrinsic" tasks are most suited to adoption. That is to say that the ICT provides an intelligent database, an integrated application which provides the service. In contrast, "extrinsic" tasks are conducted through the ICT medium rather than by it. This leads Gefen and Staub to suggest that the adoption of ICT for intrinsic tasks will be strongly impacted by perceived usefulness, but that perceived ease of use is a response to extrinsic factors, the assessment of its task orientated outcomes.

Table 1. Adoption of e-trade by size of company and by stage of trade. (% of all exporting companies)

Size	Collecting information	Transaction and negotiation	Searching for partners	Marketing	Exchange of contracts	Clearance and transportation	Credit enquiries	Payments
Large	35.3	35.3	32.3	23.5	55.9	32.4	32.4	13.5
SMEs	32.3	29.2	29.3	26.2	26.2	18.8	20.6	13.5

Source: Korea Trade International Association, The application of e-trade by exporting companies, (2002:7).

In Korea, E-trading began around 1990 in response to the potential to reduce costs, improve marketing and the general simplification of business processes. Korea is noted for the "spectacular" levels of adoption of ICT in general (Lee et al, 2003). Currently, a number of Korean SMEs use EDI (Electronic Data Interchange) and the internet for conducting business. Moreover, a recent APEC report (2005) indicates that Korea is relatively advanced, by international comparison, in some aspects of e-commerce. But despite the competitive advantages compared with traditional trade (paper based trade) transactions, fewer Korean SMEs engage in e-trade than might be expected. This concurs with Jiminez-Martinez and Polo-Redondo's (2004) findings for Spain. The most common explanations for this include a lack of e-trade systems and a shortage of funds within SMEs (Morgan et al 2006). However, a number of e-trading systems emerged in the early days of adoption of e-trading but are no longer in use. This has been attributed to difficulties encountered in their application. So it appears that the ease of use of systems may be an important factor.

In general, studies about the adoption of e-commerce or information technology in SMEs have primarily focused upon user satisfaction, acceptance factors and the success of e-commerce. Whilst this is valuable, only analysing these adoption factors in e-trade does not explain why some of the systems which had appeared are no longer in use. To address this, we examine the practical use of, and continuous adoption of e-trade. It seems useful to find the determinant factors resulting in the long term acceptance of e-trade, rather than to simply find factors related to the adoptability of e-trade (Eriksson and Nilsson 2007). Because successful innovation diffusion is not about one-off use, but continuous usage, this study examines the factors which affect continuous use.

In this study we employ the TAM model of innovation, which is well established in the study of innovation adoption (Cheng et al, 2006). Although originally intended to consider technology adoption at an individual level, TAM has been regularly applied more widely (Carayannis and Turner, 2004). Our intention is to present a more precise model of innovation adoption by SMEs in Korea. Moreover, to study the interaction effect we use the 3-mediated regression presented by Baron and Kenny (1986).

Although we base our empirical work on well established literature, the contribution of this paper is that its focus is e-trade, an area of increasing importance in the wake of globalisation. Furthermore, we believe it addresses issues about innovation adoption by SMEs. In particular our findings show a reluctance by SME's to adopt a innovative system with obvious competitive advantage. This, we argue, means that first mover advantage is tempered by a wariness to adopt new systems before they have become established and matured.

2. Background

2.1 E-trade

The development of ICT has generally influenced trade processes and offers radical changes to the processes of international trade. E-trade is similar to e-commerce, but is distinguished by the additional difficulties involving the international aspects. E-trade is complex, involving, for example, customs documentation, bills of lading, certificates of origin and letters of credit. Consequently, e-trade is intended to simplify the complex processes involved in international trade processes by using the Internet and EDI.

Activity	Traditional mode	e-trade equivalent
Information gathering	Direct visiting	Internet
Marketing	Advertisements, exhibitions	

Pre-contract negotiation	Telephone, fax and physical visiting	
Customs clearance	Paperwork and visits	All done electronically
Banking and payments	Letters of credits, bank drafts etc.	
Logistics	Bills of lading, insurance certificates and letters of guarantee	Logistics information system- EDI

Figure 1, e-trade and conventional modes, (Adapted from Korean e-business White Paper, 2004)

As Figure 1 indicates, such applications can reduce costs and increase efficiency (Fillis and Wagner, 2005). Moreover, since the internet is not bound by any time zones, transactions and information seeking can be conducted at any time. In the Korean context, Trade Law defines e-trade as a transaction using a computer or equipment which is used to manage information technology during a part or all parts of the trade. The range of e-trade activities is thus extensive, from searching for information to using payment systems. Compared to traditional methods, firms using information technology can save time and considerable costs. Korea has, for example an electronic customs process system which is argued to have saved some 30% of costs when compared to previous processes. More generally, if e-trade is adopted, firms can reduce costs across a range of activities including market research, the management of customer relations, the management of payments and generally increase efficiency in their export processes.

2.2 Previous applications of TAM

Although this study is based on TAM, we hope to make two new contributions. First, our application of TAM to e-trade; this will distinguish our work from previous studies that have considered the internet, e-commerce and technology generally. Secondly we introduce a new construct, the industry environment. Nonetheless, it is useful to review previous work employing TAM to draw out the key findings to develop our hypotheses. We begin by looking at technology acceptance in general, then move to consider more specifically SMEs and e-trade.

Lederer et al (2000) examined sixteen articles that tested the TAM model for different technologies. They conclude that beliefs about ease of use and perceived usefulness are the major factors influencing attitudes about use. Similarly, van der Heijden (2003), Grandon and Pearson (2004) and Bhattacharjee and Prekumar (2004) found that perceived usefulness and perceived ease of use affected intentions to use. These studies show that perceived usefulness and perceived ease of use have a significant effect on the adoption of e-commerce, Internet and information

technology. In addition, perceived ease of use and perceived usefulness are related. These results all corroborate the TAM model in the sense that perceived usefulness and perceived ease of use were the most influential factors of e-commerce adoption. Calisir and Calisir (2004) examined the influence of usability characteristics, perceived usefulness, and perceived ease of use on end-user satisfaction with enterprise resource planning (ERP) systems and found that end-user satisfaction related to perceived usefulness. They also noted that perceived ease of use exerted an indirect effect on end-user satisfaction via perceived usefulness. This indicates that end-users tend to rate ERP systems as less useful if they find them difficult to use. Internationally, Sung (2006) examined important success factors in e-commerce and whether the factors were different in Korea, Japan and U.S.A. Three factors; ease of use, variety of goods/service and customer orientation were important success factors of e-commerce usage across the three countries.

2.3 e-commerce adoption by SMEs

Fathian et al (2008) note that one of the main findings in the literature concerning SMEs is that the nature of innovation adoption differs according to the size of the firm. Chong (2000) explored acceptance and diffusion factors of e-commerce by SMEs and found that the factors influencing SMEs acceptance of e-commerce could be divided into external and internal categories. External factors include communication, government support, whilst the internal category consists of organization factors, such as firm size, CEO support, readiness, culture and the structure of the organisation and innovation. Within the internal category, insufficient knowledge and lack of experience were also obstacles to the acceptance of e-commerce. Grandon and Pearson (2004) attempted to build a model to explain how the perceived strategic value of e-commerce influences a manager's attitude towards e-commerce adoption in US SMEs. Their results reveal a significant relationship between the perceived strategic value of the e-commerce variable and the factors that influence e-commerce adoption in SMEs. Poon and Swatman (1999) found that one reason why SMEs adopt e-commerce was profit, savings in communication costs and the ability to generate short-term revenues. More long term benefits were experienced in securing returning customers and the securing of long-term business partnerships. Although SMEs recognised e-commerce's benefit, there were barriers such as a lack of network systems, a lack of confidence in electronic settlement and the unsuitable nature of the product.

Choi (2000) considered acceptance factors of e-commerce by Korean SMEs and found that that environmental characteristics were important. Here the type of industry, the level of information intensity, environment uncertainty, competition pressure, influence, vertical connection and the propensity to innovate all played an important role. Similarly, advantage, cost and complexity

were important; whilst the character of the organisation (as a leader in innovation and entrepreneurship), information system maturity, education and government plans all influenced e-commerce directly or indirectly.

2.4 e-trade adoption by SMEs

Although e-commerce acceptance by SMEs has been extensively examined (Bruque and Moyano, 2007), there is a lack of literature on e-trade adoption. Bruque and Mayano also note that theories developed for larger firms may not be appropriate for smaller firms. It has been argued there is a critical need to identify the variables that affect adoption (Bayo-Moriones and Lera-López, 2007). Nonetheless, the key factors appear similar. For example, Hamill (1997) explored the barriers and found trust and the lack of technology infrastructure to be important. Sim (1999) studied the establishment and performance of Internet e-commerce by Korean SMEs. His exploratory study, based on innovation diffusion theory, dichotomised the main factors into two aspects, a) the character of the industry and b) the character of the organization. Fillis and Wagner (2005) draw similar conclusions in their literature review.

Kim and An, (2004) compared the level of e-commerce acceptance of large firms and SMEs. They employed the independent variables; ability to electronically organise, degree of practical use, e-trade strategy and ICT infrastructure. In large firms, only the level of practical use factor has a positive significant influence. Therefore we can expect that firm size has a close relationship with e-trade acceptance. For SMEs, the level of industry information, level of practical use and e-trade strategy had a close positive relationship with e-trade acceptance. Broadly speaking the TAM model has been generally well supported in its emphasis on perception of perceived usefulness and perceptions of ease of use but with a number of contingent factors.

Based on these studies we employ the variables that have been seen to affect e-commerce adoption and information technology generally, thus treating e-trade as innovative. It seems important to recognise that e-commerce is not a simple or single innovation, but a cluster of innovations (Daniel et al, 2002). Our variables include: perceived usefulness, convenience, ICT maturity, the innovativeness of the firm and the degree of industry competition. We replace perceived ease of use with convenience. This is because, as we discussed earlier, perceived ease of use is not an intrinsic aspect of the ICT product (Gefen and Straub, 2000) but is indirectly related to perceived usefulness. Moreover, although convenience is similar to ease of use, convenience is employed as the simplification of the business process, for example, customs

payments using EDI and is thus more directly related to the adoption of e-trade.

3. The model derived from the literature

Our model is based on the TAM model including usefulness, but with ease of use altered to ‘convenience’. Convenience is evaluated by the simplification of the business process by the use of computers and information technology. We also add environmental variables to enable the model to explore which kinds of variables affect the practical use and the continuous adoption of e-trade as proposed by Cheng et al (2006). The model is illustrated in figure 2. It describes the impact of two sets of independent factors - perceived advantage and the environment of an industry - on the “practical use” and “continuous adoption” of e-trade by SMEs. Perceived advantages consist of perceived usefulness and perceived convenience. The industry environment consists of ICT maturity, the innovation characteristics of firms and the degree of competition in an industry. The dependent variables, practical use and continuous adoption are based on Rogers’s (1983) innovation acceptance and diffusion 5 step model (Jiminez-Martinez and Polo-Redondo, 2004). Furthermore, in the interaction relationship of each variable, the industry environment is used as a dependent variable and perceived advantage is used as an independent variable. Practical use means the extent of e-trade usage in the business process, whilst continuous adoption means the degree of willingness to use it in the future measured on a five point Likert scale.

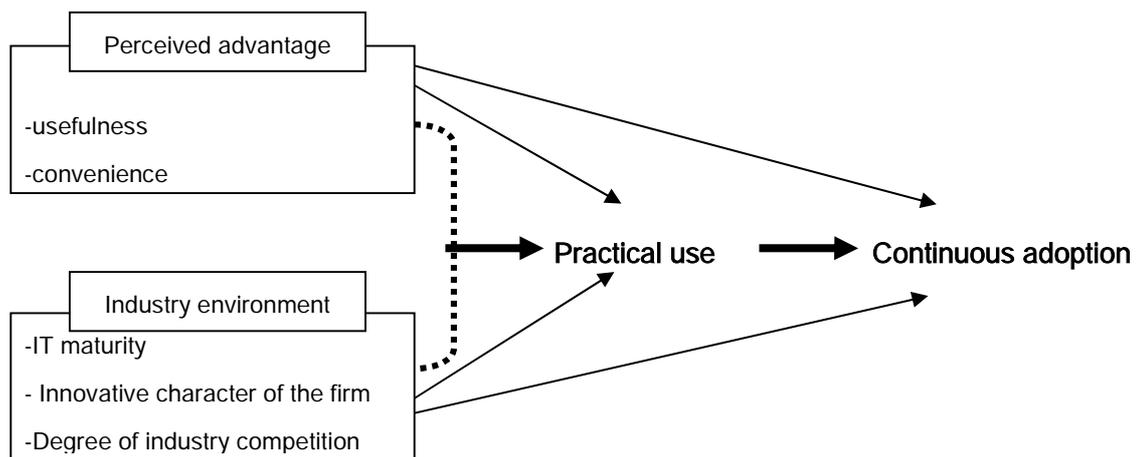


Figure 2, The model

3.1 Our hypotheses and their derivation

We explain in this section how we derived our hypotheses which, taken together, form the model. The first construct of the model is perceived advantage, which is comprised of two elements, usefulness and convenience.

3.2 Perceived advantage – perceived usefulness

In many studies relating to innovation, there has been shown to be a positive relationship between innovation adoption and perceived usefulness (Ostlund, 1974; Gatignon & Robertson, 1985; Davis, 1989; Agarwal and Prasad, 1998). Perceived usefulness is the degree to which a person believes that a particular information system would enhance his or her job performance; for example by reducing the time to accomplish a task or providing timely information, (Davis et al. 1989). Calisir and Calisir (2004) defined “perceived usefulness” as those factors that enable tasks to be accomplished more quickly and allowed users to improve their job performance, to increase their productivity, to enhance their effectiveness in a job, to make a job easier and to find the system useful in their job. These variables are positively significant for user satisfaction when utilising an ERP system. Davis et al (1989) applied perceived usefulness in the adoption of technology and found that usefulness raised productivity in performing the business process. The measurement item employed for perceived usefulness in this study was thus based on prior research. A rational adoption decision in an organisation would involve evaluating the advantages of the new technology. E-trade provides many benefits to the adopters in terms of reduced costs and reduced errors in work and increased working speed. Therefore we offer the following hypotheses;

Hypothesis 1.1: The greater the perceived usefulness, the more likely SMEs will undertake the "practical use" of e-trade systems

Hypothesis 1.2: The greater the perceived usefulness, the more likely SMEs will undertake the "continuous adoption" of e-trade systems.

3.3 Perceived convenience

Perceived convenience is a developed perceived ease of use item. Lederar et al. (2000) identified three types of ease of use; ease of understanding, ease of finding and information focus. In this study, perceived convenience is defined as when using a system or technology that this contributes to the simplification of the business process. Thus in e-trade, if the company recognises the perceived convenience of e-trade, the perceived convenience will impact on the adoption of e-trade. The developed perceived convenience items therefore focus on the ease of the entire transaction, including placing an order, making payment and usefulness of search information.

Hypothesis 2.1: The greater the perceived convenience, the more likely SMEs will undertake the "practical use" of e-trade systems.

Hypothesis 2.2: The greater the perceived convenience, the more likely SMEs will undertake the "continuous adoption" of e-trade systems.

3.4 The innovative character of firms

Many studies have been conducted on organisational support for innovation. In general terms, organizational support refers to a positive attitude towards new technology resulting in top management endorsement of efforts by staff; the provision of training and information and consulting with staff on data access, system development, and operational support (DeLone & McLean, 1992). Organisational support can thus be seen as linked to the innovative character of the firm. Consequently, the innovative character of a firm is defined as the degree of support for new technology in the company. That is, firms which have a more innovative character have a tendency to support information technology. Anandarajan et al's (2002) study considered organisational support, including encouragement by top management, perceived ease of use and perceived usefulness. They found that organisational support was a significant variable for perceived ease of use, but had no significant effect on perceived usefulness. Whilst early studies of innovation acceptance had focused only on the relationships between perceived usefulness, perceived ease of use, and adoption of ICT, more recent work also considers various environment variables along with the relationship between perceived ease of use and perceived usefulness. Thus firms that desire to be innovative will have both the intention and be willing to use new technology or services. On the other hand, if firms are conservative, they will tend to be restrained in the adoption of new technologies. Moreover, if firms understand the perceived usefulness and convenience of e-trade, then firms with a greater character of innovation will more readily adopt the innovation.

Hypothesis 3.1: The greater the innovative character of firms, the more likely SMEs will undertake the "practical use" of e-trade systems.

Hypothesis 3.2: The greater the innovative character of firms, the more likely SMEs will undertake the "continuous adoption" of e-trade systems.

3.5 Information technology maturity

ICT expertise is one important factor in the adoption of new technologies and has been found to

have a positive relationship with the adoption of new technologies (Iacovou et al, 1995, Premkumar and Roberts, 1999). To this may be added the availability of systems and hardware (Chau & Tam, 1997), so taken together these can be considered as technological maturity. Accordingly we can make the following hypotheses;

Hypothesis 4.1: The greater the information technology infrastructure maturity, the more likely SMEs will undertake the "practical use" of e-trade systems.

Hypothesis 4.2: The greater the information technology infrastructure maturity, the more likely SMEs will undertake the "continuous adoption" of e-trade systems.

3.6 Degree of industry competition

Competition increases the likelihood of adoption of innovation. Several studies have found that competitive pressure influences a company's decision to adopt IT or e-commerce (Premkumar and Ramamurthy, 1996; Iacovou et al, 1995; Gatignon and Robertson, 1985). In general, companies that compete fiercely with their rivals adopt information technology to be able to reduce business-process costs. In this study, industry competition is an environment variable and leads to the following:

Hypothesis 5.1: The greater is industrial competition, the more likely SMEs will undertake the "practical use" of e-trade systems.

Hypothesis 5.2: The greater is industrial competition, the more likely SMEs will undertake the "continuous adoption" of e-trade systems.

3.7 Mediation effect of the industry environment

Successful innovation depends largely on the mutual relationship of innovation characteristics of the industry and those of the innovation adopter. So we will explore the interaction of both the innovation characteristics of the firm and environment of the industry. In summary, it is predicted that:

Hypothesis 6: The 'industry environment' will mediate between the 'perceived advantage' and 'continuous adoption' of an e-trade system.

4. Research methods

Our initial sample universe was drawn from some 500 companies registered with the Korea

International Trade Association (KITA). This list provided details of trade type, company name, phone numbers and e-mail address of various types of small-medium sized enterprises.

4.1 Characteristics of the Sample

From the initial list we selected 500 companies for our survey. We received a total of 193 completed questionnaires. Of these, 29 had missing responses in the questionnaire and these were excluded from our analysis. Our usable final number of completed responses was 164, a satisfactory response rate of some 33%. The details and characteristics of the sample are shown in Table 2.

Table. 2 Respondent and organization sample profile				
Respondent profile		Number	Percentage (%)	
<i>Respondent's business type</i>				
Trading only firm		21	12.8%	
Trading/manufacturing firm		143	87.2%	
e-trade age, i.e. extent of time having e-traded				
Less than 6 months	6-12 months	12-24 months	24-36 months	Over 36 months
38 (23.2%)	17 (10.4%)	37 (22.6%)	33 (20.1%)	39 (23.8%)
Company size				
Less than 10 employees	11 – 50 employees	51 – 100 employees	101 - 300 employees	
41 (25.0%)	33 (20.1%)	42 (25.6%)	48 (29.3%)	
Annual sales revenue				
Less than US \$1 million	US \$ 1 to US \$10 million	Over US \$ 10 to US \$20 million	Over US \$ 20 to US \$50 million	More than US\$50 million
56(34.1%)	26 (15.9%)	23 (14.0%)	35 (21.3%)	24 (14.6%)

Thus of the one hundred and sixty-four surveys returned, our sample included 87.2% trading and manufacturing firms and 12.8 % only trade. All of the sample were SMEs according to the Korean official definition of less than 300 employees. All the responses were from companies operating e-trade and 23.8 % had operated a e-trade for at least 36 months.

4.2 The measuring instrument

The questionnaire was presented in four parts. The first part describes the concept of e-trade and assesses the level of practical use and continuous adoption of e-trade. For the dependent variables, we asked the respondents about the extent of their use of e-trade systems employing a 5 point Likert scale. We also asked about their willingness to continue with their adoption of e-

trade. In the second part, we asked about the perceived advantage of e-trade, whilst the third part asked about the industry environment and about the innovation characteristics of the respondents' firms. The final part consisted of questions about the respondent's demographics.

4.3 Reliability and Factor analysis

Factor analysis was used to demonstrate the discriminant validity of the measurement scale. The internal consistency and reliability of the scale were assessed using Cronbach's alpha.

Discriminant analysis was assessed using factor analysis. The 20 items measuring the five factors in the research model were subjected to principal component factor analysis. The 15 items of the main construct were divided into 5 groups (perceived usefulness, perceived convenience, ICT infrastructure maturity, character of innovation of firm and industry competition). Each factor analysis used principal components extraction with Varimax rotation and required eigenvalues of at least 1. We extracted any community numeric with less than 0.4. Any item that failed to load on a single factor at 0.5 or greater was dropped. Factor loadings were all higher than 0.5. Tables 3 and 4 show the final factor structures. Cronbach's alpha was used to assess the internal consistency reliability. The reliability coefficients ranged from 0.6924 to 0.8153, which was significantly higher than the acceptable level, (0.6) for this kind of study. These results confirm that the scales used are both valid and reliable.

Table 3. Factor analysis of "Perceived Advantage"

Measurement items	Perceived Advantage		Community
	Perceived Convenience	Perceived Usefulness	
F1	0.785		.650
F2	0.767		.613
F3	0.765		.628
F4	0.737		.563
F5		0.798	.655
F6		0.734	.553
F7		0.688	.605
KMO (Kaiser-Meyer-Olkin)	0.766***		
Eigenvalue	2.830	1.402	
% of Variance	40.431	20.035	
Cumulative %	40.431	60.467	

Cronbach's Alpha	.8153	.6924	
------------------	-------	-------	--

Perceived convenience

- F1: Using the system in my job enabled me to easily get additional information about selecting a partner company.
 F2: Using the system in my job enabled me to order and search of goods more conveniently.
 F3: Using the system in my job enabled me to get difficult information more easily
 F4: Using the system in my job enabled me to compare goods more easily.

Perceived usefulness

- F5 Using the system in my job enabled me to accomplish tasks more quickly.
 F6 Using the system in my job enabled me to reduce faults in our business process.
 F7 Using the system in my job enabled us to save costs in our business process.

Table 4. Factor analysis of industry environment

Item	Industry environment			
	Innovative character of firm	IT Infrastructure maturity	Degree of industries competition	Community
F8	0.834			.557
F9	0.823			.698
F10	0.822			.742
F11	0.621			.706
F12		0.921		.786
F13		0.824		.827
F14			0.907	.855
F15			0.872	.758
KMO	0.709***			
Eigenvalue	3.248	1.543	1.138	
% of Variance	40.601	19.286	14.223	
Cumulative %	40.601	59.886	74.109	
Cronbach's Alpha	.7764	.7004	.7512	

The innovative character of the firm

- F8: Our Company offers new technology education.
 F9: Our Company has many more ICT employees than other companies which deal with the same sort of products as our company.
 F10: Our CEO provides high financial resources for ICT.
 F11: Our Company uses the Internet and EDI.

IT-infrastructure maturity

- F12: Our Company has well established networks or security systems.
 F13: Our Company has software and hardware which is related to e-trade.

Competition of industry

F14: Our Company's products have a rapid PLC (Product Life Cycle).
 F15: Our Company has technology which is used to modify our products easily.

5. Regression analysis

Practical use and continuous adoption are the dependent variables in our regression, each having a particular set of independent variables: (1) perceived advantage; (2) industry environment. The perceived advantage variables consist of perceived usefulness and perceived convenience. Environmental industry variables consist of ICT infrastructure maturity, the innovative character of the firm and the degree of industry competition. Practical Use and Continuous adoption as dependent variables were investigated in firms which had already adopted e-trade. Multiple regressions were performed to examine the relationships of each independent variable and of the dependent variables. Table 5 shows the relationship between Perceived advantage and Practical use/ continuous adoption.

Table 5, Perceived advantage/Practical use & Continuous adoption

Dependent variables	Independent variables	B	Std. Error	Beta	t	Sig.	VIF
Practical use	P usefulness (H1.1)	.263	.131	.159	1.999	.047	1.083
	P convenience (H2.1)	.227	.115	.157	1.975	.050	1.083
	R2	.063					
	F	5.457					
	N	164					
Continuous adoption	P usefulness (H1.2)	.524	.123	.330	4.272	.000	1.083
	P convenience (H2.2)	.024	.107	.017	.225	.822	1.083
	R2	.112					
	F	10.196					
	N	164					

To test the hypotheses from H1.1 to H2.2, respondents were asked to indicate on a Likert scale their perceived advantages out of 7 possible advantages from the use of an e-trade system. The Likert scale ranged from 'very strongly disagree' (1) to 'very strongly agree' (5). H1.1 and H1.2 stated that perceived usefulness was related positively to practical use and continuous adoption. H1.1 was supported ($\beta=.159$, $\text{sig}=.047$). This result shows agreement with prior research such as Davis et al (1989), Davis (1989) and Calisir and Calisir (2004), who all found that perceived usefulness had a positive significant effect on practical use or continuous adoption. H1.2 was supported ($\beta=.330$,

sig.=.000). H2.1 and H2.2 stated that perceived convenience is related positively to practical use and continuous adoption. Perceived convenience has a significant positive relationship with practical use. This result matches our predicted result. H2.1 ($\beta=.157$, sig.=.050) was supported. We, however, fail to find a noticeable relationship between the continuous adoption of e-trade and the perceived convenience. This result is in contrast to previous studies by Lederer et al. (2000), which reported that perceived convenience is a determinant variable of acceptance of Internet/EDI. Therefore H2.2 ($\beta=.017$, sig=.822) is rejected.

Table 6 shows the relationship of the environment of an industry and practical use/continuous adoption.

Table 6. Mediation regression analysis of industry environment

Industry environment	perceived advantage	practical use	continuous adoption
Character of Innovation	perceived usefulness	Beta	Beta
	step 1	.320 (.000)	.320 (.000)
	step 2	.202 (.010)	.335 (.000)
	step 3a	.187 (.109)	.325 (.000)
	step 3b	.381 (.000)	.254 (.000)
	perceived convenience	Beta	Beta
	step 1	.197 (.011)	.197 (.011)
	step 2	.201 (.010)	.109 (.166)
	step 3a	.129 (.081)	.058 (.753)
	step 3b	.363 (.000)	.225 (.001)

In order to test hypotheses from H3.1 to H5.2, respondents had to indicate to what extent they use IT infrastructure; the innovative character of their firm and their products' industry competition. H3.1 and H3.2 stated that IT infrastructure maturity has a positive relationship with practical use and continuous adoption. This result is similar to that of other researchers, in that firms that have greater IT infrastructure prefer to use technology systems such as e-trade, Internet and EDI. Therefore H3.1 and H3.2 are accepted.

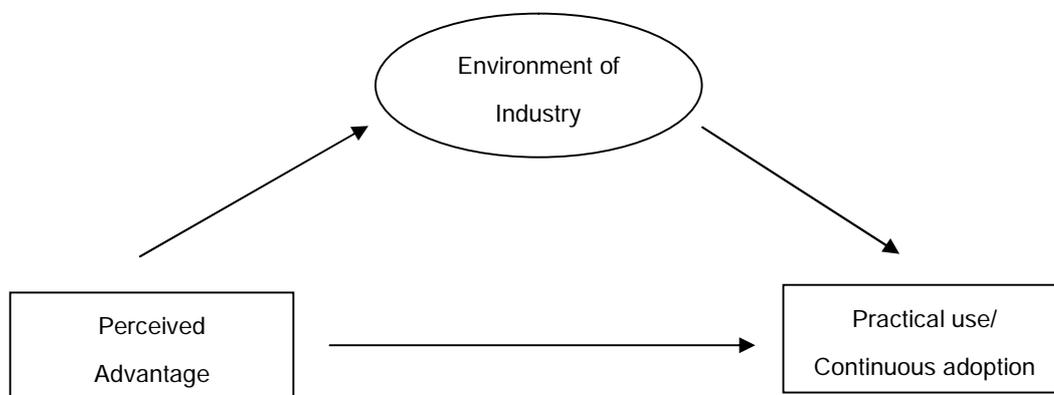
Our predictions of H4.1 and H4.2 are related to the innovation character of firms. The innovation character of firms has a positive significant effect ($\beta=.223$) with practical use, which supports our prediction. H4.1 was also supported. H4.2, the relationship between innovation character of firms and continuous adoption, has a positive statistical significance. So, H4.2 ($\beta=.147$ sig=.066) was supported.

The degree of industry competition (H5.1) has a negative relationship to practical use, but it ($\beta=-.014$,sig. =.851) was not statistical significant, and thus does not support our prediction. The degree of industry competition (H5.2) has a negative relationship with continuous adoption ($\beta=-.058$ sig. .431), but this also has no significance statistically.

5.1 Mediation regression

The mediators explain how external factors take on an internal significance towards adoption, see Figure 3.

Figure. 3 Diagram of mediator variable



Our study employed a structural model for mediation regression, based on Baron and Kenny's (1986) suggestion. In the relationship between "perceived advantage" and "acceptance", we obtained meaningful results when industry environment was used as mediating variable. Baron and Kenny propose that a variable which functions as mediator must satisfy the following conditions; first, the independent variable must affect the mediator in the first equation; second, the independent variable must be shown to affect the dependent variable in the second equation; and third, the mediator must affect the dependent variable in the third equation. If these conditions all hold in the predicted direction, then the effect of the

independent variable on the dependent variable must be less in the third equation than in the second. Perfect mediation holds if the independent variable has no effect when the mediator is controlled. That is, first, the ‘perceived advantage’ variable must affect the ‘industry environment’ in the first equation; and second, the ‘perceived advantage’ must be shown to affect the ‘practical usage and continuous adoption’ in the second equation; and third, the ‘perceived advantage and industry environment’ must affect the dependent variable in the third equation, at this time, the effect of mediator being bigger than the effect of independent. Moreover, the effect of the ‘perceived advantage’ on the ‘acceptance’ variable must be less in the third equation than in the second. Thus as Table 6 demonstrates: Step 1: $X_2 = \alpha_1 + \beta_1 X_1 + \epsilon_i$; Step 2: $Y_1 = \alpha_1 + \beta_2 X_1 + \epsilon_j$; Step 3: $Y_2 = \alpha_1 + \beta_3 X_1 + \beta_4 X_2 + \epsilon_k$, but, β_2 of beta $> \beta_3$ beta and $\beta_3 < \beta_4$.

5.2 The Firms’ Environment as mediator variable

Following these conditions; first, the character of innovation is a perfect mediator between practical usage and perceived advantage but it is a partial mediating effect between continuous adoption and perceived advantage. This because step 1, step 2, and step 3b are statistically significant and step 3a is smaller than step 2 and step 3b. If step 3a is not significant, it is a perfect mediator. In other words, the non-significance of step 3a means that independent variable has no influence on the dependent variable without the mediator. However, if step 3a is significant statistically, it is a partial effect. Second, ICT maturity is a perfect mediator in the perceived usefulness and acceptance, but it has a partial influence other relationships. Thirdly, the degree of industry competition has a partial influence in all relationships. See tables 6, 7, and 8.

Table 7. ICT maturity mediation regression analysis

Industry Environment	Perceived advantage	Practical Use	Continuous adoption
	Usefulness	Beta	Beta
	Step 1	.135(.085)	.135(.085)
	Step 2	.202(.010)	.335(.000)
	Step 3a	.159(.033)	.290(.000)
	Step 3b	.320(.000)	.333(.000)
	Convenience	Beta	Beta
	Step 1	-.145(.065)	-.145(.065)
	Step 2	.201(.010)	.109(.166)
	Step 3a	.255(.001)	.166(.024)
	Step 3b	.378(.000)	.396(.000)
IT infrastructure Maturity			

Table 8. Industry competition mediation regression analysis

Industry Environment	Perceived advantage	Practical Use	Continuous adoption
Degree of industry competition	Usefulness	Beta	Beta
	step 1	.005(.954)	.005(.954)
	step 2	.202(.010)	.315(.000)
	step 3a	.202(.010)	.335(.000)
	step 3b	.054(.481)	.018(.645)
	Convenience	Beta.	Beta
	step 1	.260(.001)	.260(.001)
	step 2	.202(.010)	.109(.166)
	step 3a	.200(.013)	.116(.154)
	step 3b	.003(.966)	-.029(.722)

*: $p < 0.1$, **: $p < 0.05$

6. Discussion and Conclusions

The results show that perceived usefulness is a good predictor for the practical use of e-trade innovations. Moreover, perceived usefulness also predicts that e-trade innovations will be continuously adopted. We can make some deductions from these findings. Most obviously, the perceived ability of an e-trade system to perform tasks better is an important predictor of its application. Thus if we consider Table 1, it seems likely that tasks categorised as pre-contract, those that are “intrinsic” in Gefen and Staub’s (2000) terms, are fulfilled well by e-trade innovations but that users are somehow less convinced about their usefulness for post contract tasks. Considering this in the light of our findings about usefulness might suggest that current and future innovations should focus on improving their perceived usefulness in those aspects. Although usefulness predicted both practical use and continuous adoption, perceived convenience only predicted practical use. We might argue then, that the ability of the innovation to perform the tasks better is of more importance than how convenient it is seen to be. This is interesting in the light of the arguments about smaller firms having a less sophisticated understanding of technical ICT issues (Fillis and Wagner, 2005). Our findings imply that, even if this is the case, innovation adoption is more dependent upon the ability of the innovation to do the job better.

In the case of the industry environment variables, ICT infrastructure maturity and the innovative character of firm variables are important for the continuous use of e-trade. This is as we might

expect, since these are background conditions that favour or discourage innovation adoption. More interesting is the mediation regression which shows that the industry environment variable plays mediator between continuous use of e-trade and perceived advantage and has a positive relationship on these variables. In other words, perceived advantage affects the ICT Maturity (see step 1 of table 7). If firms have a proper ICT infrastructure, firms perceive more usefulness and convenience of e-trade than those who do not have a good ICT infrastructure, which can lead to the use of e-trade continuously. This is obviously a chicken and egg situation, where it is difficult to attribute the direction of causality. It does, however, seem reasonable to propose that in emerging competitive conditions it behoves firms who want to maintain or acquire competitive advantage to consider investment in IT expertise and infrastructure. In addition to any first mover advantage, as Roth and Morrison (1992) had pointed out, innovation is regularly identified as a contributor to competitive advantage. By extrapolation, failure to innovate to reduce costs could lead to strategic disadvantage.

Our literature review had led us to expect infrastructure maturity to play a significant role in adoption. But we had noted that several systems which had been developed had failed to adopted for e-trade. So it seems to be that as Chong (2000) and Poon and Swatman (1999) had noted, these factors about the maturity of the infrastructure imply that that for e-trade to become widely adopted a mature infrastructure has to be in place. So first mover advantage, despite the opportunity for competitive advantage, seems to take secondary place, eclipsed perhaps, to a possible wariness about new systems. Our findings had shown how the early stages of e-commerce (see Table 1) adoption were attractive to SMEs. This may be because these stages are, although important, not crucial to the actual trade. In contrast, the final stages, financial and fiscal, if improperly completed would create considerable problems for the SME. In many ways this argument is confirmed by our findings that ICT maturity is a perfect mediator between perceived usefulness and acceptance. Indeed it seems that there is little incentive to be a first mover.

In summary, our results indicate that each variable has a relationship with other variables. However, in the context of e-trade, this study demonstrated that convenience is not an important variable when considering the continuous use of e-trade.

7. Contributions

7.1 Contribution for academic researchers

For academic researchers, this study contributes to a theoretical understanding of the factors that promote the diffusion of e-trade. Our research designs a modified model, based on TAM. In general the TAM model is used for Internet use or Information Technology but our research explored the diffusion of e-trade employing the well established TAM model. Reflecting recent research, we added the variable 'industry environment' to perceived advantage and we changed the 'perceived ease of use' variable into a 'perceived convenience'. TAM stresses the importance of perceived usefulness and perceived ease of use (perceived convenience) as key determinants. However, in the context of e-trade, this study demonstrated that convenience is not an important variable when considering the continuous use of e-trade. We also explored the mediation effect of the environment of industry. The industry environment variable has influence on both the perceived advantage and the acceptance of e-trade. Our analysis thus shows the TAM model can be usefully modified for e-trade in particular and possibly for e-commerce in general. These variables explained much of the variances in e-trade's practical and continuous use. So, we suggest a modified innovation model including the industry environment variable. The modified model has greater explanatory power than existing TAM models.

7.2. Contribution for Policy

These results indicate some relevant points for a diffusion policy for e-trade. The results show that perceived usefulness is still an important variable in the practical use and continuous adoption but the perceived convenience, the modified definition from perceived ease of use, is not an important variable in the continuous adoption of e-trade. That is, perceived usefulness is more important than perceived convenience in the continuous use of e-trade. Consequently, developers introducing diffusion policy for e-trade must be cognisant of how firms employ and plan to employ e-trade. Accordingly, we can now understand better which of the e-trade factors offered to SMEs should be more considered as most important. Developments and innovations should concentrate upon the perceived usefulness, factors such as the reduction of cost and time efficiency, rather than the convenience of a system. Nonetheless the existence of a mature ICT infrastructure is also important for adoption.

In the case of environment of industry variables, the ICT infrastructure maturity and the innovative character of firm variables are important for the continuous use of e-trade. Furthermore, through mediation regression we found that the industry environment variable plays mediator between continuous use of e-trade and perceived advantage and has a positive relationship on these variables. In other words, perceived advantage affects ICT Maturity (see step 1 of Table 7). If firms have proper ICT infrastructure, firms perceive more usefulness and convenience of e-trade than those not having ICT infrastructure, which can lead to the use of e-trade continuously. Consequently the industry environment must be taken into account when encouraging e-trade, and possible e-commerce in general.

Since our results show that each variable has a relationship with other variables, we propose policies which reflect all aspects of the character of innovation. For example, governments can provide various incentives, such as the training of users of e-trade, designing or adapting a system in keeping with the actual environment of SMEs. Overall, we expect that the results will help a governments' understanding of the relationship among the perceived advantage, industry environment and the acceptance of e-trade for SMEs.

References

- Agarwal, R., Prasad, J., 1998. A Conceptual and Operational Definition of Personal Innovativeness in the Domain of Information Technology, *Information Systems Research* (9) 2, 204-215.
- Anandarajan, M., Igbaria, M., Anakwe, U.P., 2002. IT acceptance in a less-developed country: a motivational factor perspective, *International Journal of Information Management* (22)1, 47-65.
- APEC, 2005, Symposium on E-commerce and Paperless Trading , Busan, Korea, November
- Baron, R.M., D.A. Kenny., 1986. The Moderator-Mediator Distribution in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations, *Journal of Personality and Social Psychology* (51)6, 1173-1182 .
- Bayo-Moriones, A., Lera-López, F., 2007, A firm-level analysis of determinants of ICT adoption in Spain, *Technovation*, 27 (6-7) 352-366

- Bhattacharjee, A. and G. Prekumar 2004, Understanding Changes in Belief and Attitude Towards Information Technology Usage: A Theoretical Model and Longitudinal Test. *MIS Quarterly* 28(2): 229-254.
- Bruque, S., Moyano, J., 2007 Organisational determinants of information technology adoption and implementation in SMEs: The case of family and cooperative firms, *Technovation*, 27(5) 241-253
- Bruque, S., Moyano, J., 2007 Organisational determinants of information technology adoption and implementation in SMEs: the case of family and cooperative firms, *Technovation*, (27) 241-253
- Calisir F., Calisir, F., 2004. The relation of interface usability characteristics, perceived usefulness, and perceived ease of use to end-user satisfaction with enterprise resource planning (ERP) systems, *Computers in Human Behavior* (20) 4, 505-515.
- Carayannis E.G., Turner, E., 2004, Innovation diffusion and technology acceptance: The case of PKI technology, *Technovation*, 26, 847-855
- Chau, P.Y.K., Tam, K.Y. 1997, Factors affecting the adoption of open systems; and exploratory study, *MIS Quarterly*, (21) 1, 1-21
- Cheng M-S., J., Sheen, G-J., Lou, G-G., 2006. Consumer acceptance of the internet as a channel of distribution in Taiwan- a channel function perspective, *Technovation* (26) 856-864
- Choi, S.H., 2000. Study on Factors Affecting the Utilization of EC in SMEs, Unpublished master's thesis, Hankuk University of Foreign Studies, Korea
- Chong Y. L., 2000. Model of Factors Influences on Electronic Commerce Adoption and Diffusion in Small-&Medium-sized Enterprises, School of Information Systems, Curtin University of Technology.
- Daniel, E., Wilson, H., Myers, A., 2002 Adoption of e-commerce by SMEs in the UK, *International Small Business Journal*, 20(3) 253-270
- Davis, F.D., 1989. Perceived usefulness, perceived ease of use and user acceptance of information technology, *MIS Quarterly*, (13)3, 319-339
- Davis, F.D., Bagozzi R.P., Warshaw, P.R., 1989. User Acceptance of Computer Technology: A Comparison of Two Theoretical Models, *Management Science* (35) 8, 982-1013.
- Deeter-Schmelz, D.R, Bizzari, A., Graham, R., Howdysshell, C., 2001. Business-to-Business Online Purchasing: Suppliers' Impact on Buyers' Adoption and Usage Intent, *The Journal of Supply Chain Management*(37)1, 4-10.

- DeLone, W. H., McLean, E. R., 1992. Information systems success: The Quest for the dependent variable. *Information Systems Research* (3) 1, 60-95.
- Eriksson, K., Nilsson, D., 2007, Determinants of the continued use of self-service technology; the case of internet banking, *Technovation*, (27) 159-167
- Fathian, M., Akhavan, P., Hoorali, M., 2008 E-readiness assessment of non-profit ICT SMEs in a developing country: The case of Iran, *Technovation*, In Press, Corrected Proof, , Available online 18 April 2008.
- Fillis, I., Wagner, B., 2005, E-business Development: An Exploratory Investigation of the Small Firm, *International Small Business Journal*, 23: 604 - 634
- Gatignon, H., Robertson, T.S., 1985. A Propositional Inventory for New Diffusion Research *Journal of Consumer Research*, 11(4), 849-867.
- Geflen, D., Straub, D., 2000, The relative importance of perceived ease of use in IS adoption; a study of e-commerce adoption, *Journal of the Association for Information Systems*, 1(8) 1-20
- Grandon, E.E, Pearson, J.M, 2004. Electronic commerce adoption: an empirical study of small and medium US businesses, *Information & Management* 42(1), 197-216
- Hamill, J, 1997. "The Internet and International Marketing", *International Marketing Review* (14) 5, 303-317.
- Hong, W., Thong, J.Y.L., Wong, W.-M., Tam, K.Y. 2002. Determinants of user acceptance of digital libraries: An empirical examination of individual difference and systems characteristics. *Journal of Management Information Systems* 18(3).97-124.
- Houghton, K. A., Winklhofer, H., 2004, The effect of website and e-commerce adoption relationship between SMEs and their export intermediaries, *International Small Business Journal*, 22(4) 369-388
- Iacovou, C. L., I. Benbasat, Dexter, A.S., 1995 Electronic Data Interchange and Small Organizations: Adoption and Impact of Technology, *MIS Quarterly*, (19) 4, 465-485
- Jimenez-Martinez, J., Polo-Redondo, Y., 2004, The influence of EDI adoption over its perceived benefits, *Technovation*, 24, 73-79
- Kearney, A.T. 2002. *Assessment of excellence in procurement: How leaders create value through e-supply management*, A.T. Kearney Inc., Chicago.

- Kim Y, D., An, C. G., 2004 . An Empirical Analysis on the Performance of e-Trade by the Utilization Level of International Commercial Enterprises, Korea Academy of International Business (15)1, 53-78.
- Lederer, A.L, Maupin, D.J., Sena, M.P., Zhuang, Y, 2000, The technology acceptance model and the World Wide Web, Decision Support Systems (29)3, 269-282.
- Lee, H., O'Keefe, R.M., Yun, K., 2003 The growth of broadband and electronic commerce in South Korea: contributing factors, The Information Society, (19) 81-93
- Lorhke, F. T., McClure Franklin, G., Frownfelter-Lorhke, C., 2006, The internet as an information conduit; a transaction cost analysis model of US SME. International Small Business Journal, 24(2) 159-179
- Mccloskey, D., 2003-2004. Evaluating Electronic Commerce Acceptance with the Technology Acceptance Model, Journal of Computer Information System (44) 2, 49-57.
- Morgan, A., Colebourne, D., Brychan, T., 2006, The development of ICT advisors for SME businesses; an innovative approach, Technovation, 26, 980-987
- Ostlund, L.E., 1974. Perceived Innovation Attributes as Predictors of Innovativeness, Journal of Consumer Research (1),23-29.
- Poon, S., Swatman, P.M.C., 1999. An exploratory study of small business Internet Commerce issues, Information and Management (35)1, 9-18.
- Premkumar, G., Ramamurthy, K., 1996. The role of interorganizational and organizational factors on the decision mode for adoption of inteorganizational system, Decision Science 26(3), 303-336.
- Premkumar, G., Roberts, M., 1999. Adoption of new information technologies in rural small business, The International Journal of Management Science (27) 4, 467-484.
- Quale, M., 2002 E-commerce; the challenge for UK SMEs in the Twenty First century, International Journal of Operations and Production Management, 22(10) 1148-1161
- Redoli, J., Mompó, R., García-Díez, R.J., López-Coronado, M., 2008, A model for the assessment and development of Internet-based information and communication services in small and medium enterprises, Technovation, 28 (7), 424-435
- Rogers, E. M., 1983 *Diffusion of Innovations*, New York: The Free Press
- Roth, K., Morrison, A.J., 1992, Implementing global strategy; characteristics of global subsidiary mandates, Journal of International Business (23) 4, 713-735

- Saarenketo, S., Puumalainen, K., Kylaheiko, K. Kuivalainen, O., 2008, Linking knowledge and internationalization in small and medium-sized enterprises in the ICT sector, *Technovation*, In Press, Corrected Proof, , Available online 5 February 2008
- Sim, S.R. 1999. A Study on the Implementation and Performance of Electronic Commerce via Internet of Korean Traders, Unpublished doctoral thesis. Hanyang University, Korea
- Sung, T.K., 2006. E-commerce critical success factors: East vs. West, *Technological Forecasting and Social Change* (73) 9, 1161-1177
- van der Heijden, H., 2003, Factors influencing the usage of websites: the case of a generic portal in the Netherlands, *Information & Management* 40, 541-549