An empirical Study of Determinants of E-commerce Adoption in SMEs in Vietnam an economy in transition

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ABSTRACT
Experts and business pundits forecasted drastic changes in Vietnam’s fledgling e-commerce when the Southeast Asian country became an official member of the World Trade Organization (WTO) in 2007. Over the last few years, as part of the Reform– called Doi moi– some Vietnamese enterprises have adopted e-commerce and already benefitted from it. In this research, we build and test a model of e-commerce adoption including numerous internal and external factors identified in theoretical and empirical studies. The final sample of 926 small and medium-sized enterprises in Vietnam includes both adopter and non-adopter firms. The policy implications of this study on promoting e-commerce adoption by SMEs in transition economies, such as Vietnam, are discussed.

Key words: e-commerce, SME, Vietnam, B2B, B2C, adoption, innovation
An empirical Study of Determinants of E-commerce Adoption in SMEs in Vietnam: the case of a transition economy

ABSTRACT
Experts and business pundits forecasted drastic changes in Vietnam’s fledgling e-commerce when the Southeast Asian country became an official member of the World Trade Organization (WTO) in 2007. Over the last years, as part of the Reform—called Doi moi—some Vietnamese enterprises have adopted e-commerce and already benefitted from it. In this research, we adapt the Technology-Organization-Environment (TOE) framework and test a model of e-commerce adoption including numerous internal and external factors identified in empirical studies. The final sample of 926 small and medium-sized enterprises representative of the Vietnamese transition economy and of its regional diversity includes both adopter and non-adopter firms. The policy implications of this study on promoting e-commerce adoption by SMEs in transition economies, such as Vietnam, are discussed.

Key words: e-commerce, SME, Vietnam, adoption, transition economy, TOE framework

1. INTRODUCTION
With the implementation of its open-door policy in 1986 the Vietnamese government sought to move away from its dependency on foreign financing and influence by developing local markets and economic infrastructure sustain its economic growth. One of the potential growth areas sought was via the development of small and medium size enterprises (SMEs), long recognized worldwide as engines of economic growth not only in the developed but also in the developing countries (McMillan & Woodruff, 2002). Many transition economies have accelerated growth via supporting more small business entrepreneurial activities (Watkins, 1993; Friedman, 2004). This often coincides with the adoption and use of e-commerce.

For firms domiciled in developed economies the adoption of e-commerce is an essential tool. But how would such adoption play out for small firms in a transition economy? In this paper, we look at Vietnam as one case of a transition economy wherein the adoption of e-commerce is growing among SMEs. Using a regionally balanced sample of firms within Vietnam this paper addresses two research questions. They are:

RQ1 – What are the factors driving the adoption of e-commerce in Vietnam from a managerial perspective?

RQ2 – What are the insights we can learn from within a transitional economy?

Although there have been previous studies related to the adoption of e-commerce by SMEs around the world (Thomas & Simmons, 2010), most of these previous studies had been conducted in relatively well developed economies; Malaysia, S.E. Wales,
Switzerland, The Netherlands, and Italy (Thomas & Simmons, 2010); the United Kingdom (Simpson, et al., 2004); New Zealand (Al-Qirim, 2007), South Africa (Cloete, et al., 2002) and parts of Asia (Sharma & Sheth, 2004). Only a handful of studies have focused on the e-commerce adoption by SMEs in a transition economy, notably China (Li et al., 2010). Even fewer studies have focused on Vietnam. In this respect, this paper reports on the first large-scale empirical study on e-commerce adoption by SMEs in Vietnam. We will explore various factors that influence the adoption process and attempt to understand and explain the phenomenon through the lens of the Technology, Organization, and Environment (TOE) framework. In doing so this paper crosses two domains and contributes to building knowledge about e-commerce and about the adoption of information technology and developing countries (Checchi et al., 2012). More specifically it addresses the case of SMEs in a dynamic economy in transition.

This paper is organized as follows: next, in the literature review section, we contextualize the Vietnamese small-to-medium-enterprise and the nature of e-commerce in a transition economy while comparing the relevant extant literature examining e-commerce adoption in Asia in general and Vietnam in particular. In this section we also examine models for studying technology and e-commerce adoption in the current literature. The third section describes how these models are adapted for this research, and presents the research model and the research hypotheses. In the fourth, research methodology, section the paper describes the sample selection, instrument development and analyses approaches. Fifth, the paper presents the findings and discusses those findings giving further consideration of the context. This last section also identifies the implications and limitations of the work and offers policy recommendations and future research options.

2. LITERATURE REVIEW – ADAPTING A MODEL OF E-COMMERCE ADOPTION IN THE VIETNAMESE CONTEXT

2.1 SMEs and e-commerce in a Vietnamese Context

Prior to Vietnam’s reunification in 1975, North Vietnam, as a socialist state had a centrally planned economy. After the reunification, a consistent economic policy was instituted in the North and South wherein state-owned enterprises were the key component in the country’s economic system. However, at its Sixth Congress in 1986, the Vietnamese Communist Party adopted the open door policy commonly known as doi moi. This adoption of doi moi policy jump-started a series of fundamental transitions in Vietnam’s economy. One of such transition was the economic liberalization in which private and individual ownership of businesses was allowed. However, the development of small and medium enterprises was not a top priority in the initial versions of this policy. But when in 1997, the Asian currency crisis caused a sharp decline in foreign investment in Vietnam and severely hampered the growth in its economy, Vietnam, like other Southeast Asian countries, began to focus on the potential in its small and medium enterprises as one alternative to grow its economy. Generally, it was expected that as these enterprises developed, they would bootstrap a host of other economic benefits to the country. For instance, the SMEs could improve the trade balance with the increase of exports and decrease of imports.

\[1\] In English, doi moi literally means renew.
Vietnam represents one of the economies in the world in which the on-going transition from centrally planned organizations and state-owned enterprises to privately owned small and medium businesses is taking place at a rapid and orderly pace. But the notion of the SME was not well defined in early versions of the doi moi policy. It was not until June 1998 that the Vietnamese government provisionally characterized SMEs as “companies with less than VND 5 billion in paid up capital and fewer than 200 employees”. Two years later, it adopted a formal definition of SMEs (c.f, Decree, No.91/2001/CP-ND) saying that SMEs:

“are independent business entities, which have registered their business in accordance with prevailing laws, with registered capital of not more than VND 10 billion or the annual average number of labor of not more than 300 people”.

There are no formally established governmental measures of the SME sector thus depriving us of official estimates of the contribution of SMEs’ to the country economy; but other indicators do exist. Although sources and figures vary estimates generally agree that in Vietnam SMEs account for more than 95% of all businesses (ASMED 2006), provide 77.3% of all employment in the labor market (Hall 2002; Asasen & Asasen 2003; Sakai & Takada, 2000; Vietnam Economic Portal, 2008). The Vietnam Chamber of Commerce and Industry, estimated that 90 percent of the new jobs were created by SMEs from 2000-2005. In just four months in 2007, 6400 SMEs were established with a capitalization of US$5 billion. In terms of the growth of the sector’s size a February 2006 report from Vietnam’s Minister of the Ministry for Planning & Investment estimated the number of SMEs enterprises to be more than 225,000 in 2005 and projected the sector to grow to 500,000 in 2010. A more recent estimate showed the number to be 300,000 SMEs in Vietnam (VNEB.org, 2009). Thus the ten-fold growth in the number of SMEs in just one decade, when compared to the 35,000 SMEs that existed in 1999, is a further indicator of the importance of SME sector to Vietnam’s economy. SMEs have been credited with playing a key role in helping the country to reduce hunger and poverty and hence in narrowing the gap among different parts of the country (Vietnam Economic Portal, 2008). Vietnam’s official governmental economic development strategy depends, to a large degree, on the development of the private sector. In the spirit of the doi moi policy Vietnam shifted from a centrally planned system to a market-oriented socialist economy. Nevertheless the government’s “Overall Plan on Developing E-commerce” for 2006-2010 still set goals for e-commerce development. The plan wanted some 60 percent of large enterprises to be conducting B2B e-commerce, and 80 percent of small and medium firms engaged in B2C or B2B by the end of 2010 (Huy, 2008). Vietnamese firms and government both recognized the need for Vietnamese SMEs to open themselves to new techniques, in particular to web protocols, the Internet and to e-commerce. Vietnamese firms have begun to establish their own websites to introduce products and services to customers and clients as well as to implement online sale and purchase (B2C) or built up websites to gather many enterprises to introduce products and services (B2B). Established examples include: GoodsOnlines, VDC Supermarket, VnEmart, VietOffer, and WorldTradeB2B. Owners of these websites are typically industry associations, trade offices, governmental agencies, or even companies or individuals. Their presence has signaled the development of e-commerce in Vietnam. Nevertheless there are still physical and societal factors inhibiting the growth of e-commerce in Vietnam. Despite all these major advances, the slow development of physical infrastructures as well as of certain legal infrastructures protecting intellectual
property, and privacy rights, both enterprises and consumers have not been eager and confident enough to participate in e-commerce. An in-depth investigation of the factors driving e-commerce adoption in Vietnam as well as a clear definition and scope of e-commerce in this context is needed.

2.2 Defining e-commerce in the Vietnamese Context

Researchers hold that e-commerce on the Internet goes beyond simply buying and selling electronically; it involves a wide variety of pre and post-sales activities, such as advertising, maintaining business relationships, and enhancing business communication (Zwass, 1996). However, for our purpose in this paper, we define “E-commerce” as simply the purchase and sale of products and services by electronic means such as Internet. We recognize that this definition is narrower than more common e-commerce definitions that typically include all online exchange of goods, services, information, as well as money among firms and their customers over an electronic medium. But we believe that our definition better fits the specific context of Vietnam as a transition economy for two reasons. First, given the relative immaturity and technical build out of the countries banking and financial infrastructure, online exchange of money is rather rare. Second, in a socialist society, the unfettered exchange of information is restricted because of governmental control. Learning to embrace and to take advantage of openness and freer transfers of information is requisite condition for effective implementation and use of online technologies. As a consequence of these societal limitations the notion of e-commerce in the context of our paper mainly focuses on the purchase and sale of products and services among SMEs and between SMEs and their customers over the Internet and relatively few related activities beyond buying and selling. Since, at its core, e-commerce is the use of electronic means to expedite commercial transactions and improve efficiencies in business processes within and across organizations we argue that or more limited definition is still consistent with the generic notions of e-commerce (c.f., Turban et al., 2000, or, Zhu et al., 2004), namely:

that any firm having a website used to facilitate any form of business transaction (B-2-C and/or B-2-B) in which the parties interact electronically rather than by physical exchanges or direct physical contact would be said to engage in e-commerce.

Huy and Filiatrault (2006) conducted a study on E-commerce adoption in 300 small and medium-sized enterprises in Vietnam. Their results indicate the influence of various factors such as: firm size, its resources and its strategic orientation, employees’ knowledge of e-commerce, managers’ attitude towards innovation and knowledge of the new technologies and of e-commerce, competition intensity, degree of government support, national IT infrastructure, perceived relative advantages, and the complexity and compatibility of e-commerce. However, in practice, it is not easy to implement e-commerce in SMEs in Vietnam. There are difficulties associated with SMEs that are known to impede economic development, such as the scarcity of capital, the very limited use of technology, the lack of administrative expertise, the failure to hire and keep specialists, the difficulties in distributing goods in both internal and external markets, the very strong competition among SMEs and the problems of administrative procedures (Blili & Raymond, 1993). Most Vietnamese SMEs are incapable of resolving such problems by
themselves, which is why government authorities, financial institutions and large enterprises must support and encourage them with their policies and their assistance programs. With a few rare exceptions, Vietnamese enterprises, like most enterprises in developing countries, have not yet adopted technological innovations for some years now, often because of the lack of resources, but also because of the work habits and culture of those who manage these SMEs (Huy, 2008). Many simply cannot, or will not, accept the risk inherent in changing the way they do business and their decision-making processes.

2.3 Extending the Technology, Organization, and Environment (TOE) Framework in the Context of E-Commerce

Not knowing how e-commerce adoption plays out in this transition economy we begin our investigation with a general framework of technology adoption and the assumption that the adoption of e-commerce may follow a pattern similar to that of general IS and IT. Their adoption in SMEs, is driven by factors ranging from competitive pressures and other environmental characteristics to internal factors such as a manager’s innovation and risk taking characteristics (cf. Table 1). Few studies have examined IS and IT adoption in SMEs in the developing world and fewer have examined the SMEs in emerging Southeast Asian economies. Studies made in the developed world inform us that the utilization of IS and IT in the SME is driven by the attitude of managers towards the use of information technology, their knowledge of information technologies, the size of the enterprise, the structure and culture of the organization, and the economy and infrastructure as important factors affecting the adoption of technologies and information systems (Chieochan et al., 2000; Grover & Goslar, 1993; Iacovou et al., 1995; Yap et al., 1992). Accordingly we are making a contingent assumption that this may true for the SME in this transition economy.

Previous research on e-commerce adoption found that the adoption of Internet and of e-commerce are significantly impacted by the Technological context (Premkumar & Roberts, 1999), the Organizational context (Ling, 2001; Mehrzens et al., 2001; Seyal & Rahman, 2003) and the Environmental context (Lertwongsatien & Wongpinunwatana, 2003; Rashid & Al-Qirim, 2001; Teo & Tan, 2000). In addition studies also identified the characteristics of managers as influencing e-commerce adoption (Rashid & Al-Qirim, 2001; Seyal & Rahman, 2003). And other studies have shown that characteristics of managers do play a significant role in generalized technology adoption decisions by a firm (Cragg & King, 1993; Thong, 1999). Therefore the adoption of each electronic network can be measured according to the contingent criteria (technology, organizational, environmental, and managerial characteristics) as described above. (c.f., Lertwongsatien & Wongpinunwatana (2003); Limthongchai & Speece (2003); Molla & Licker (2005)). Table 1 below displays the four major contexts and the influencing factors associated with each of these contexts as drawn from the relevant literature. The result of this categorization provides a foundation for our proposed extended TOE framework to examine various factors involved in the e-commerce adoption.

Given that the major purpose of this study is to identify factors influencing EC adoption in Vietnamese SMEs, and since it is the first large scale study in Vietnam, we wanted to get a comprehensive, if high-level, view of factors, both internal and external,
that could influence e-commerce adoption for all types of SMEs. The TOE framework provides a place to begin. The TOE is a meta-framework that has been applied in different ways and with varying degrees of specificity in identifying and describing its main constructs. For us the proof of the pudding in the utility of the model is represented by how the high-level constructs are rationalized or described by the variables that researchers have chosen to test. Some implementations of the TOE model are therefore richer than others. But the fact remains that the model is applied differently from study to study. This renders making direct comparisons between studies difficult. But for our purposes the TOE model is not being used to compare between firms or countries but rather to frame the perceptions of managers within a large sample of firms drawn from across the breadth of Vietnam. In our framing, classical TOE studies testing internal and external factors were considered most relevant. Many of these studies employ the TOE framework, developed by Tornatzky and Fleischer (1990) or the diffusion of innovation model (DOI) (Moore & Benbasat, 1996; Rogers, 1983). The later (environmental context) refers to the firm’s industry and deals with business partners, competitors and government (Tornatzky & Fleischer, 1990). Thus, TOE recognizes that the decision to adopt a technological innovation is based on factors in the organizational and external environment, as well as characteristics of the technology itself (Kuan & Chau, 2001; Li et al., 2010).

Table 1: Summary of the factors for e-commerce in light of the Technology, Organization, and Environment (TOE) framework

<table>
<thead>
<tr>
<th>E-Commerce Adoption Context</th>
<th>Influencing Factors identified</th>
<th>Relevant literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology (Innovation) related</td>
<td>Information system, attitude toward e-commerce, attitude toward innovation</td>
<td>Karahanna et al 1999; Lefebvre &amp; Lefebvre, 1996; Premkumar &amp; Roberts, 1999; Thong, 1999.</td>
</tr>
<tr>
<td>Environment related</td>
<td>Governmental policies, cultural factors, economy, infrastructure, self-efficacy</td>
<td>Cui et al. 2008; Teo &amp; Tan 2000.</td>
</tr>
<tr>
<td>Manager related (internal)</td>
<td>Risk-taking attitude, enthusiasm, support, cultural profile</td>
<td>Cragg &amp; King 1993; Thong, 1999; Chen &amp; McQueen 2008; Rashid &amp; Al-Qirim, 2001; Seyal &amp; Rahman, 2003.</td>
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</table>
Some of the prior research on IT in SMEs in the literature extends and refines this framework. For instance, Iacovou, Benbasat and Dexter’s (1995) study of small firm Electronic Data Interchange (EDI) adoption found many of the factors previously demonstrated to be significant predictors of Internet adoption in profit-based SMEs. Their model further identified three factors affecting EDI adoption by SMEs: perceived benefits, organizational readiness, and external pressure. Mehrtens, Cragg and Mills (2001) developed a model of Internet adoption by SMEs that was similar in form to the previous EDI adoption model. They further refined definitions of the institutional and environmental contexts. They defined: 1) perceived benefits in terms of efficiency benefits, effective information gathering, and a business tool to build the firm’s image, 2) organizational readiness in terms of the level of IT knowledge among non-IT professionals, and 3) external pressure as arising from customers, suppliers, and potential employees for the firm to be an Internet user, and to communicate electronically. In the next section, we describe the development of research hypotheses from the extended TOE framework.

3. RESEARCH MODEL AND HYPOTHESES

Based on previous studies in the adoption of information technologies and e-commerce, the following relevant factors have been identified and grouped into the four categories of the extended TOE meta-model as described above. Figure 1 presents the research model used in this study.

Figure 1. The proposed extended TOE Framework for understanding the adoption of e-commerce by SMEs in Vietnam

3.1 Adopters vs. Non-adopters in the model

The adoption, or the planned adoption, of e-commerce by SMEs can be measured according to the four characteristics as shown in Figure 2. An enterprise can be using e-commerce currently, or planning to use it in the future (Teo & Tan 1998; Thong, 1999). In
this study, we analyze the impact of various internal and external factors on the extent of adoption of e-commerce on ‘adopter’ and ‘not-adopter’ Vietnamese firms. Based on the actual use and the intention to use e-commerce, we classify SMEs in our samples into two binary categories:

**Adopters:** i.e., those firms currently using a form of e-commerce technology.

**Non-adopters:** This category is further broken down as
1. Firms planning to engage in e-commerce within one year,
2. Firms planning to engage in e-commerce in more than one year, or
3. Firms that do not plan to use it at all.

In this study, our classification thus considers as equivalent the notions of “adoption” and “use”. Therefore these notions may be used alternatively throughout this paper.

### 3.2 Research Hypotheses

The research model as shown in Figure 2 provides the conceptual framework guiding this study. To reiterate, the purpose of this study main focus is to examine the determinant factors for the adoption of e-commerce by SMEs in Vietnam so we may understand a) what make an SME to adopt or not adopt e-commerce and b) the unique aspects of SMEs e-commerce in a transition economy. This section describes the research hypotheses that are proposed to accomplish these research goals.

#### 3.2.1 Organizational characteristics & hypotheses 1 to 5

Among organizational characteristics the issue is to determine the influence of factors such as employee’s knowledge, resources, strategic orientation, size, and global orientation on the adoption of e-commerce by SMEs in Vietnam.

The employee’s knowledge is crucial for a firm’s ability to adopt and make use of technology. Adapting to new technologies may require changes in the working attitudes of the employees, as well as their qualifications, their level of performance and the extent of their knowledge of e-commerce technology. Teo and Tan (1998) have stated that one of the main reasons for not adopting the Internet is lack of internal expertise. Many organizations have attempted to delay the adoption of an innovation or new technology until they had acquired sufficient internal expertise (Thong, 1999). As long as the employees already have some knowledge of e-commerce, then the organization may be more disposed to adopt e-commerce (Huy & Filiatrault, 2006; Looi, 2005; Molla & Licker, 2005). In the context of Vietnam, SMEs there face a tremendous challenge in recruiting qualified employees because of the steep competition. In early 2010, many enterprises reported that they do not have enough qualified workers to begin their new year’s plans. (Vietnam Financial Review, 2010). Based on the relationship between employee’s knowledge and a firm’s adoption of new technology, we proposed the first hypothesis as:

**H1:** The firm employee’s e-commerce knowledge is positively correlated with a firm’s e-commerce adoption.

In an enterprise, the financial, human and technology resources (computers, telephone lines, cable, etc.) play a very important role in the adoption of new technologies
Empirical study of determinants e-commerce adoption in Vietnam

(Rashid & Al-Qirim, 2001; Thong, 1999; Thong & Yap, 1995b). In the case of SMEs in particular, even if the managers perceive the adoption of new technologies and e-commerce to be important, the enterprises often do not have sufficient resources to adopt them. For SMEs in Vietnam, the scarcity of needed resources is a major challenge. Because of the recent worldwide recession and the lack of available capital resource, many SMEs turned to shaky bank loans for needed fund to boost production or expand their capability. (Vietnam Economic Portal, 2008) Since the human, technological, cultural, and structural readiness is crucial to both facilitating or impeding initial adoption and subsequent institutionalization of e-commerce (Grandon & Pearson, 2004; Zhu & Kraemer, 2004), the scarcity of resources might make it difficult for a firm to adopt any new technology. Based on this tenet, we proposed our second hypothesis as:

\[ H2: \text{Organizational readiness is positively correlated with e-commerce adoption.} \]

The strategic orientation of the enterprise has been found by Auger, Barnir and Gallaugher (2003), Huy (2008), Hong and Zhu (2006) and Lefebvre and Lefebvre (1996) to be an organizational factor that influences the adoption of e-commerce. Those strategic orientation variables retained by these authors are whether firms engage in strategy analysis and planning. For these authors, a strategic orientation assesses the risk of the strategy and helps speed up the adoption process (Vilaseca – Requena et al., 2007; Zhu & Kreamer, 2005). Consequently, it is suggested that when a firm decides to adopt IT, it might act so with a strategic intention. Culturally Vietnamese managers may have been well adapted to live and cope with risk because of various constraints in legal and administrative framework. Based on the how risky managers perceive the strategic orientation to be our third hypothesis is:

\[ H3: \text{A firm’s strategic orientation positively impacts e-commerce adoption.} \]

With most SMEs in Vietnam operating on a small scale, the size of the enterprise becomes a very relevant variable in the adoption decision. The studies of Ling (2001) and Teo and Tan (1998) have stated that small size is one of the main factors hindering adoption of the Internet technology by enterprises. Large enterprises have the resources and the infrastructure necessary to facilitate the adoption of innovations. Small enterprises, by contrast, are less apt to adopt e-commerce because they often lack resources, a situation brought about by such factors as operating in a strongly competitive environment, major financial constraints, lack of professional expertise and greater sensitivity to external forces (Thong, 1999; Thong & Yap, 1995a). Li et al. (2010) treat firm size as a control variable noting that: “…in the innovation literature firm size is often treated as a surrogate for total resources, slack resources and organization structure.” (p. 47). Based on the role of a firm’s size, we hypothesized that:

\[ H4: \text{Firm size is positively correlated with e-commerce adoption.} \]

Since 1986, with the implementation of do i moi policy, opportunities for SMEs and their international counterparts began to emerge. In an annual survey on Asia’s business situation conducted by Asia Business Monitor (ABM), 58 percent of Vietnamese SMEs declared that international business has positive impacts and opens up new opportunities for their operation. Thus, in Vietnam, a firm’s globalization orientation helps speed up the adoption process in the enterprise (Huy, 2008). The global reach of the Internet enables
cost-efficient means of reaching out to new markets, attracting new customers, and delivering products and services, as well as improving coordination with suppliers and business partners (Zhu & Kraemer 2002). Based on the above we hypothesized:

\[ H5: \text{A firm’s globalization orientation positively impacts e-commerce adoption.} \]

### 3.2.2 Characteristics of managers & hypotheses 6 and 7

Among characteristics of managers we investigate specifically two factors: (1) the effects of managers’ attitude toward innovation and (2) the knowledge of managers on the adoption of e-commerce by SMEs in Vietnam.

The literature suggests that there is a clear link between a CEO’s attitude towards IT and the successful IT adoption (Chieochan et al. (2000), Mehrten et al. (2001), Rashid & Al-Qirim (2001), Seyal & Rahman (2003)). Moreover the CEO’s patterns of computer use and user characteristics are measures in terms of the CEO’s attitude toward IT adoption (Kuan and Chau, 2001). A number of authors have posited that a positive attitude towards general IT adoptions also positively correlates with the spread of Internet use and of e-commerce development (Lertwongsatien & Wongpinunwatana, 2003; Poon & Swatman, 1999, Seyal et al., 2006; Thong, 1999, Thong & Yap, 1995a).

The knowledge of the information technologies possessed by managers has an effect on the adoption of e-commerce (Thong & Yap, 1995b), and their knowledge of the new technologies and of e-commerce also has a positive influence on the degree of use of e-commerce (Chieochan et al., 2000; Joen et al., 2006; Rashid & Al-Qirim, 2001).

In the context of Vietnam, a survey conducted in 2007 by the Ministry of Planning and Investment on 63,000 SMEs nationwide revealed that 43 percent of SME owners do not have a college degree. This is a potential barrier to access, adopt, and use technology in SMEs’ businesses. (Vietnam Economic Portal, 2008)

These previous studies suggest the potential relationships existed between the two factors: (1) managerial attitude towards innovation and (2) managers’ knowledge of IT and the IT adoption decision. As a result, we proposed the following two hypotheses for the context of e-commerce adoption:

\[ H6: \text{Positive managerial attitudes towards innovation positively impact e-commerce adoption.} \]

\[ H7: \text{A manager’s relative IT knowledge positively impacts e-commerce adoption.} \]

### 3.2.3 Environmental factors & hypotheses 8 to 12

Among environmental characteristics we assess specifically the impacts of five factors on the adoption of e-commerce by SMEs in Vietnam: (1) intensity of competition, (2) support from industry associations, (3) governmental support, (4) national IT infrastructure, and (5) the behavior of suppliers and buyers. To improve their chances of survival, there are incentives to innovate and to utilize advanced technology. However, the current literature shows conflicting results on the effect of competition upon e-commerce implementation. Premkumar and Roberts (1999) found pressure of competition to be a factor that influences adoption. This study measured the intensity of competition by the number of competitors and the policies of adoption of e-commerce in these enterprises. Similarly Gibbs and
Kraemer (2004), Lertwongsatien and Wongpinunwatana (2003), Zhu and Kraemer (2005) have found a positive relationship between the intensity of competition in an industry and the degree of adoption of e-commerce. However in contrast Thong (1999) found that competition exerts little influence on the adoption of new technologies or of e-commerce in small enterprises. To test the role of competitive pressure we hypothesize:

\[ H8: \text{The perception of competitive pressure positively impacts e-commerce adoption.} \]

The adoption of new technology is not a purely individual process but is nurtured by the policy of industry associations and professional communities who collectively decide to promote certain standards. In the context of international business activities, industry support could be a new factor in the model of adoption of e-commerce. Through their participation in professional communities large enterprises can help SMEs adopt new technologies and e-commerce (Mollar & Licker, 2005). However, Vietnamese SMEs seems to be able to manage and survive without much support (Vietnam’s SMEs, 2010). To test whether that Vietnamese SMEs lack of awareness and support from industry associations has any effect on their e-commerce adoption, we hypothesize:

\[ H9: \text{The perception of professional industry associations’ support positively influences e-commerce adoption.} \]

In a fashion similar to the influence of professional industry associations, the impact of governmental policies and initiatives has been shown to have direct and indirect stimulation effects on technology and e-commerce adoption. Governments may fund infrastructure development (Kettinger & Lee, 1994). In developing countries, government’s research and development (R&D) policies and incentives, research agencies policies, investment tax credits and R&D tax credits or direct access to government funded research all encourage technology adoption (Pick & Aziri, 2011). In a transition economy such as Vietnam’s, the role of government is crucial in supporting the growth and development of SMEs as is shown by the improvements brought by the Government’s doi moi policy implemented since 1986. To test the effect of government’s support we hypothesize:

\[ H10: \text{The perception of strong governmental policy positively impacts e-commerce adoption.} \]

In Vietnam, the importance of infrastructural capacities is reflected in the growth of Information & Communication Technology (ICT) sector. E-commerce requires robust national technical and social infrastructures. Those include common ICT infrastructure, standards and applications at the technology and standards level and legal norms and support at the societal level (Applegate et al, 1996; Kalakota & Robinson, 1999). If e-commerce is to be taken up by enterprises in developing countries continued infrastructure development is critical. In some instances individual enterprises and the market can supply some of these infrastructural capacities. In many instances, however, intervention by government at a national level is required.

As reported in previous studies, the infrastructure of a country positively influences the adoption of new technologies (Chieochan et al., 2000; Ling, 2001). In countries with good technological support and a sound infrastructure, adoption is even more prevalent (Tan & Teo, 2000). To test the impact of infrastructure we hypothesize:.
H11: The perception of a robust national technology infrastructure positively correlates with e-commerce adoption.

The power of suppliers and buyers is among the forces in Porter’s model for competitive analysis. Ling (2001), Mehrten et al. (2001), Rashid and Al-Qirim (2001) have addressed how the pressure of suppliers and that of buyers impacts an enterprise’s adoption of e-commerce. This influence depends on the characteristics of the suppliers and buyers, such as geographical distance, habits, tradition and purchase behavior. Another common form of external pressure to adopt e-commerce is that coming from customer demands, such as branded firms requiring their suppliers to adopt e-commerce. For example, multinational corporations create coercive pressures on their subsidiaries and suppliers by requiring them to use e-commerce technologies to link to global production networks (Gibbs et al. 2003). Several empirical studies have found such coercive or normative pressure from trading partners, customers or parent corporations to be a strong determinant of EDI adoption (Chwelos et al. 2001; Iacovou et al. 1995; Teo & Pian, 2004). Li et al. (2010) treat this when they measure this as the extent to which technology is used industry wide.

In Vietnam, two indicators on the power of e-commerce buyers and suppliers are: (1) the number of internet users and (2) the availability of online payment. With regard to the number of internet users, according to a survey by Royal Pingdom (2010), Vietnam has been listed among the top 20 countries in the world with the highest numbers of Internet users. With respect to the payment system, according to Nielsen market researchers there are 600,000 credit cards in Vietnam, or two per cent of its 86 million population. With more people having access to the internet and credit or debit card, there would be pressure for SMEs to offer more transactions from the web. Based on such a relationship, we hypothesize that:

H12: Perceived pressure to conduct e-transaction from buyers and suppliers positively correlates with e-commerce adoption.

3.2.4 Characteristics of innovation & hypotheses 13 to 16

Consistent with Roger’s diffusion of innovation framework we examine four factors: (1) perceived advantages of innovation, (2) compatibility of innovation, (3) complexity of innovation, (4) perceived risks of innovation and their relationship to the adoption of e-commerce by SMEs in Vietnam.

Perceived relative advantages are related to the degree to which potential adopters perceive the innovation to be preferable to existing conditions. Relative advantages are addressed by Kendall et al. (2001), Limthongchai and Speece (2003), Seyal and Rahman (2003) and Li et al (2010). The positive perception of the advantages of e-commerce provides an incentive to adopt e-commerce. The degree of relative advantage is often expressed in terms of profitability, cost reduction or transaction acceleration. Generally, a positive relationship exists between advantages and the relative adoption behaviors. The advantages generally gained from the use of e-commerce in enterprises include the creation of a worldwide client database, rapid access to information, worldwide distribution of information, reduced costs, extension of the market worldwide, and improvement of customer service and of service to new hires (Poon & Swatman, 1999). Unfortunately in
Vietnam, with limited capital resources, it is difficult for SMEs to embrace innovation. A recent survey revealed that more than 90 percent of SMEs are using medium or lower technologies (Quynh, 2010). To test the perception of the advantages of e-commerce we hypothesize:

\[ H13: \text{The perception that an innovation will be better than the present condition positively correlates with e-commerce adoption.} \]

Compatibility is the degree to which an innovation is perceived to be in keeping with previous experience and existing values, and with the needs of possible adopters (Grover, 1993; Teo & Tan, 1998). Enterprises choose forms of e-commerce conforming to certain internal values and experience and which enable them to reduce the perceived risks while making minimal adjustments and changes. Making these choices in turn leads to lower resistance to adoption. Conversely, we find that the incompatibility of a new e-commerce system with existing work procedures, value systems and infrastructure negatively affects the attitudes of users and increases their resistance to change, in turn hindering the adoption of e-commerce (Grover, 1993; Teo & Tan, 1998).

Complexity on the other hand refers to the degree to which an innovation is perceived as being difficult to use. The technical know-how required for e-commerce can prevent its adoption. One would expect that a high degree of perceived complexity of e-commerce would negatively influence the decision to adopt it (Seyal & Rahman, 2003; Grover, 1993).

With its young population, increasing wealth, and high economic growth, Vietnamese consumers also tend to be eager to embrace new technology and apply them quickly in their life and work. To evaluate the effects SME manager’s perceptions of both compatibility and complexity, we hypothesize:

\[ H14: \text{The perception of the compatibility of innovation with existing systems positively impacts e-commerce adoption.} \]
\[ H15: \text{The perceived complexity of technical innovation is negatively correlated to e-commerce adoption.} \]

In the realm of business decisions trust in one’s business partners coupled with the reputational strength of the e-commerce environment as a place one may safely conduct business impacts a manager ‘s risk propensity towards e-commerce. People with a higher level of perceived site quality seem to have a higher level of perceived market orientation and trustworthiness towards e-commerce. Furthermore, people with a higher level of trust in e-commerce are more likely to participate in e-commerce. Brian, Theerasak and Han (2003) suggest that people are more likely to purchase from the web if they perceive a higher degree of trust in e-commerce and have more experience in using the web. At the time of the survey in 2007, most of the websites in Vietnam were designed for promotion purpose. Given their geographic proximity, most consumers would go online, view the products/services; then they would go to the actual store to make the purchase. However, as the quality of products and services is improved, trust could be built between vendors and consumers. As vendors become more established, perhaps the consumers’ perception of risks might be lower. Similarly, from the SME manager or owner’s perspective, they want to ensure proper payment upon delivery of their products/services. If they have more confidence in their consumers, they would be more willing to go with e-commerce. To test the effect of manager’s risk perception, we hypothesize:
H16: A manager’s perception of risk with respect to e-commerce is negatively correlated with e-commerce adoption.

3. RESEARCH METHODOLOGY

3.1 Measurement instruments

The data were collected through a questionnaire whose questions were derived from the four groups of internal and external factors described above. A pretest of the instrument was administered in 10 Vietnamese SMEs, prior to data collection, and modifications were made to the questionnaire following the pre-test. The parts of the questionnaire that were used for this study are presented in the appendix, along with each varimax rotation that was done for each group of variables.

3.2 Size of the sample and data collection

The survey was sent in 2007 to a random sample of 1200 SMEs drawn from three geographic regions in Vietnam; 400 SMEs from the South, 400 SMEs in Central, and 400 SMEs in North Vietnam. The sample was drawn from the three regions because important as geographically and culturally differences exist between the different Regions. The names of the enterprises were drawn from a list of SMEs compiled by the Young Businesspeople Association of Vietnam. Because the national statistical system in Vietnam is still in development we do not have a precise count of SMEs nor their distribution. However, we know that qualitatively firm characteristics differ by region in Vietnam, hence the need to stratify our sample.

Data collection was performed in two stages. In stage 1 a proposal letter and the questionnaire were sent out by the Young Businesspeople Association of Vietnam itself effectively introducing and endorsing the research program and, specifying an appointment (date and time) for interview two weeks later. In stage 2 professional students of Danang University (residing in each of the three regions) visited each enterprise and administered the questionnaire in person. This method of data collection, explains the high response rate of 926 completed questionnaires, or a 77.2% response. Face to face data collection also provided secondary benefits because 1) interviewers could respond to an interviewee’s questions, and; 2) by contributing to a consistent understanding of the questions and answers, reduced the possibility of miscoding responses. Thus data collection approach assured higher both quality data and a higher survey completion rate.

3.3 Analysis of validity and reliability

Once the data collection had been completed, we verified the validity and reliability as follows. First, principal components factorial analyses, with a varimax rotation, were performed for all the respondents in order to analyze the quality of the measurements from a number of angles. According to Nunnally (1978), in order to respect the validity of the variables, the values of the dimensions must be above or equal to 0.50. As a result of this process, the items “be compatible with customers’ behavior” (variable compatibility of the innovation) and “consume a lot of financial resources of enterprise” (variable perceived risk) were eliminated (value <0.50). Second, we examined reliability of the constructs by
calculating Cronbach’s alpha coefficient for multi-item scales. According to Hair et al. (1998), values above 0.7 are acceptable. This analysis suggests a good reliability of the chosen measures. All of the alpha values are higher than the value of 0.7 (table 2).

*Table 2. Analysis of validity and reliability*

<table>
<thead>
<tr>
<th>Variables</th>
<th>Cronbach Alpha</th>
<th>Eigenvalue</th>
<th>Cumulative (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employees’ knowledge of e-commerce</td>
<td>0.809</td>
<td>6.50</td>
<td>12.49</td>
</tr>
<tr>
<td>Resources of the enterprise</td>
<td>0.845</td>
<td>4.38</td>
<td>20.91</td>
</tr>
<tr>
<td>Strategic orientation of the enterprise</td>
<td>0.703</td>
<td>3.92</td>
<td>28.46</td>
</tr>
<tr>
<td>Firm’s globalization orientation</td>
<td>0.722</td>
<td>3.16</td>
<td>34.54</td>
</tr>
<tr>
<td>Attitudes of managers towards innovation</td>
<td>0.709</td>
<td>2.81</td>
<td>39.94</td>
</tr>
<tr>
<td>Knowledge of the new IT and of e-commerce</td>
<td>0.791</td>
<td>2.60</td>
<td>44.95</td>
</tr>
<tr>
<td>Intensity of competition</td>
<td>0.981</td>
<td>2.31</td>
<td>49.38</td>
</tr>
<tr>
<td>Support of industries</td>
<td>0.899</td>
<td>2.08</td>
<td>53.38</td>
</tr>
<tr>
<td>Support of government</td>
<td>0.711</td>
<td>1.84</td>
<td>56.92</td>
</tr>
<tr>
<td>National IT infrastructure</td>
<td>0.798</td>
<td>1.72</td>
<td>60.23</td>
</tr>
<tr>
<td>Suppliers and buyers behavior</td>
<td>0.728</td>
<td>1.59</td>
<td>63.3</td>
</tr>
<tr>
<td>Perceived relative advantages</td>
<td>0.934</td>
<td>1.49</td>
<td>66.16</td>
</tr>
<tr>
<td>Compatibility of the innovation</td>
<td>0.765</td>
<td>1.35</td>
<td>68.76</td>
</tr>
<tr>
<td>Complexity of the innovation</td>
<td>0.817</td>
<td>1.26</td>
<td>71.18</td>
</tr>
<tr>
<td>Perceived risk</td>
<td>0.899</td>
<td>1.11</td>
<td>73.33</td>
</tr>
</tbody>
</table>

3.4 Sample Profiles

The random sample enabled us to obtain profiles of the survey respondents, and of the SMEs, categorized according to their adoption type.

3.4.1 Profile of the respondents and firms

Three times as many men responded to the questionnaire as women. This could be an indication that the number of men who are managers of SMEs in Vietnam is higher than that of women. The mean age of respondents is 38.5 years, with a mean length of service of 13.7 years. This finding must be considered in context. In Vietnam, since the implementation of the Reform (“Doi Moi”) in 1986, while there are more and more individuals doing business and becoming enterprise managers the reform process is still relatively new. It is therefore not surprising that the mean length of service is only 13.73 years.

In terms of education (c.f., Table 4) most of the respondents hold a Bachelor’s degree or vocational college diploma (69.2%). Male respondents numbered 761 (82.3%) versus 164 (17.7%) female respondents. We also noted that about 8% of the managers and employees have a Master’s degree. To contextualize this finding we note that in Vietnam individuals with this level of education usually have sound professional knowledge in general and knowledge of the Internet in particular. We infer that they may have been opinion leaders, and as such were likely to be the first to adopt and use e-commerce in their enterprise.
In terms of position in the firm, the respondents generally occupy management positions (55.2%): general managers (180) and department heads (331). A number (133) also have specialties (these are employees who have an administrative function, such as import-export or data processing, for example), they have a sound knowledge of business activities in general and know how to use the new technologies in business communications.

Firm size was measured by the number of employees. A large proportion of the firm surveyed employ between 21 and 300 people (c.f., Table 3). They belong to all industries.

Table 3. Firm Characteristics

<table>
<thead>
<tr>
<th>Categories</th>
<th>Firm size</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6 to 20</td>
<td>21 to 200</td>
</tr>
<tr>
<td>Industry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retail/wholesale</td>
<td>39</td>
<td>258</td>
</tr>
<tr>
<td>Construction</td>
<td>37</td>
<td>125</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>76</td>
<td>170</td>
</tr>
<tr>
<td>Other</td>
<td>71</td>
<td>195</td>
</tr>
<tr>
<td>Total</td>
<td>186</td>
<td>623</td>
</tr>
</tbody>
</table>

3.4.2 Profile of the categories of adopters

We have operationalized e-commerce by measuring whether or not the SMEs had a website “through which you conduct business”. Accordingly the enterprises have been grouped into two main categories: adopters (307 enterprises); non-adopters (619 enterprises) (Lertwongsatien & Wongpinunvatana, 2003). The questionnaire also asked whether or not they planned to use the web to conduct business in the future.

Table 4. Sample description

<table>
<thead>
<tr>
<th>Categories</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMEs in our sample</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Adopters</td>
<td>307</td>
<td>33.2</td>
</tr>
<tr>
<td>b. Non-adopters</td>
<td>619</td>
<td>66.8</td>
</tr>
<tr>
<td>Profile of the respondents</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Doctor</td>
<td>3</td>
<td>0.3</td>
</tr>
<tr>
<td>b. Master</td>
<td>74</td>
<td>8.0</td>
</tr>
<tr>
<td>c. Bachelor</td>
<td>641</td>
<td>69.2</td>
</tr>
<tr>
<td>d. Other</td>
<td>208</td>
<td>22.5</td>
</tr>
<tr>
<td>Industry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Manufacturing</td>
<td>282</td>
<td>30.5</td>
</tr>
<tr>
<td>b. Retail/wholesale</td>
<td>342</td>
<td>36.9</td>
</tr>
<tr>
<td>c. Other</td>
<td>302</td>
<td>32.6</td>
</tr>
</tbody>
</table>

3.4.3 Use of the web indicating early stage adoption

In this study, managers were asked to respond to a 5 point likert scale question to ascertain the purpose of the use of the website. The question “The use of your website” could be answered from (1) totally disagree to (5) totally agree. Results indicate that that their
websites are use principally for information sharing and promotion and to a much extent

<table>
<thead>
<tr>
<th>Purpose of website use by Vietnamese SMEs</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is used to provide general information about enterprise</td>
<td>3.88</td>
<td>.824</td>
</tr>
<tr>
<td>Is used to provide information about products and services</td>
<td>3.80</td>
<td>.846</td>
</tr>
<tr>
<td>Is used to provide information about manufacturing processes</td>
<td>3.93</td>
<td>.845</td>
</tr>
<tr>
<td>Is used to market products and services</td>
<td>3.61</td>
<td>.884</td>
</tr>
<tr>
<td>Is used to receive suggestions from clients</td>
<td>3.62</td>
<td>.848</td>
</tr>
<tr>
<td>Is used to provide services on line</td>
<td>3.23</td>
<td>1.122</td>
</tr>
<tr>
<td>Is used to sell take orders on line</td>
<td>3.23</td>
<td>1.158</td>
</tr>
<tr>
<td>Is used to receive payments on line</td>
<td>3.15</td>
<td>1.206</td>
</tr>
<tr>
<td>Valid N (listwise)</td>
<td>307</td>
<td></td>
</tr>
</tbody>
</table>

for transactional purposes.

*Table 5. Purpose of website use by Vietnamese SMEs*
4. RESULTS

In this study, we attempted to answer to the question: “What are the factors driving the adoption of e-commerce in Vietnam from a managerial perspective”. In order to do so, we have performed a logistic analysis (Table 6) to test the research model and used the significance of the regression coefficients of the independent variables to determine support for the hypotheses. The results of the logistic regression are presented in table 3. A likelihood ratio (=537.665) implies a strong relationship between the dependent variable and the independents variables. The Nagelkerde R square showed that about 69.3% of the variance was explained by the logistic model. The Hosmer and Lemeshow Chi-square (=19.913, p = 0.029) indicates that the logistic regression model is significantly different from a perfect model that correctly classifies all respondents into their respective groups. (c.f. Table 7)

Table 6: Results of the logistic regression

<table>
<thead>
<tr>
<th>Variables</th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employees’ knowledge of e-commerce (H1)</td>
<td>0.711***</td>
<td>0.175</td>
<td>47.779</td>
</tr>
<tr>
<td>Resources of the enterprise (H2)</td>
<td>0.503 **</td>
<td>0.191</td>
<td>6.951</td>
</tr>
<tr>
<td>Strategic orientation of the enterprise (H3)</td>
<td>0.125</td>
<td>0.172</td>
<td>0.529</td>
</tr>
<tr>
<td>Size of the enterprise (H4)</td>
<td>0.004 **</td>
<td>0.002</td>
<td>6.796</td>
</tr>
<tr>
<td>Firm’s globalization orientation (H5)</td>
<td>0.056</td>
<td>0.189</td>
<td>0.088</td>
</tr>
<tr>
<td>Attitudes of managers towards innovation (H6)</td>
<td>0.596***</td>
<td>0.175</td>
<td>32.333</td>
</tr>
<tr>
<td>Knowledge of the new IT and of e-commerce (H7)</td>
<td>0.222</td>
<td>0.161</td>
<td>1.915</td>
</tr>
<tr>
<td>Intensity of competition (H8)</td>
<td>1.228***</td>
<td>0.162</td>
<td>57.192</td>
</tr>
<tr>
<td>Support of industries (H9)</td>
<td>0.448***</td>
<td>0.128</td>
<td>12.274</td>
</tr>
<tr>
<td>Support of government (H10)</td>
<td>0.629***</td>
<td>0.169</td>
<td>61.537</td>
</tr>
<tr>
<td>National IT infrastructure (H11)</td>
<td>0.149</td>
<td>0.249</td>
<td>0.359</td>
</tr>
<tr>
<td>Behavior of suppliers and buyers (H12)</td>
<td>0.738***</td>
<td>0.175</td>
<td>17.822</td>
</tr>
<tr>
<td>Perceived relative advantages (H13)</td>
<td>0.330</td>
<td>0.185</td>
<td>3.181</td>
</tr>
<tr>
<td>Compatibility of the innovation (H14)</td>
<td>0.121***</td>
<td>0.234</td>
<td>22.946</td>
</tr>
<tr>
<td>Complexity of the innovation (H15)</td>
<td>-0.588 *</td>
<td>0.239</td>
<td>6.029</td>
</tr>
<tr>
<td>Perceived risk (H16)</td>
<td>-1.148***</td>
<td>0.172</td>
<td>44.400</td>
</tr>
<tr>
<td>Constant</td>
<td>11.510***</td>
<td>1.676</td>
<td>47.142</td>
</tr>
<tr>
<td>-2 Log Likehood</td>
<td>= 37.665</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cox &amp; Snell R Square</td>
<td>= 0.498</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nagelkerke R Square</td>
<td>= 0.693</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hosmer and Lemeshow</td>
<td>= 19.913 (*)</td>
<td>p &lt; 0.05</td>
<td></td>
</tr>
<tr>
<td>Chi-square Test</td>
<td>= 0.029 (**)</td>
<td>p &lt; 0.01</td>
<td></td>
</tr>
<tr>
<td>Significance</td>
<td>= 0.029 (***</td>
<td>p &lt; 0.001</td>
<td></td>
</tr>
</tbody>
</table>

Tests of hypotheses and of the logistic regression

The regression model supports eleven hypotheses.
**Positively supported measures:** Because the following measures were found to have significantly positive coefficients, this research suggests that the following factors support e-commerce adoption in Vietnamese SMEs.

1. employees’ knowledge of e-commerce,
2. resources of the enterprise,
3. size of the enterprise,
4. attitudes of managers towards innovation,
5. intensity of competition,
6. support of industries,
7. support of government,
8. comportment of suppliers and buyers,
9. compatibility of the innovation

**Negatively supported measures:** as expected two measures were found to have significantly negative coefficients suggesting that these measure inhibit e-commerce adoption in Vietnamese SMEs

10. complexity of the innovation,
11. perceived risk

**Unsupported hypotheses:** The coefficients for five variables were not statistically significant.

12. strategic orientation of the enterprise,
13. firm’s globalization orientation,
14. manager’s knowledge of the new information technologies and of e-commerce,
15. national IT infrastructure,
16. perceived relative advantages

We assessed the overall discriminating power of the observed 619 non – adopter and 307 adopter firms. The adoption classification by purely random choice would be 55.67% ($\frac{307}{926}^2 + \frac{619}{926}^2 = 55.67\%$). But because the logistic regression model yielded 86.8% we conclude that it has a much higher discriminating power than the random choice model (c.f. Table 6). To confirm that each variable discriminates between adopters and non-adopters we used the F-test and found that all variables but the variable “support of Industry” were significantly discriminating at the $p < 0.001$ level.

**Table 7: Classification table- Predicted vs. Observed**

<table>
<thead>
<tr>
<th></th>
<th>Predicted</th>
<th></th>
<th>Percentage Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Observed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-adopters</td>
<td>561</td>
<td>58</td>
<td>90.6</td>
</tr>
<tr>
<td>Adopters</td>
<td>64</td>
<td>243</td>
<td>79.2</td>
</tr>
<tr>
<td>Overall Percentage</td>
<td></td>
<td></td>
<td>86.8</td>
</tr>
</tbody>
</table>

5. **DISCUSSION**
The objective of this study was to identify the major internal and external factors explaining the adoption of e-commerce in SMEs in Vietnam. Few studies have considered the adoption of technology, particularly in e-commerce in Vietnam. In 2006, Huy and Filiatrault (2006) did consider the adoption model of e-commerce, but the study only surveyed 300 SMEs. In the present study, we extended the sample size to 926 observations. Moreover our analysis also identifies a set of variables upon which adopters differed significantly from non-adopters. In addition, the perception and the sensitivity of the impact of these factors on the adoption of e-commerce differ depending on whether it involves users or non-users. Our findings support certain aspects of Huy and Filiatrault’s (2006) study particularly the relative stability of the adopter and non-adopter groups over time. However this research refutes prior studies suggesting that there were no significant differences between adopter and non-adopter firms with regard to the uptake of ERP or of B2C e-commerce (Chau & Tam, 1997; Pan & Jang, 2008; To & Ngai, 2006).

5.1 Factors driving the adoption of e-commerce

Next, we continue our discussion by returning to our four groupings of hypotheses and of factors theorized to impact e-commerce adoption in Vietnam.

**Group 1: Organizational characteristics**

The empirical results supporting organizational characteristics suggest that the determinants of e-commerce adoption are (in order of decreasing importance): 1) the employees’ knowledge of e-commerce (Looi, 2005; Scupola, 2005), 2) the resources available to the enterprise (Al-Qirim, 2006; Hong & Zhu, 2005; Molla & Licker, 2005; To & Ngai, 2006), and, 3) the size of the enterprise (Gibbs & Kraemer, 2004; Hong & Zhu, 2005; Thong, 1999; Zhu & Kraemer, 2005). Our results are dissimilar to findings reported by Jeon et al. (2006) with regard to the employees’ knowledge of e-commerce, and to reported results by Vilaseca-Requena et al. (2007) with respect to the resources of the enterprise. In Vietnam the financial resources, technologies and qualified human resources appear to be the key element for increasing e-commerce adoption by SMEs.

**Group 2: Characteristics of managers**

The role of managers with positive attitudes towards innovation, in adopting and expanding e-commerce cannot be overemphasized. Our findings indicate a positive relation between attitudes of managers towards innovation and adoption (Al-Qirim, 2006; Joen et al., 2005; Seyal & Rahman, 2003). However, regarding knowledge of the new information technologies and of e-commerce, the relationship is not significant. This does not confirm previous research findings (Al-Qirim, 2006; Joen et al., 2005; Thong, 1999). In particular, given the general educational background and the newness of the technologies and of e-commerce in Vietnam one cannot expect managers to have prior knowledge upon which they might draw.

**Group 3: Environmental characteristics**

In this group four factors are positively correlated to the adoption e-commerce by Vietnamese SMEs. They are the manager’s perception of: 1) the intensity of competition, 2) support of industry ‘support’ groups, 3) governmental support, and 4) supplier and buyer behavior. Our findings support the results of prior studies by Al-Qirim (2006), Looi
Empirical study of determinants e-commerce adoption in Vietnam

(2005), Scupola (2003), To and Ngai (2007). However, our results are inconsistent with those of Joen et al. (2006), Premkumar and Roberts (1999) and Vilaseca-Requena et al. (2007). Government incentives and support were found to be significant influencing e-commerce adoption (Joen et al. 2006; Molla & Licker, 2005; Seyal & Rahman, 2003; Seyal et al., 2004).

Our findings also suggest that the greater the government incentives as perceived by an organization, the higher the likelihood of an organization to recruit competent staff and use e-commerce. It is mainly due to governmental policies to develop and promote the e-commerce within SMEs. With the support from government, for training and the development of advanced management skills; in the use of technologies; in disseminating new laws and government policies, and guidance on the implications of regulatory and statutory changes on implementation and management firms seemed more willing to make the transition to e-commerce activities. We predict that with a build out and modernization of the telecommunication and Internet infrastructure providing broadband with concomitant high-speed and high quality, services we will see a uptake of SME e-commerce development and growth. This is consistent with Pick and Azari’s (2011) findings that in developing countries, unlike developed countries, socioeconomic development is not the major driver of IT use. Rather the major driver is organizational readiness and business investment which blossoms with governments support and drives IT use.

**Group 4: Characteristics of innovation**

Perceived relative advantages do not seem to play an important role in adopting e-commerce by SMEs in Vietnam. Our results contradict findings reported by Joen et al. (2006), Looi (2005), To and Ngai (2006, 2007). However in our study, perceived compatibility, complexity and risk of the innovation are found to be an important predictor for e-commerce adoption in SME. The plausible reason for the relevant importance of these factors within the SMEs arises from the adoption of better management structures and policies. The management of these SMEs considered the compatibility of the innovation as an important pre-requisite to technology adoption. Our findings also tell us that if managers perceive the technology as being too complex they might not adopt the technology. Our findings do not agree with those from with Joen et al. (2006), Premkumar and Roberts (1999) on the dimension of perceived compatibility. Our findings also contradict findings by Joen et al. (2006), Lingthongchai and Speece (2003), Seyal et al. (2004) on the dimension of perceived complexity.

5.2 E-commerce in a transition economy

The issue of the adoption of e-commerce in transition economies has rarely been addressed. An Asian country that has also experienced such a transition on an unprecedented scale is, of course, China. A few extant studies report on this transition in China which serve as a starting point for a comparison. There are however significant difference in the scope and context in the two studies that must be identified and acknowledged which render analogies from the Chinese setting inappropriate for the Vietnamese context.
The Li et al. (2010) study of e-business implementation in Beijing area international trade companies is, by virtue of its geography and the desire to better understand factors that drive e-business uptake, an important point of reference for our own study. On the one hand both China and Vietnam are each “developing countries [that] do not have mature institution and infrastructures supporting e-business operations.” And, in each of these studies, embedded organizational knowledge and learning capabilities proved important to e-commerce adoption. On the other hand the study contexts are very different. China has characteristics of a developing nation but paradoxically has a huge influence on the global economy by virtue of its enormous positive trade surpluses and huge stocks of foreign capital. The Li et al. (2010) study differs because it examined firms in only one region – the Beijing area. The study authors note that Beijing is a “political and cultural center and is one of China’s most developed cities and regions.” In another study of more than 1,500 firms in Shanghai, Cui et al. (2008) found firm infrastructure and managerial competence and inquisitiveness along with governmental support to be important to internet and e-commerce adoption. Our own research findings concur. Of course the Cui et al study differs in that it is drawn from 14 industries and firms that were on balance much larger than the firms in our own sample. Moreover, Shanghai is one of China’s most vibrant and well-developed regions in terms of Internet penetration (Pick et al, 2011).

In short, the context of our own study is much different than previous studies of the Chinese firms drawn from some of the most developed regions in China. Vietnam is in geography, population and economic power much smaller. And in key respects, namely infrastructure development Vietnam is truly a developing nation. Our own study, by virtue of a large sample of firms from all three regions of the country is, we believe, more representative of the SME throughout Vietnam. So we claim it gives a more balanced picture of how e-commerce diffusion is fairing in Vietnam as a transitional economy.

Transitional economies are an interesting but understudied phenomenon particularly in the realm of IT adoption and use. Because Vietnam is one of the few transitional economies and since this study sheds light in the growth of SMEs and their adoption of E-commerce in the specific context of Vietnam as a transitional economy, the study addresses a gap in the literature. The study makes seven observations directly related to the uptake of EC in Vietnam’s SMEs.

Table 8: Main characteristics of a transition economy, e-commerce adoption and Vietnam specificities

<table>
<thead>
<tr>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Growth of a market economy</strong></td>
</tr>
<tr>
<td>The Government’s decision to liberalize the formation of private and individual ownership of businesses resulting in an incredible 10-fold increase in the number of SMEs in just one decade (VNEB.org, 2009) 90% of businesses have Internet connections and over all number of internet users in Vietnam now reaches 24.3 million, (Pingdom, 2010) which is an impressive 30% of the population.</td>
</tr>
<tr>
<td><strong>2. Impact of globalization</strong></td>
</tr>
<tr>
<td>Globalization not a major factor in e-commerce adoption. Vietnam became a Member of WTO and other international organizations recently (Thai, 2008).</td>
</tr>
<tr>
<td><strong>3. Skilled Personnel</strong></td>
</tr>
<tr>
<td>It becomes increasingly difficult for SMEs to recruit</td>
</tr>
</tbody>
</table>
shortages and Resources  
scarcity  

qualified staff and retain them. Owners, CEOs, and managers lack of access to advanced IT and do not possess the knowledge of IT. With 43% of SME owners without a college degree, the gap in knowledge is still a major barrier for technology adoption.

4. Formal and informal sector  
The formal sector has the recognition and financial resources, but they have to pay high taxes and are subject to government regulations. The informal sector on the hand does not receive legal recognition, but is able to avoid the high cost of taxes. Furthermore, there is also a problem of rampant corruption due to the transitional legal and administrative framework (Vietnam Business News, 2010a). Finally, as originally a communist country, a significant part of its economy still relies on state-owned enterprises.

5. Communication barriers between SMEs & ‘supporting’ groups  
Industry associations and professional communities are charted to help and promote SMEs. However, many SMEs are not aware of resources. Similarly, in recent years, government provides supports and grants to promote SMEs, yet not many SMEs are able to secure these grants and have access to the supports and funding (Vietnam Financial Review, 2010).

6. Limited options for online payment  
Despite important recent banking automation Vietnam does not have a reliable and secure online payment option. The use of credit card is limited; only 2% of its 86 million population have credit cards (Saigonmoney.com, 2010).

7. Cultural barriers with online buying  
Websites in Vietnam are merely places for promotion; not for purchase. This is attributed to the lack of secure online payment systems but also to cultural influences. Vietnamese consumers are used to the practice of seeing and touching before buying. Consumers tend to look at the products on the webs and then purchase them in person (Vietnam Business & Economy News, 2010).

As described in the above table, there are many challenges for Vietnamese SMEs to adopt and use e-commerce in Vietnam. The challenges involve not only scarcity of financial, technological, and human resources but also intense competition, complex external environment, transitional legal and administrative framework, barriers in communication, and constraints in infrastructure. However, in order to improve their chance to survive and thrive in a global market, these SMEs have to innovate and utilize advanced technology. One of the positive forces is the need for partnership. Firms regardless of size are seeking partnership even among large enterprises. Many partnerships form through trade and industry associations with SMEs emerge as satellite of large enterprises. Furthermore, with its young population, increasing wealth, and high economic growth, SMEs are willing to embrace new technology. With more people have access to the internet, this means more demands for e-commerce. In recent years, government also set policy to promote
and support the adoption of technology. For instance, a recent master plan from the government to promote the use of email, websites, use of credit card help to create catalyst to speed up the technology adoption process in Vietnam (Vietnam Business & Economy News, 2010).

5.2 Implications for e-commerce in transition economies

In the realm of practice, given the findings of statistically significant impacts of the internal and external factors on the adoption of e-commerce found in this study, SME managers and government planners could anticipate effective measures to apply in order to advance and promote the adoption of e-commerce in SMEs in transition economies. One might have expected adopters and non-adopters to react in the same way to the internal and external factors. In reality, however, the logistical regression shows that there are significant statistical differences between the perceptions of user firms and non-user firms with respect to various factors (cf. Table 6). Users are very influenced by certain variables, which means that different measures will be required for adopters and non-adopters in order to promote the activities of e-commerce in each category of enterprise.

Based upon the results of the study, we propose several broad policy implications for planners in Vietnam. Our study suggests ways the government could take a leadership role in helping to create a more enabling environment for the development of e-commerce by making information and communication technology (ICT) adoption among SMEs a national priority. We make these inferences because of the strong indications that SME managers in Vietnam are risk sensitive with respect to doing e-enabled business (c.f., H16) and because government support has been shown to enhance the adoption of e-commerce (c.f., H10).

First, as part of the national ICT strategy and Vietnamese national SME strategy, the government should further provide support for integrating ICT uptake. Second, the government should grant higher priority to consumer protection and the protection of individual rights in order to reduce the perception of risk of engaging in e-enabled business (Huy, 2008). Third, government can help managers develop positive attitudes towards the adoption of e-commerce (H6 & H10). Fourth, free market competition supports e-commerce adoption. Given the continuing liberalization of the economy and therefore of increased competition this will naturally increase the adoption of e-commerce (H8).

Finally since human resource development is a critical factor in the successful development of e-commerce (H1) and that SMEs in Vietnam are responsive to government support we suggest that continued support for university and continuing education training focused on e-commerce be developed.

5.3 Limitations and future research

In spite of the care taken in conducting this research, one limitation of our research concerns the uniqueness of the Vietnamese context. The principle limitation is that this study was conducted in a developing country whose economy is also in transition. This creates difficulties in making comparisons at this historical juncture. This also represents and opportunity to anticipate the trajectory of transitions should other transitional (read former Eastern Bloc countries) begin to experience accelerated development. Because
Vietnam is also part of Southeast Asia we have also borrowed from the experiences of other Asian countries (like Singapore, Thailand, Brunei and to a limited extent China). It is, of course, possible that other variables exist that we did not retain and which might have had an impact on the adoption of e-commerce in SMEs in Vietnam.

A second limitation is that this research has only addressed the adoption of e-commerce in SMEs in Vietnam in general terms but has not focused on B2C, B2B, and C2C practices.

A third limitation arises from the nature of studies using the TOE framework. While studies share the meta-level of Technology, Organization and Environment these large constructs are described with many different and, at times incommensurate measures. This renders direct comparison difficult or impossible. That being said, each study using the TOE framework suggests variation of ways to measure and account for the constructs. As an example while the Li et al. (2010) study included ownership type as part of its organizational context variables we did not test for ownership type.

In terms of future research one could envision carrying out the same type of research for the adoption on other practices like ISO standards or electronic banking services. Another area of study might be the behavior of individuals with respect to the adoption of e-commerce, or to the use of credit cards that is still in its early stages in Vietnam and may constitute a barrier to e-commerce development in Vietnam.

6. CONCLUSION

Two primary conclusions can be drawn from the results obtained in this study. Both have public policy implications for the Vietnamese government in the short-run and in the long run. First, adopter-firms and non-user firms perceive and have differing degrees of sensitivity to factors driving e-commerce adoption. This suggests that the Vietnamese government will have to develop various types of policies designed to promote the process of e-commerce adoption in SMEs.

The second conclusion is that this study captured a picture of early stage adoption when websites were mostly introducing the institutional presence of the form on the Internet and had rarely moved to dynamic e-commerce (c.f., Table 7). Continuing improvements in national ICT infrastructure and in statutory changes regarding e-commerce, it will soon be possible to conduct e-transactions between enterprises. The new law on e-commerce, in 2012 still at the project stage, will allow electronic transactions, and will accept the value of an electronic signature, thus protecting the interests and ensure the security of buyers on the Internet. Just as these changes helped propel the development of e-commerce in the developed nations these changes in the legal infrastructure are very important considerations in promoting the adoption of e-commerce between enterprises in Vietnam (dissertation citation removed for anonymity during review). In parallel and in anticipation of the new legislation, key banks (National Bank, Investment and Development Bank, Asian Bank (ACB), Commercial Bank, etc.) have begun to issue credit cards and allow online payments, which will also contribute to the process of adoption of e-commerce in enterprises.

The adoption and use of e-commerce in Vietnam, as in many developing countries and countries in transition, is only in its very earliest stages. The adoption of e-commerce is strongly linked to the development of competition but, to the difference of developed countries, is not yet linked to globalization.
Acknowledgements: The authors would like to thank the journal editor and three anonymous reviewers for their insightful critique and many suggestions to move this paper forward. We would also like to acknowledge funding from the Université de Nantes and the University of Economics of Danang as well as advice from Professor Lemoine during the dissertation project upon which the study is based.

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Quynh, Chi. “Tough Year for SMEs”, Vietnam Business Forum - The weekly magazine of the Vietnam Chamber of Commerce and Industry, December 31, 2010,


APPENDIX A: QUESTIONNAIRE

Please note: The original instrument was conceived, written and administered in French and later translated into Vietnamese and, then for the purposes of this paper, retranslated into English. Thus the English version may seem a bit awkward to the eye. But we ask the reader to trust that in Vietnamese it was consistent and comprehensible to the respondent.

C.1. Please indicate your opinion on E-commerce adoption related the enterprise where you are working for. When the enterprise where you are working for adopts E-commerce, it needs:
1. ORGA1. employees and staff who are knowledgeable about e-commerce (H1)
2. ORGA2. employees and staff who are competent about new technology (H1)
3. ORGA3. proficiency in computer use of most of the employees (H1)
4. ORGA4. financial resources to invest in E-commerce business plan (H2)
5. ORGA 5. IT resources (computer, telephone line, etc.) (H2)
6. ORGA 6. human resources (staff specialists, experts ...) on E-commerce (H2)
7. ORGA 7. to orient business strategies toward E-commerce (H3)
8. ORGA 8. an ability to coordinate effectively between functional departments of the organization (H3)
9. ORGA 9. good alignment between IT and business strategy (H3)
10. ORGA 10. to be aware of the role of E-commerce in improving competitiveness of global business (H5)
11. ORGA 11. to recognize the role of E-commerce allows to play in the global market (H5)
12. ORGA 12. to recognize the role of E-commerce to improve the strategic orientation towards global competitiveness (H5)
13. MAN1. a positive attitude of the leaders towards innovation (H6)
14. MAN 2. to have receptive leaders towards organizational change (H6)
15. MAN 3. to have leaders capable of accepting and organizational change (H6)
16. MAN 4. to have leaders able to realize the necessity of E-commerce applications (H6)
17. MAN 5. to have leaders able to use computer or business software by management (H7)
18. MAN 6. full awareness of the E-commerce technology by management (H7)
19. MAN 7. rapid adoption of E-commerce business model by management (H7)
20. ENVI 1. to be operating in a sector with great competitiveness (H8)
21. ENVI 2. to be facing competitive pressures to adopt E-commerce (H8)
22. ENVI 3. to have a large number of competitors in the same sector which have adopted E-commerce (H8)
23. ENVI 4. to receive support from the business community to adopt E-commerce (H9)
24. ENVI 5. to receive information about leaders and laggards in E-commerce application adoption (H9)
25. ENVI 6. to receive experience returns or technical information about leaders and laggards (H9)
26. ENVI 7. to receive financial support for e-commerce from the government (H10)
27. ENVI 8. government’s support (orientation, direction, information, etc ) encouraging E-commerce development (H10)
28. ENVI 9. positive policies related to information security or information protection of the enterprise (H10)
29. ENVI 10. to be located in a country where inhabitants are used to credit cards (H11)
30. ENVI 11. to be located in a country with good national IT infrastructure (H11)
31. ENVI 12. to be located in a country with a high speed of development of IT infrastructure (H11)
32. ENVI 13. to be located in a country with E-commerce national IT infrastructure orientation (H11)
33. ENVI 14. to be located in a country with sufficient capability to control networks risks (H11)
34. ENVI 15. to have an adequate perception of customers’ (or suppliers’) role in E-commerce (H12)
35. ENVI 16. to know how its customers (or suppliers) utilize E-commerce (H12)
36. ENVI 17. to know customers (or suppliers) behavior in E-commerce (H12)
37. ENVI 18. to know the habits of online buyers (or sellers) (H12)

C.2. Please indicate your opinion on E-commerce adoption related the enterprise where you are working for. According to you, E-commerce adoption in the company where you are working will:
1. INNO 1. reduce its expenses (H13)
2. INNO 2. improve customer relationship (H13)
3. INNO 3. help provide customer services (H13)
4. INNO 4. broaden market or market share (H13)
5. INNO 5. increase market enterprise revenue (H13)
6. INNO 6. be compatible with customers’ behavior (H14 NOT VALIDATED)
7. INNO 7. be compatible with suppliers’ behavior (H14)
8. INNO 8. be suitable with current values or objectives of enterprise (H14)
9. INNO 9. be compatible with experience of other e-commerce adopting enterprises in the same sector (H14)
10. INNO 10. be more complicated due to lack of needed tools (H15)
11. INNO 11. be more complicated due to lack of experience (H15)
12. INNO 12. be more complicated due to not meeting industry standards (H15)
13. INNO 13. consume a lot of financial resources of enterprise (H16 NOT VALIDATED idem)
14. INNO 14. be at risk of losing important informations (H16)
15. INNO 15. damage the social relationship of enterprise (H16).

APPENDIX B: Varimax Rotations

<table>
<thead>
<tr>
<th>Groupe 1. Organizational characteristics</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ORGA1</td>
<td></td>
<td></td>
<td>0.773</td>
<td></td>
</tr>
<tr>
<td>2. ORGA2</td>
<td></td>
<td></td>
<td>0.802</td>
<td></td>
</tr>
<tr>
<td>3. ORGA3</td>
<td></td>
<td></td>
<td>0.797</td>
<td></td>
</tr>
<tr>
<td>4. ORGA4</td>
<td></td>
<td></td>
<td></td>
<td>0.683</td>
</tr>
</tbody>
</table>
5. ORGA5 0.852
6. ORGA6 0.588
7. ORGA7 0.799
8. ORGA8 0.842
9. ORGA9 0.797
10. ORGA10 0.87
11. ORGA11 0.865
12. ORGA12 0.879

<table>
<thead>
<tr>
<th>Eigenvalues</th>
<th>3.436</th>
<th>2.233</th>
<th>1.923</th>
<th>1.097</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of Variance</td>
<td>28.827</td>
<td>18.733</td>
<td>16.129</td>
<td>9.199</td>
</tr>
<tr>
<td>Cronbach's Alpha</td>
<td>0.809</td>
<td>0.845</td>
<td>0.703</td>
<td>0.722</td>
</tr>
</tbody>
</table>

### Groupe 2. Characteristics of managers

| MAN1 | F1 | 0.705 |
| MAN2 | F2 | 0.719 |
| MAN3 | F3 | 0.716 |
| MAN4 | F4 | 0.734 |
| MAN5 | F5 | 0.873 |
| MAN6 | F6 | 0.804 |
| MAN7 | F7 | 0.669 |

| Eigenvalues | 2.228 | 1.832 |
| % of Variance | 31.826 | 26.172 |
| Cronbach's Alpha | 0.709 | 0.791 |

### Groupe 3. Environmental characteristics

<p>| ENV11 | F1 | 0.830 |
| ENV12 | F2 | 0.817 |
| ENV13 | F3 | 0.595 |
| ENV14 | F4 | 0.807 |
| ENV15 | F5 | 0.722 |
| ENV16 | F6 | 0.85 |
| ENV17 | F7 | 0.767 |
| ENV18 | F8 | 0.878 |
| ENV19 | F9 | 0.716 |
| ENV20 | F10 | 0.863 |
| ENV21 | F11 | 0.891 |
| ENV22 | F12 | 0.885 |
| ENV23 | F13 | 0.652 |</p>
<table>
<thead>
<tr>
<th></th>
<th>ENV114</th>
<th>ENV115</th>
<th>ENV116</th>
<th>ENV117</th>
<th>ENV118</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.</td>
<td>0.879</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td></td>
<td>0.946</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td></td>
<td></td>
<td>0.935</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td></td>
<td></td>
<td></td>
<td>0.944</td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.934</td>
</tr>
</tbody>
</table>

| Eigenvalues | 5.640 | 2.232 | 1.945 | 1.732 | 1.672 |
| % of Variance | 31.33 | 12.39 | 10.8  | 9.62  | 9.29  |
| Cronbach's Alpha | 0.981 | 0.899 | 0.711 | 0.798 | 0.728 |

<table>
<thead>
<tr>
<th>Groupe 4. Characteristics of innovation</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>INNO1</td>
<td>0.808</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>INNO2</td>
<td>0.934</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>INNO3</td>
<td>0.934</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>INNO4</td>
<td>0.758</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>INNO5</td>
<td>0.787</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>INNO7</td>
<td></td>
<td>0.951</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>INNO8</td>
<td></td>
<td>0.946</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>INNO9</td>
<td></td>
<td>0.721</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>INNO10</td>
<td>0.952</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>INNO11</td>
<td>0.887</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>INNO12</td>
<td>0.948</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>INNO14</td>
<td></td>
<td></td>
<td>0.985</td>
</tr>
<tr>
<td>13.</td>
<td>INNO15</td>
<td></td>
<td></td>
<td>0.985</td>
</tr>
</tbody>
</table>

| Eigenvalues | 3.308 | 2.796 | 2.425 | 1.554 |
| % of Variance | 25.444 | 21.506 | 18.652 | 11.951 |
| Cronbach's Alpha | 0.934 | 0.765 | 0.817 | 0.999 |