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# Adoption of e-commerce applications in SMEs

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## Abstract

**Purpose** – The purpose of this paper is to examine the factors within the technology-organization-environment (TOE) framework that affect the decision to adopt electronic commerce (EC) and extent of EC adoption, as well as adoption and non-adoption of different EC applications within small- and medium-sized enterprises (SMEs).

**Design/methodology/approach** – A questionnaire-based survey was conducted to collect data from 235 managers or owners of manufacturing SMEs in Iran. The data were analyzed by employing factorial analysis and relevant hypotheses were derived and tested by multiple and logistic regression analysis.

**Findings** – EC adoption within SMEs is affected by perceived relative advantage, perceived compatibility, CEO's innovativeness, information intensity, buyer/supplier pressure, support from technology vendors, and competition. Similarly, description on determinants of adoption and non-adoption of different EC applications has been provided.

**Research limitations/implications** – Cross-sectional data of this research tend to have certain limitations when it comes to explaining the direction of causality of the relationships among the variables, which will change overtime.

**Practical implications** – The findings offer valuable insights to managers, IS experts, and policy makers responsible for assisting SMEs with entering into the e-marketplace. Vendors should collaborate with SMEs to enhance the compatibility of EC applications with these businesses. To enhance the receptiveness of EC applications, CEOs, innovativeness and perception toward EC advantages should also be aggrandized.

**Originality/value** – This study is perhaps one of the first to use a wide range of variables in the light of TOE framework to comprehensively assess EC adoption behavior, both in terms of initial and post-adoption within SMEs in developing countries, as well adoption and non-adoption of simple and advanced EC applications such as electronic supply chain management systems.

**Keywords** Adoption, Electronic commerce, Iran, Small to medium-sized enterprises

**Paper type** Research paper



## 1. Introduction

In the global business environments, small- and medium-sized enterprises (SMEs) are incrementally using information and communications technologies (ICT)-based electronic commerce (EC) to gain competitive advantages and to have access to global markets (Al-Qirim, 2003). Both buyers and sellers can significantly benefit from implementation and usage of EC (Zhu, 2004), those benefits which can also be materialized for SMEs (Al-Qirim, 2007). EC has been defined in several ways depending on the context and research objective of the author (Grandon and Pearson, 2004). For SMEs, EC is generally defined as the utilization of ICT and applications to support

business activities (Poon and Swatman, 1999). Prior EC literature has shown that only a small number of studies focused on the adoption and use of EC in SMEs (Grandon and Pearson, 2004). Moreover, it has been found that in spite of exponential growth of EC within SMEs, the rate of EC adoption by these businesses has remained relatively low (MacGregor and Vrazalic, 2005) and large organizations have noticeably profited more than SMEs in both their improved sale and costs saving (Riquelme, 2002). In looking for reasons for such differences in EC adoption in SMEs, unique characteristics of these businesses can be highlighted. SMEs generally have limited access to the market information and suffer from globalization constraint (Madrid-Guijarro *et al.*, 2009). Moreover, management techniques such as financial analysis, forecasting, and project management are rarely used by SMEs (Bili and Raymond, 1993). Tendency to employ generalists rather than specialists, reliance on short-term planning, informal and dynamic strategies and decision-making process, and lack of standardization of operating procedures are other distinctive characteristics of SMEs (Dibrell *et al.*, 2008; Thong *et al.*, 1996). However, restricted resources controlled by SMEs, which is commonly referred to as resource poverty (Thong *et al.*, 1997; Welsh and White, 1981), is the major differentiator between SMEs and large organizations. Therefore, and with regard to the weakness of SMEs at different organizational and managerial, technological, individual, and environmental levels, the EC adoption and use in SMEs is in a disadvantage position in this respect (Al-Qirim, 2007; MacGregor and Vrazalic, 2006). Here, we focus our attention on this “under-studied” segment of business organizations where the findings of prior research on large businesses cannot be generalized (Grandon and Pearson, 2004) and there is a significant need to identify the reasons behind such slowness and laggardness in adopting EC. Accordingly, this paper aims to fulfill the following objectives:

- (1) to identify factors influencing innovation adoption and to test their significance on initial and post-EC adoption in SMEs; and
- (2) to differentiate between adopters and non-adopters of different EC applications in SMEs.

## 2. EC adoption in developing countries

There is a belief that EC contributes to the advancement of businesses in developing countries which is driven by the perceived potential of the internet and communication technologies in reducing transaction costs by bypassing some, if not all, of the intermediary and facilitating linkages to the global supply chains (Hempel and Kwong, 2001; Molla and Licker, 2005a). It is believed that EC promises many benefits, ranging from modest advantages such as reduced communication and administration costs, and improved accuracy to transformative advantages including enabling business process reengineering or supporting industry value chain integration initiatives such as just-in-time inventory, continuous replenishment, and quick response retailing (Chwelos *et al.*, 2001). Moreover, prior literature has provided consolidate evidence of significant link between firm’s EC resources and business value/performance gain, in particular in developed countries (Ordanini and Rubera, 2010; Zhu and Kraemer, 2002). The e-business value of ICT-enabled EC was found to lead to improved firm performance in sale, internal processes and customer/supplier relationships through market expansion, improved information sharing efficiency, and improved transactional efficiencies (Melville *et al.*, 2004; Zhu and Kraemer, 2002; Zhu, 2004).

However, businesses, in particular SMEs in developing countries face challenges different from those in developed countries and differs greatly in adopting and benefiting from EC (Tan *et al.*, 2007). EC adoption in these businesses has only recently gained attention in the academic press. Likewise, research related to EC implementation is even scarcer when it applies to SMEs in developing countries. This calls for researches that are robust enough to capture most, if not all, of the idiosyncrasies.

The literature suggests that in most developing countries, EC adoption has been hindered by the quality, availability, and cost of access to necessary infrastructure while developed countries have employed a relatively well-developed, accessible and affordable infrastructure for EC. Likewise, the readiness of businesses to govern and regulate EC is an essential element, which lacks in developing countries, due to the trust necessary to conduct e-business (Molla and Licker, 2005b). Since web and communications technologies are complex and offer a variety of functionalities ranging from the static presentation of content to the dynamic capture of transactions with provisions for security and personalization, organizations in developing countries must comprehend these technologies and decide how to draw upon their functionalities for effectively developing EC initiatives (Chatterjee *et al.*, 2002; Sutanonpaiboon and Pearson, 2006). Owing to the contextual differences (both organizational and environmental) between these two socio-economic arenas, it is recently warranted to understand how businesses in developing countries could overcome the environmental and organizational EC readiness impediments and benefit from EC. The EC adoption literature implies that in order to adopt EC appropriately in developing countries, firms need to be internally and externally ready (Tan *et al.*, 2007). This readiness which is termed e-readiness of an SME can be defined as the ability of a company to successfully adopt, use, and benefit from EC (Fathian *et al.*, 2008). Molla and Licker (2005a) demonstrated that in initial adoption of EC in developing countries, internal (organizational) readiness is significantly influential. Internal EC readiness can be defined as availability of financial and technological resources, the top management's enthusiasm to adopt EC, e-commerce technology infrastructure (ECTI), compatibility of the firm's EC, as well as culture and values (Saffu *et al.*, 2008). On the other hand, it is suggested that after the initial EC adoption, external readiness (e.g. whether business partners allow an electronic conduct of business) significantly affect institutionalization of EC in developing countries (Fathian *et al.*, 2008; Molla and Licker, 2005b). These discussions imply the necessity of business maturity (regarding the readiness) prior to EC adoption in developing countries. Therefore, there is a great interest in scrutinizing the relationships between elements of e-readiness and adoptions of different EC applications in developing countries.

### 3. Conceptual model and hypotheses

The review of prior EC literature (Table I) suggests that the technology-organization-environment (TOE) framework may indeed provide an appropriate starting point for studying EC adoption. Hence, a theoretical model of EC adoption and use needs to take into account factors that affect the propensity to adopt and use EC, which is rooted in the particular technological, organizational, and environmental circumstances of an organization (Zhu and Kraemer, 2005). TOE framework is consistent with the Rogers' (1983) diffusion of innovation (DOI) theory as focuses on both internal and external characteristics of the organization, as well as technological characteristics in study of drivers for new technology diffusion. Based on reviews of prior theoretical and empirical

Study	Theory/model	Survey overview	Factors/major findings
Oliveira and Martins (2010)	Conceptual framework developed based on TOE framework and Iacovou <i>et al.</i> 's (1995) EDI adoption model	Telephone interviews ( <i>n</i> = 2,459) European businesses Telco and tourism industries Large, medium-sized, small, and micro enterprises	Dependent variables (DV): e-business adoption (defined as using the internet platform (e.g. TCP/IP, HTTP, XML) to conducting transactions along the value chain) Independent variables (IV): environment and external pressure factors, technology and organization readiness, perceived benefits Perceived benefits and obstacles of e-business, technology readiness, competitive pressure, and trading partner collaboration are the drivers of e-business adoption in Europe There are differences in the relative importance of drivers for e-business adoption for the different industries DV: EC (internet, e-mail, and web site use for business) adoption extent IV: perceived organizational and external readiness Factors inhibiting EC in China are restricted access to computers, lack of internal trust, lack of enterprise-wide information sharing, intolerance towards failure, and incapability of dealing with rapid change DV: internet-based EC adoption (non-adopter, potential-adopter, adopter)/intention to adopt EC IV: technology integration, web functionalities, web spending, and partner usage Firms in the service industry tend to have higher EC migration level as they deal with intangible products DV: EC adoption /non-adoption (regarding number of PCs and presence of internet and web site) IV: organizational readiness, perceived usefulness, compatibility, and external pressure were (as discriminators) EC implementation costs and the availability of the technological infrastructure continue to be an issue in US SMEs DV: EC (e.g. internet, e-mail, and web site) adoption and potential institutionalization (extent of adoption and integration with processes) IV: perceived organizational e-readiness (e.g. commitment and resource availability) and perceived external e-readiness (e.g. supporting industries e-readiness) For initial EC adoption, organizational readiness factors are of prime importance, while as organizations adopt EC practices, environmental readiness factors affect EC institutionalization
Tan <i>et al.</i> (2007)	Perceived eReadiness model Review of EC adoption literature	Electronic survey ( <i>n</i> = 134) Chinese SME's from different industries	
Hong and Zhu (2006)	Conceptual model drawn on technology diffusion theory	Field survey using phone interview ( <i>n</i> = 1,036) US firms from various industries and from all business size	
Pearson and Grandon (2005)	Review of behavioral intention models	Electronic survey ( <i>n</i> = 100) US SMEs	
Molla and Licker (2005a)	Review of innovation adoption perspectives: managerial, organizational, technological, and environmental imperatives and interactionism	Survey ( <i>n</i> = 150) South African firms from various industries and from all business size	

(continued)

Table I.  
Review of prior literature on EC adoption

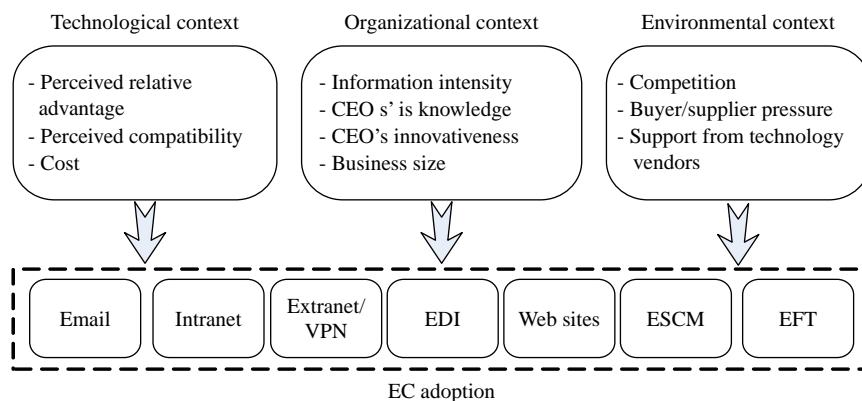
Study	Theory/model	Survey overview	Factors/major findings
Zhu <i>et al.</i> (2003)	TOE framework	Survey ( $n = 3,100$ ) European businesses from different manufacturing and distribution sectors	DV: intent to adopt e-business IV: technology competence, firm scope, size, consumer readiness, partner readiness, and competitive pressure In high e-business-intensity countries, e-business is no longer a phenomenon dominated by large firms Firms are more cautious in adopting e-business in high e-business-intensity countries (more informed firms are less aggressive in adopting e-business) DV: EC adoption and non-adoption
Mirchandani and Motwani (2001)	Review of IS/EC adoption literature	Structured interviews with the top managers (CEOs ( $n = 62$ )) Small businesses	IV: enthusiasm of the top manager/CEO toward EC, compatibility of EC with the work of the company, relative advantage perceived from EC, and knowledge of the company's employees about computers Mentioned DVs were found to discriminate between adopters and non-adopters of EC
Beatty <i>et al.</i> (2001)	Innovation diffusion perspective (IT adoption)	Survey ( $n = 286$ ) Medium-to-large US firms from various industries	Non-adopters of EC were found suffer from difficulty in hiring and retaining skilled IS professionals to implement EC DV: web site adoption – entry timing (pioneer, early adopter, early majority, late majority, laggard) IV: perceived benefits, complexity, technical compatibility, organizational compatibility, top management support Early adopters place more emphasis on perceived benefits and compatibility of the web with existing technology and organizational norms than did later adopters Usefulness (benefits) and compatibility affect both initial EC adoption and subsequent use of a technology
Teo <i>et al.</i> (1998)	Contingency theory, TOE	Survey ( $n = 188$ ) Various industries Singaporean small and large firms	DV: decision to adopt EC-trichotomy (adopters with web site, adopters without web site, non-adopters) IV: technological factors, organizational factors, environmental factors Aggressive technology policies, compatibility of the internet with organization culture and infrastructure, top management support, and potential relative advantage are four contingency factors affecting internet commerce adoption

evidences, it has been revealed that TOE framework has been a popular foundational model in examining issues such as EC adoption, implementation, and usage (Salwani *et al.*, 2009; Zhu *et al.*, 2003; Zhu, 2004). Similarly, TOE framework was found to provide consistent empirical support in a number of IS domains including electronic funds transfer (EFT), electronic data interchange (EDI), open systems, material requirement planning, and enterprise resource planning (Pan and Jang, 2008; Zhu and Kraemer, 2005). One of the issues which might be concerned is the reason why a new theoretical model for EC adoption and use should be developed in this research given that there are already a significant number of EC researches. It should be mentioned that as suggested by Zhu and Kraemer (2005), EC applications can be categorized as three different types in accordance with Swanson (1994). Thus, we need to articulate how the adoption and use of different EC applications (e.g. type II EC innovations such as EFT or type III EC innovations such as EDI) are influenced by technological, organizational, and environmental circumstances. This necessity is more imperative in the context of SMEs owing to their unique characteristics and since majority of prior EC research has focused on large organizations. With regard to the above-mentioned discussion and drawing on the empirical evidences, we believe that the TOE framework is appropriate for studying EC adoption.

### 3.1 EC adoption

The research framework used here is shown in Figure 1. Our research model assumes ten adoption predictors within the three contexts of the TOE framework. Technological context includes perceived relative advantage, compatibility, and cost. Organizational context refers to the information intensity, CEOs' IS knowledge, CEO's innovativeness, and business size. Environmental context includes competition, buyer/supplier pressure, and support from technology vendors.

In this research, the dependent variable is adoption of EC which is defined as utilization of ICT and applications to support business, operations, management, and decision making in the business (Thong, 1999). Because EC adoption can take various forms, two levels of adoption are identified: initial EC adoption and EC adoption extent (or post-EC adoption). The first measure, initial EC adoption, was operationalized as the likelihood of EC adoption (EC adoption decision behavior). This measure is commonly used in innovation diffusion research (Tan *et al.*, 2009; Thong, 1999). The second measure of EC adoption, extent of EC adoption refers to the extent of an

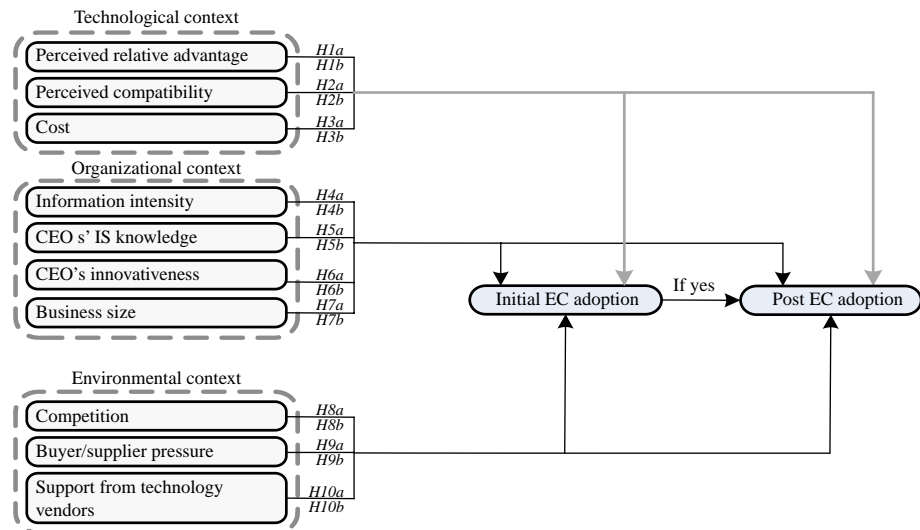


**Figure 1.**  
Research framework  
of EC adoption



organization's utilization of EC (reflecting its level of sophistication in term of number of EC application used), which is commonly used by prior EC research (Grandon and Pearson, 2004; Molla and Licker, 2005b). Figure 2 schematically shows the research model and hypothesized relationships. A brief justification for our selection and subsequent use of these specific variables followed by some research questions, as well as ten research hypotheses are presented in what follows.

Prior IS literature suggests that technological characteristics of EC such as its perceived relative advantage are significant determinants of EC adoption in organizations (Grandon and Pearson, 2004). According to Rogers's (1983) DOI theory, individual beliefs such as perceived relative advantage are the drivers of the decision to adopt new systems. Similarly, Davis's (1989) Technology Acceptance Model (TAM) suggests that perceived usefulness of a system is one of two direct causal antecedents of new technology adoption and usage behavior. In the context of EC, perceived relative advantage can be categorized as usefulness and benefits of EC for customers of a company (Sutanonpaiboon and Pearson, 2006) or benefits of EC for the internal users of EC in a company and for the company itself (Grandon and Pearson, 2004; Pearson and Grandon, 2006). The EC literature provides significant evidence of direct relationship between EC adoption decision and adoption or non-adoption of EC applications within SMEs (Al-Qirim, 2007). In SMEs, if the CEO perceives that the benefits of new systems adoption outweigh the risks, then the business is more likely to adopt them (Thong and Yap, 1995). Likewise, compatibility is another technological characteristics perceived by individual which was suggested by DOI as a driver of the decision to adopt a new system (Rogers, 1983). EC compatibility can be defined as the extent to which EC is consistent with the existing technology infrastructure, culture, values, and preferred work practices of the firm (Beatty *et al.*, 2001). Several prior researches on EC adoption within SMEs found that EC adoption and usage is significantly affected by EC compatibility (Hong and Zhu, 2006; Saffu *et al.*, 2008).



Note: Technological context

Figure 2. Research model of EC adoption

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Similarly, it was found that even within SMEs controlling required financial resources for EC adoption, compatibility is still a significant discriminator between adopters and non-adopters of EC (Sutanonpaiboon and Pearson, 2006).

On the other hand, costs of IS adoption is another important technological factor influencing IS adoption within SMEs (Tan *et al.*, 2009). According to the Welsh and White's (1981) framework of resource constraints in small businesses, these businesses are operating under severe resource constraints, in particular financial constraints. Limited financial resources compel SMEs to be cautious about their investment and capital spending, thus, only SMEs having adequate financial resources would regard adoption of IS as a feasible project to undertake (Thong and Yap, 1995). IS adoption is also affected by the indirect costs of IS adoption such as the costs of human factors (e.g. training) and early cost of temporary loss in firm's productivity (Love and Irani, 2004), which may be more significant than the direct costs (Love *et al.*, 2005). Therefore, total costs of EC deployment can be a significant influential factor of EC adoption. Hence, the following hypotheses are stated:

- H1a.* Perceived relative advantage of EC will be positively related to EC adoption decision behavior.
- H1b.* Perceived relative advantage of EC will be positively related to extent of EC adoption.
- H2a.* Compatibility of EC will be positively related to EC adoption decision behavior.
- H2b.* Compatibility of EC will be positively related to extent of EC adoption.
- H3a.* Cost of EC will be negatively related to EC adoption decision behavior.
- H3b.* Cost of EC will be negatively related to extent of EC adoption.

*Organizational context.* IS literature suggests that another rationale for SMEs to adopt information systems such as EC applications is to deal with the experiencing information intensity (Al-Qirim, 2007). Information intensity can be defined as the extent of presented information to the business regarding their products and services. According to Thong and Yap (1995), since enterprises in differentiated business sectors possess dissimilar information processing requirements, firms that belong to information intensive industries are more pushed to adopt IS. Information processing requirements rise from internal and environmental uncertainty (Anandarajan and Arinze, 1998). These uncertainties are attributable to the production methods, supply chains, industry clock speed or the larger competitive scenery (Melville and Ramirez, 2008; Mendelson and Pillai, 1998), thus, are the function of business type (Thong and Yap, 1995). Moreover, through investing on more advanced IS aimed at increasing information processing capacity and flexibility, businesses can effectively tolerate and managing uncertainties and supporting decision-making process mechanism (Karimi *et al.*, 2004). Therefore, it could be inferred that enterprises with higher information processing requirements, which are active in information intensive environment, are more intended to adopt and use IS innovations (Melville and Ramirez, 2008; Thong and Yap, 1995).



CEO's IS knowledge is another trait affecting IS adoption in SMEs (Fink, 1998). According to idea of "knowledge barriers" defined by Attewell (1992), users' skill and knowledge development can facilitate and speed up the adoption of new technologies such as IS. As SMEs are facing significant risks and problems with their computerization regarding their inadequate knowledge of IS (Caldeira and Ward, 2003; Igbaria *et al.*, 1997), greater knowledge of CEOs will reduce the degree of uncertainty entangled with IS adoption which will result in lower risk of IS adoption. Similarly, it seems that if these CEOs could be educated on the functions and benefits of EC applications for their businesses so they may be more willing to adopt such technologies. Likewise, another determinant of EC applications adoption attributable to the top management characteristics is CEO innovativeness (Lee, 2004). On the subject of CEOs' innovativeness in SME context, it was found that movements toward IS adoption in small enterprises with innovator CEOs are more likely to succeed (Fink, 1998). A recent study by Al-Qirim (2007) found that EC adoption in New Zealand SME segment is positively affected by CEO innovativeness. Innovative CEOs would prefer to apply distinctive and risky solutions such as IS that modify the structure in which the problems are generated. Thus, CEO's desire to be more innovative will expedite the process of IS adoption (Thong and Yap, 1995).

In addition, prior literature on IS adoption within SMEs suggests that business size definable by turnover and/or number of employees is one of the most important determinants of IS adoption (Love *et al.*, 2005; Premkumar and Roberts, 1999). The importance of firm size is significant because of its role as the source of firm's capabilities, as well as since firm's resources including financial and human capital might be an approximation of firm size (Mole *et al.*, 2004). An investigation by Premkumar and Roberts (1999) and Premkumar (2003) found that larger firms in the small business group have a higher inclination to adopt communication technologies than smaller ones. Similarly, larger businesses in SME business group tend to adopt more advanced IS as they have more resources available (Thong, 1999). In the context of EC adoption, it has also been suggested that business size is a significant determinant of adoption or non-adoption of EC applications, in particular EDI (Al-Qirim, 2003, 2007). These facts lead us to state the following hypotheses:

- H4a.* Information intensity of environment will be positively related to EC adoption decision behavior.
- H4b.* Information intensity of environment will be positively related to extent of EC adoption.
- H5a.* CEOs' IS knowledge and experience will be positively related to EC adoption decision behavior.
- H5b.* CEOs' IS knowledge and experience will be positively related to extent of EC adoption.
- H6a.* CEOs' innovativeness will be positively related to EC adoption decision behavior.
- H6b.* CEOs' innovativeness will be positively related to extent of EC adoption.
- H7a.* Business size will be positively related to EC adoption decision behavior.
- H7b.* Business size will be positively related to extent of EC adoption.

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*Environmental context.* Some researchers argue that movement toward IS could be a response or reaction to an event or this change has its origin in the pressure from customers and an emphasis on improving efficiency, as well as pressure from the internal and external environment (Pavlou and El Sawy, 2006). The two main sources of environmental pressure to adopt IS are competitive pressure, and more importantly pressure by trading partners, customers, and government (Iacovou *et al.*, 1995).

One reason for SMEs to adopt and use EC is the firms' desire and need to stay competitive and innovative as a necessity for their survival (MacKay *et al.*, 2004; Pearson and Grandon, 2006). It seems rational to believe that the competitive pressure impacts the adoption of EC applications when SMEs perceive that these technologies may strengthen their competitive position and assist them to achieve superior firm performance (Grandon and Pearson, 2004; Premkumar and Ramamurthy, 1995). It has been suggested that by using IS, SMEs may indeed be able to change the rules of competition, alter the industry structure, and leverage new strategies to stand ahead of their competitors, altering the competitive landscape consequently (Oliveira and Martins, 2010; Wu *et al.*, 2006). Lin (2006) suggests that competitive pressure (i.e. the pressure resulting from a threat of losing competitive advantage) is a determinant of IS strategies in organizations. IS adoption and use could bring about more effective SMEs both internally and externally, so SMEs consider IS applications as an essential tools with the purpose of compete for the organizational adaptation as well as environmental changes. Furthermore, these technologies heighten SMEs survival rate where they are functioning in a competitive environment with higher rate of failure risk (Levy *et al.*, 2001). As such, SMEs active in industries having high rate of innovation and intense competitive challenge are probable to perceive EC tools as a stronger driver for strategic change than those in other types of industries (Al-Qirim, 2007; Premkumar and Roberts, 1999).

From the other perspective, the pressure from customers and suppliers for electronic business was found to be another determinant of EC adoption and use within businesses (Barua *et al.*, 2004; Oliveira and Martins, 2010), so that pressure exerted by trading partners was revealed to be the main determinant of EDI adoption within SMEs. In these businesses, it has been largely demonstrated that satisfying suppliers' and customers' expectation by delivering higher level of electronic services and better communication with them are some of the major drivers of adoption of IS such as internet-based commerce (Caldeira and Ward, 2003; Mehrtens *et al.*, 2001; Riemenschneider *et al.*, 2003). One point to mention here is that this perspective is corresponding with the concept of trading partners' e-business readiness, suggesting that businesses which have adopted EC applications such as EDI and E-procurement systems would attempt to influence and encourage their trading partners to adopt these applications as well to increase their own benefits of EC adoption (Chwelos *et al.*, 2001; Teo *et al.*, 2009).

Moreover, prior literature has shown that EC adoption is also affected by support from technology vendors (Al-Qirim, 2007). According to the IS literature, SMEs are suffering from lack of internal IS experts and difficulty in hiring external consultants (Gable, 1991; Morgan *et al.*, 2006). Cragg and Zinatelli (1995) pointed out that lack of internal expertise has seriously hindered IS sophistication within small firms, therefore, they must overcome this problem through either seeking help from external sources or developing their own internal end-users' computing skills (DeLone, 1981). Owing to the general financial constraint in SMEs, these businesses usually cannot

afford costs of hiring external IS expertise to provide training for employees, as well as to help them with IS adoption (Thong and Yap, 1995; Thong, 2001). Therefore, technology vendors can be considered as the main source of external IS expertise and a significant determinant of IS adoption within SMEs (Thong *et al.*, 1997). Accordingly, it can be assumed that if CEOs of SMEs perceive that required supports for EC adoption are provided by vendors of EC applications, they would be more willing to adopt and intensely use these technologies. Hence, the following hypotheses are stated:

- H8a.* Competitiveness of environment will be positively related to EC adoption decision behavior.
- H8b.* Competitiveness of environment will be positively related to extent of EC adoption.
- H9a.* Buyer/supplier pressure will be positively related to EC adoption decision behavior.
- H9b.* Buyer/supplier pressure will be positively related to extent of EC adoption.
- H10a.* Support from technology vendors will be positively related to EC adoption decision behavior.
- H10b.* Support from technology vendors will be positively related to extent of EC adoption.

## 4. Methodology

### 4.1 Instrument development

Table AI presents the operationalization of the constructs of EC adoption model, which have been developed on the foundation of validated items from prior researches. The first measure of dependent variable, termed initial EC adoption is defined in accordance with Rogers' (1983) DOI theory as adoption or rejection. Accordingly, adoption is considered as a decision by the SMEs to use EC in support of business, and rejection is seen as the decision not to adopt EC in the business operations of the Iranian SMEs. The statistics (report from ministry of communications and information technology) suggest that in the 2009-2010 period, Iran has experienced 35 percent growth in satellite data transmission stations, 41 percent growth in high-speed internet ports, and almost 1,394 percent growth in use of Worldwide Interoperability for Microwave Access services. Moreover, the widespread of more than 155,000 km optical fiber cable (mostly aimed at government departments, businesses and non-profit organizations rather individual users) has provided relatively appropriate infrastructure of B2B EC in Iran[1]. In this regard, initial EC adoption is assessed through a single question measuring how SMEs are decided to adopt seven different EC applications. This question employs five-point Likert scale, which ranges from 1 – more than four years; 2 – next three-four years; 3 – next two-three years; 4 – within one year; to 5 – current user. The second measure of EC adoption, extent of EC adoption (or post-EC adoption) is assessed through the number of EC application used by Iranian SMEs. This measure indicates the degree to which EC has been adopted.

### 4.2 Sampling and data collection

The sampling frame of this study consists of all manufacturing SMEs located in central industrial part of Iran. Only CEOs of SMEs are targeted as respondents of this

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study because in these businesses IS implementation process is directly affected by top management where in most cases, owner, chief information officer and chief executive officer (CEO) are one and the same person. Hence, CEOs (owners or executives) of the manufacturing SMEs were targeted as the key respondents of this research as they own or oversee the entire operations of their business and are responsible and decision maker for all stages of IS implementation. The data collection was conducted by means of an electronic survey administered during mid-March to early-September 2010. In order for testing and assuring face validity of the questionnaire before final data collection, we piloted the questionnaire on 20 CEOs of the SMEs in both provinces (ten CEOs in each province) and within different industries (food, construction, oil products, etc.). These interviews assisted us to ensure the clarity and the understanding of items. Based on the feedback from the pilot study, some questions were rephrased to improve their clarity. As a result, some minor revisions were applied to the questionnaire before final data collection. The revised questionnaire consisted of short questions and simple words that avoided ambiguous formulations.

From 1,237 qualified manufacturing SMEs invited to participate in this research, 235 valid questionnaires were received for a response rate of 18.99 percent. Table II lists the demographics of the study. The valid questionnaires obtained came from firms in 18 different manufacturing sectors. A total of 36 firms (15.31 percent of surveyed SMEs) operated in automotive industry, 31 firms (13.2 percent) in food, drink, and beverage, 23 (9.8 percent) in electrical equipments, 18 (7.7 percent) in chemistry, 18 (7.7 percent) in wood, tissue, and paper products, 15 in textile (6.4 percent), 12 in (5.1 percent) in optical and medical instruments, and the rest (82 firms, 34.9 percent) in other manufacturing sectors. Using relatively large sample size and covering vast majority of the manufacturing sectors from the Iranian industrialized regions can help with the generalizability and external validity of the study.

## 5. Hypotheses testing

Consistent with the objectives of this study, our proposed framework of EC adoption aims to investigate which factors and how they affect the initial and post-EC adoption, as well as adoption and non-adoption of different EC applications. Regarding internal consistency reliability as the most prevalently employed psychometric measure evaluating survey instruments and scales (Tan *et al.*, 2009), high internal consistency reliability in the measurement of constructs used in proposed framework of EC adoption has been provided since all the variables possess Cronbach  $\alpha$  values of more than 0.70 (Table III), which exceeds the minimum standard recommended by prior literature (Benitez-Amado *et al.*, 2010a, b). Moreover, and to ensure proper construct validity, factor analysis was performed on the questions using principal axis factoring method. As a result of performing this analysis (using Varimax rotation method with Kaiser normalization), nine factor influencing EC adoption, including three technological, three organizational, and three environmental factors with eigenvalues of 1.00 or higher were extracted (Table AIII). Kaiser's overall measure of sampling adequacy 0.725 indicates that these data were appropriate for factor analysis (Benitez-Amado *et al.*, 2010a). Moreover, the results explain 55.867 percent of the all independent variables, showing an acceptable and satisfactory level of construct validity.

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	Frequency	Percent	Cumulative (%)
Gender			
Male	188	80.00	80.00
Female	47	20.00	100.00
CEO age			
Below 30	14	5.96	5.96
30-40	67	28.51	34.47
40-50	71	30.21	64.68
50-60	53	22.55	87.23
Above 60	30	12.77	100.00
CEO education level			
Senior high school (or below)	28	11.92	11.92
Undergraduate	108	45.96	57.88
Postgraduate (or above)	99	42.12	100.00
Number on employees			
Less than 50	124	52.76	52.76
50-100	43	18.30	71.06
100-150	25	10.63	81.69
150-200	29	12.34	94.03
200-250	14	5.97	100.00
Annual sale (million USD)			
Below 10	61	25.96	25.96
10-30	52	22.13	48.09
30-50	50	21.27	69.36
50-70	35	14.89	84.25
Above 70	37	15.75	100.00
EC applications usage frequency (%)			
E-mail			74.89
Intranet			45.96
Extranet/VPN			37.45
Web sites			59.15
EDI			32.34
ESCM			20.42
EFT			22.55

**Table II.**  
Demographic attributes  
of the respondents

Item	Variable	No. of items	Mean	SD	Cronbach's $\alpha$
1	Perceived relative advantage	11	3.3779	0.88374	0.912
2	Perceived compatibility	7	2.2243	0.75313	0.842
3	Cost	3	3.2823	0.85526	0.769
4	Information intensity	3	3.4511	0.93209	0.813
5	CEOs' IS knowledge	3	3.2468	0.87263	0.763
6	CEO's innovativeness	4	3.6326	0.94621	0.774
7	Competition	3	3.4426	0.84781	0.715
8	Buyer/supplier pressure	4	3.3163	0.91349	0.783
9	Support from technology vendors	3	3.0926	0.83186	0.785

**Table III.**  
Coefficient  $\alpha$  values of all  
the variables

**Source:** Own processing

To test the relationship between influencing factors, and initial EC adoption and extent of EC adoption multiple regressions analyses have been used. For initial EC adoption, the coefficient of determination ( $R^2$ ) value shows that 37.9 percent of the variance associated with initial EC adoption is explained from the independent variables included in our research. For post-EC adoption however  $R^2$  value shows that 29 percent of the variance associated with extent of EC adoption is explained from the independent variables. Result of the variance inflation factor (VIF) analysis (Table IV) demonstrates that the VIF values for all the variables do not exceed the threshold generally accepted in the literature with values of 3.3 (Petter *et al.*, 2007), indicating that no multicollinearity problems exist with the variables. Likewise, Durbin-Watson value of 1.960 for determinants of initial EC adoption (Table IV), and 1.837 for determinants of post-EC adoption (Table V) which is between 1.5 and 2.5, demonstrates that there are no auto correlation problems in the data used in this study (Hair *et al.*, 2006). According to Table IV, buyer/supplier pressure appears to be the most important variable that positively affects EC adoption in Iranian SMEs. Support from technology vendors,

Variable	B	SE	Standardized coefficients				Tolerance	VIF
			$\beta$	<i>t</i> -value	Sig.			
Business size (annual sales)	0.263	0.129	0.107	2.044	0.042	0.977	1.023	
Perceived relative advantage	0.501	0.184	0.144	2.723	0.007	0.962	1.040	
Perceived compatibility	1.241	0.217	0.303	5.710	0.000	0.957	1.044	
Cost	-0.054	0.199	-0.015	-0.273	0.785	0.880	1.137	
Information intensity	0.337	0.174	0.102	1.930	0.055	0.963	1.038	
Buyer/supplier pressure	1.385	0.200	0.374	6.922	0.000	0.915	1.093	
Support from technology vendors	1.205	0.179	0.357	6.747	0.000	0.965	1.036	
Competition	0.413	0.193	0.114	2.138	0.034	0.949	1.054	
CEO's innovativeness	0.637	0.174	0.196	3.666	0.000	0.932	1.072	
CEO's IS knowledge	0.204	0.188	0.058	1.082	0.281	0.942	1.062	

Notes:  $F = 15.277$ ; sig.  $F$  change = 0.000;  $R^2 = 0.379$ ; Durbin-Watson = 1.960

**Table IV.**  
Results of multiple regression between influencing factors and initial EC adoption

Variable	B	SE	Standardized coefficients				Tolerance	VIF
			$\beta$	<i>t</i> -value	Sig.			
Business size	0.144	0.051	0.159	2.848	0.005	0.977	1.023	
Perceived relative advantage	0.165	0.073	0.127	2.267	0.024	0.962	1.040	
Perceived compatibility	0.257	0.086	0.168	2.992	0.003	0.957	1.044	
Cost	0.099	0.079	0.074	1.261	0.209	0.880	1.137	
Information intensity	0.197	0.069	0.160	2.856	0.005	0.963	1.038	
Buyer/supplier pressure	0.448	0.079	0.325	5.637	0.000	0.915	1.093	
Support from technology vendors	0.322	0.070	0.256	4.570	0.000	0.965	1.036	
Competition	0.255	0.077	0.189	3.335	0.001	0.949	1.054	
CEO's innovativeness	0.108	0.069	0.089	1.558	0.121	0.932	1.072	
CEO's IS knowledge	0.104	0.075	0.079	1.392	0.165	0.942	1.062	

Notes:  $F = 10.559$ ; sig.  $F$  change = 0.000;  $R^2 = 0.290$ ; Durbin-Watson = 1.837

**Table V.**  
Results of multiple regression between influencing factors and post-EC adoption



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perceived compatibility, CEO's innovativeness, perceived relative advantage, competition, information intensity, and business size are, respectively, other important variables that positively affect EC adoption. Moreover, Table V suggests that for extent of EC adoption, buyer/supplier pressure is the dominant determinant, followed by support from technology vendors, competition, information intensity, perceived compatibility, business size, and perceived relative advantage.

Further, and to test the effects of identified factors on adoption and non-adoption of different EC applications studied in this research, logistic regression (LR) has been used. Table VI summarizes the output from the different LR runs across the sample which only highlights significant factors. In the case of e-mail adoption, perceived relative advantage, information intensity, and buyer/supplier pressure were found to be the significant discriminating factors. Table VI also suggests that support from technology vendors, CEO's involvement, CEO's innovativeness, and business size (in term of annual sale) are only factors determining the adoption of intranet. However, result of LR runs emphasizes on significance of business size (in term of number of employees), perceived relative advantage, and CEO's innovativeness over extranet/virtual private network (VPN) adoption within Iranian SMEs. In the context of EDI adoption, Table VI shows that perceived compatibility, buyer/supplier pressure, support from technology vendors, and business size (in term of annual sale) are factors in favors of adaptors of EDI. For web site adoption, result of linear regression (LR) in Table VI provides support for perceived compatibility, information intensity, competition, CEO's innovativeness, and business size (in term of annual sale) as five determinants of adoption of this EC application. Moreover, and for electronic supply chain management (ESCM), perceived relative advantage information intensity, and business size (in term of annual sale) are reasons for adoption, and cost is the only reason for non-adoption. Finally, and in the case of EFT adoption, business size (in term of number of employees) and buyer/supplier pressure were found to be the significant discriminating factors.

## 6. Discussion

The results of this study on the subject of the level of EC adoption in SMEs are in accordance with prior IS literature. Consistent with *H1a* and *H1b*, EC adoption within Iranian SMEs were found to be positively affected by perceived relative advantage which provides support for Rogers' (1983) DOI model and Davis' (1989) TAM. The result of LR statistic also shows that the introduction of three EC applications termed e-mail, extranet/VPN, and ESCM depended on the perceived relative advantage of these applications. This means that CEOs of SMEs perceiving EC applications more useful for their businesses are more probable to adopt EC. Similarly and consistent with *H2a* and *H2b*, compatibility is another determinant of EC adoption within Iranian SMEs. Moreover, CEOs of SMEs those whom are adopters of EDI and web technologies were found to perceive these applications compatible with their businesses which corroborate the DOI model in the sense that compatibility turned out to be one the most influential factors of EC adoption as perceived by top managers of SMEs. The results of our study suggesting perceived relative advantage and compatibility of EC as significant factors affecting initial and post-EC adoption also confirm the researches by Igarria *et al.* (1997) regarding the factors that influence personal computer adoption, Riemenschneider *et al.* (2003) concerning the factors that affect web site adoption, and Grandon and Pearson (2004), concerning the determinants

Variable	B	SE	Wald	df	Sig.	Exp(B)	95 percent CI for EXP(B)		Cox and Snell R <sup>2</sup>	Nagelkerke R <sup>2</sup>	χ <sup>2</sup>	Sig.
							Lower	Upper				
<i>E-mail</i>												
1. PRA	0.523	0.217	5.822	1	0.016	1.688	1.103	2.582	0.0102	0.169	25.266	0.008
2. Int	0.549	0.219	6.276	1	0.012	1.732	1.127	2.662				
3. Prs	0.584	0.242	5.830	1	0.016	1.793	1.116	2.880				
<i>Intranet</i>												
1. Sup	0.327	0.168	4.060	1	0.042	1.443	1.038	2.006				
2. Cinn	0.467	0.179	6.817	1	0.009	1.595	1.123	2.264				
3. Cis	0.496	0.185	7.186	1	0.007	1.642	1.143	2.360				
4. Size (AS)	0.804	0.115	15.612	1	0.000	0.635	0.507	0.795				
<i>Extranet/VPN</i>												
1. Size (NE)	1.047	0.441	5.636	1	0.018	2.850	1.200	6.764				
2. PRA	0.444	0.179	6.151	1	0.013	1.559	1.098	2.215				
3. Cinn	0.379	0.174	4.749	1	0.029	1.461	1.039	2.056				
<i>EDI</i>												
1. Cbt	0.572	0.224	6.540	1	0.011	1.772	1.143	2.746				
2. Prs	0.851	0.196	18.873	1	0.000	2.343	1.596	3.440				
3. Sup	0.416	0.176	5.598	1	0.018	1.516	1.074	2.141				
4. Size (AS)	0.236	0.114	4.291	1	0.038	0.790	0.632	0.987				
<i>Web sites</i>												
1. Cbt	0.526	0.185	8.077	1	0.004	1.692	1.177	2.432				
2. Int	0.427	0.182	5.519	1	0.019	1.532	1.073	2.187				
3. Cmp	0.778	0.206	14.189	1	0.000	2.176	1.452	3.261				
4. Cinn	0.350	0.174	4.039	1	0.044	1.420	1.009	1.998				
5. Size (AS)	0.223	0.109	4.164	1	0.041	1.249	1.009	1.547				
<i>ESCM</i>												
1. PRA	0.442	0.192	5.296	1	0.021	1.556	1.068	2.267				
2. Cost	-0.760	0.207	13.509	1	0.000	0.468	0.312	0.701				
3. Int	0.419	0.190	4.894	1	0.027	1.521	1.049	2.205				
4. Size (AS)	0.325	0.112	8.453	1	0.004	0.722	0.580	0.899				
<i>EFT</i>												
1. Size (NE)	1.129	0.536	4.444	1	0.035	3.094	1.083	8.843				
2. Prs	0.895	0.239	14.023	1	0.000	2.448	1.532	3.911				

Note: AS – annual sale, NE – number of employees

Table VI. Predictors of EC technologies adoption in Iranian SMEs

of EC adoption, all within SMEs. On the other hand, although cost negatively influences the adoption of ESCM whining SMEs, inconsistent with *H3a* and *H3b*, cost was not found to be significant influential factor of decision to adopt EC, as well as extent of EC adoption. This means that ESCM is the only EC application which is perceived to be costly and thus risky by CEOs of SMEs comparing to other applications. These results are in accordance with Al-Qirim's (2007) study finding that the financial cost of implementing and operating the EC applications has not influenced EC adoption by SMEs in New Zealand.

Furthermore, the factors in the organizational context were also found to be significant. The result provides support for *H4a* and *H4b* showing that initial and post-EC adoption is affected by information intensity. This means that Iranian SMEs having greater information requirements have adopted EC to improve their information processing competence, which provides support for information processing view (Karimi *et al.*, 2004; Melville and Ramirez, 2008) and prior literature showing what these businesses active in information intensive environment adopt EC to satisfy their information needs (Al-Qirim, 2007; Thong and Yap, 1995). Accordingly, our results also revealed that e-mail, web site, and ESCM systems are EC applications particularly used to satisfy the information need of SMEs.

Although the result of LR suggests that CEOs of SMEs, which are adopters of intranet, have been more knowledgeable and experienced regarding IS, CEOs' IS knowledge and experience was not found to affect EC adoption. This finding is inconsistent with *H5a* and *H5b*, as well as with some prior researchers such as Fink (1998) and Thong and Yap (1995). However, the result suggests that initial EC adoption within Iranian SMEs is significantly affected by CEO's innovativeness, thus, provides support for *H6a* which means that Iranian SMEs with more innovative CEOs have been more intended to adopt EC. This finding supports prior literature on IS adoption suggesting CEO's innovativeness as a significant determinant of EC adoption (Al-Qirim, 2007). Similarly, it was found that SMEs with CEOs who are more innovative are more likely to adopt web technologies, extranet/VPN, and intranet which provide support for prior literature (Agarwal and Prasad, 1998; Thong and Yap, 1995). Owing to the specific characteristics of SMEs and their organizational structure, CEO has a supreme role in all functions of SMEs and all decision and activities, both in current and in future (Bruque and Moyano, 2007). Regarding this significant role of CEOs in determining the innovative attitude of these businesses, SMEs with innovative and risk-averse CEOs would be more intended to adopt risky EC applications which may necessitate significant changes in organizations.

On the subject of relationship between organizational characteristics and EC adoption, the results suggest that although SMEs adopting extranet/VPN and EFT are significantly larger in size regarding the number of employees, SMEs adopting intranet, EDI, web sites, ESCM are significantly larger in size regarding the annual sale. We first assessed the effect of business size defined as number of employees on initial and post-EC adoption in the regression analyses and did not find any significant relationship between business size and EC adoption. This finding can be of concern as it is inconsistent with the majority of prior IS research in this context. We believe this inconsistency is attributed to the definition of business size, as well as the nature of Iranian manufacturing SMEs. We therefore tested the effect of business size defined

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as annual sale and found significant relationship between SMEs' annual sale and initial and post-adoption which is consistent with *H7a* and *H7b*.

The results of this study also shows that in the context of Iranian SMEs, competitiveness of environment, which is also interpreted as competitive pressure (Elbertsen and Van Reekum, 2008), significantly and positively affects the adoption of EC. In the other word, Iranian SMEs which activate in more competitive environments are more intended to adopt and use EC. As a result, *H8a* and *H8b* are accepted. Likewise, it was found that competitiveness of environment discriminate between adapters and non-adapters of web sites within Iranian SMEs. This finding is consistent with and supports previous researches discussing that EC adoption in SMEs is significantly and positively affected by competitiveness of environment (Lin, 2006; Oliveira and Martins, 2010; Premkumar and Ramamurthy, 1995). Since EC applications has become technologically feasible and socially acceptable due to contemporary digital revolution, employing these technologies by firms has become strategically necessary (Premkumar and Ramamurthy, 1995), so that SMEs active in industries having high rate of innovation and intense competitive challenge are probable to perceive EC applications as a stronger driver for strategic change and business outperformance than those in other types of industries (Saffu *et al.*, 2008). Moreover, the results of this research suggest that EC is significantly and positively affected by level of external pressure on firms for having EC, which provide support for *H9a* and *H9b*. Similarly, Iranian SMEs which are adopters of e-mail, EDI, and EFT were found to be pressured to adopt these EC applications. These results provide support for prior researches emphasizing on external pressure as an influential factor of EC adoption within SMEs (De Burca *et al.*, 2005; Sutanonpaiboon and Pearson, 2006). This external pressure could be imposed by government, customers, suppliers, and larger counterparts (Caldeira and Ward, 2003; Iacovou *et al.*, 1995). For instance, Teo *et al.* (2009) found that businesses ready for doing business electronically have recommended and requested their partners to adopt and e-procurement. As an example of these pressures in Iran, EDI can be analyzed. Iranian SMEs which are suppliers of Iran's automotive industries are required to adopt EDI since according to certain standards necessitated by automotive industries, their suppliers in the supply networks are obliged to communicate and interchange electronic documents or business data in a standard electronic format.

On the other hand and consistent with *H10a* and *H10b*, EC adoption within Iranian SMEs were found to be positively affected by support from technology vendors which provide supports for prior EC researches (Al-Qirim, 2007; Mirchandani and Motwani, 2001). For SMEs generally experiencing lack of resources such as financial, skills, and professionals (Welsh and White, 1981), lack of internal IS experts and difficulty in recruiting and retaining IS professionals, as well as affording costs of providing IS training for employees can impose major problem is adoption of IS (Premkumar and Roberts, 1999; Thong *et al.*, 1997). In such circumstances, the professional abilities of external experts (i.e. IS vendors) can significantly make up for lack of IS skills and experience in SMEs (Thong, 2001). Similarly, if CEOs of SMEs perceive that their need of EC applications are being offered by vendors and there are enough technical supports and training campaigns provided by vendors that fit their needs, they would be more intended to adopt EC. For Iranian SMEs, it was found that businesses receiving higher support from technology vendors have adopted intranet and EDI more intensely.

6.1 International comparison

The obvious differences between developing and developed countries have made it difficult to develop a unifying, one-size-fits-all theory of EC adoption. Table VII shows the ICT Development Index (benchmarking tools to monitor information society developments worldwide) of countries that has hosted the prior literature on EC (International Telecommunication Union, ITU, 2010). These statistics may signify that businesses in developed and developing countries differ in respect to information technology and EC context. Therefore, the international comparison of prior research on EC adoption in developing and developed countries, in both initial (early) adoption and post-adoption can offer new perspectives for understanding the global adoption and assimilation of EC.

For initial EC adoption which refers to an organization’s attaining an interactive EC status (or decision to adopt or reject the interactive EC), Molla and Licker (2005b) found that for South African SMEs, initial EC adoption occurs when organizational resources are positively supported (as requirements for initial motivating and implementing efforts). This means that human, business, and technology resource dimensions of organizational e-readiness, along with EC awareness, all have a major effect on initial EC adoption. Interestingly, Tan *et al.* (2007) found that for Chinese SMEs and in spite of great enthusiasm of central government towards the adoption of EC, internal organizational factors (Molla and Licker (2005b)) are main barrier of early (initial) EC adoption in China. These finding may suggest that in the context of initial EC adoption in developing countries, EC maturity is of the main importance as internal EC adoption factors (internal e-readiness) is the major determinant of initial EC adoption. However, our result revealed that in the context of developing countries, factors affecting initial EC adoption do not limit to organizational factors facilitating EC adoption where factors such as human/financial resources or EC awareness are factors that facilitate initial EC adoption and can be considered as drivers or inhibitors of EC adoption. We found that along with facilitating factors (support from technology vendors, CEO’s innovativeness, and perceived relative advantage in our study), initial EC adoption determinants include factors that pressure and force SMEs to move toward adoption of EC, which are information intensity, buyer/supplier pressure to use EC, and competition experienced by SMEs. In the context of developed countries and for Singaporean SMEs, it was found that relative advantage, compatibility, and reliability are significant determinant of decision to adopt EC (Kendall *et al.*, 2001). Likewise, and in the US SMEs context, perceived benefits, compatibility, enthusiasm of the top

**Table VII.**  
Comparison between ICT development of developed and developing countries

Country	Development	ICT Development Index (IDI), 2008 and 2007				IDI access sub-index, 2008 and 2007			
		IDI 2008	Ranking 2008	IDI 2007	Ranking 2007	Use 2008	Ranking 2008	Use 2007	Ranking 2007
USA	Developed	6.54	19	6.33	17	7.11	28	7.03	21
Singapore	Developed	6.95	14	6.47	15	8.02	10	7.81	10
Canada	Developed	6.49	21	6.30	18	7.51	18	7.33	13
Iran	Developing	3.08	84	2.73	86	3.36	83	3.06	80
South Africa	Developing	2.79	92	2.64	91	3.14	94	2.88	90
China	Developing	3.23	79	3.03	81	3.75	73	3.61	70

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manager/CEO toward EC, and knowledge of the company's employees were found to significant determinant of initial EC adoption (Beatty *et al.*, 2001; Mirchandani and Motwani, 2001). For European businesses (all size) however, technology and customer readiness and competitive pressure determine the decision to implement EC (Zhu *et al.*, 2003). The comparison between developing and developed countries suggests that organizational resources readiness plays more significant role as the facilitator of initial EC adoption. Similarly, it seems that SMEs in developing countries experience more pressure for movement toward initial EC adoption.

On the other hand for extent of an organization's utilization of EC which is termed EC institutionalization, EC post-adoption, EC migration, and EC sophistication by prior literature (Hong and Zhu, 2006; Molla and Licker, 2005a; Tan *et al.*, 2007; Tung and Rieck, 2005), extent of EC usage by business partners/clients and market pressure were signified as the determinants of EC post-adoption in South Africa SME segment (Molla and Licker, 2005b). For Chinese SMEs however, and similar to initial adoption, business and human resources and resources available for employees to pursue innovation are the significant influencing factors of post-adoption (Tan *et al.*, 2007). For Iranian SMEs, we found that the effects of organizational e-readiness factors (CEO innovativeness, CEO IS knowledge and perceived cost as the indicator of available financial resources) are significantly less salient, and EC post-adoption is mainly affected by environmental determinants pressuring SMEs to use more sophisticated EC applications. In the context of developed countries and for US and Canadian firms (including SMEs), the literature suggests that organizational readiness, perceived ease of use, perceived usefulness, external pressure, partner EC usage, and perceived obstacles are influencing factors of EC post-adoption (Grandon and Pearson, 2004; Molla and Licker, 2005b). Prior literature also suggests that perceived benefits and obstacles of e-business, technology readiness, competitive pressure, and trading partner collaboration are factors affecting extent of EC implementation within European (EU27) SMEs (Oliveira and Martins, 2010).

These findings suggest that in both developing and developed countries, post-adoption of EC within SMEs is mostly affected by environmental determinants. As the weaker partners in inter-organizational relationships, SMEs are extremely susceptible to impositions by their larger partners, as well as imposition from customers to receive better services (Caldeira and Ward, 2003; Riemenschneider *et al.*, 2003). Trading partners may pursue three different strategies to induce a SME to adopt EC including recommendation, promises (providing SMEs with specific support and/or reward), and threats (e.g. discontinuance of the partnership), thus, these businesses comply with external demands to enhance their e-business competency to satisfy the expectations of their trading partners and customers (Iacovou *et al.*, 1995). By taking global comparison into consideration, future research can effectively design their research model to be robust enough to capture most of the idiosyncrasies of EC adoption within developing countries.

## 7. Conclusion

### 7.1 Contributions to the research and practice

Our work builds upon prior adoption research but is different in important ways. This study intends to address factors affecting EC adoption, as well as adoption and non-adoption of different EC applications among the SMEs through the use of a wide



range of variables in the light of TOE framework. We believe that the suggested model of EC adoption makes a significant contribution to research and practice since; it provides support for TAM model in the context of EC finding that perceived relative advantage (usefulness) of EC is a significant discriminator between adopters and non-adopters of different EC applications. Embedded within TAM is the idea of focusing on predicting the usage behavior of the user of the technology. However, justifying this model in the contexts of EC adoption is problematic since in most cases, the decision to integrate EC into business operations is determined by the perceived strategic value (e.g. improved service to key customers) that can be achieved through this investment, not on perceptions of the individual user (Zhu, 2004). Nonetheless, we tried to assess the perception of CEOs of Iranian SMEs as the users of EC applications to predict the EC usage behavior within these businesses. Although prior literature (Iacovou *et al.*, 1995; Riemenschneider *et al.*, 2003) corroborate the TAM model in the sense that perceived usefulness is an influential factor of IS (e.g. EDI) adoption, even in internet commerce acceptance in academic environment (McCloskey, 2004), our support provided for TAM in the sense that perceived usefulness influences EC adoption can be significant due to broad and comprehensive definition of EC in this research. Moreover, our findings empirically support DOI theory by suggesting perceived relative advantage of EC and EC compatibility as significant influential factors of EC adoption decision behavior. Our study demonstrated the value of tailoring the TEO framework to understand the adoption of complex innovation. We tried to broaden the concept of EC to be a type III innovation, because it is often embedded in the SMEs' core business processes or is extending basic business products and services, and integrating suppliers and customers in the value chain. Accordingly, and to the best of our knowledge, this is the first study examining the effects of factors found in the TOE framework on adoption decision behavior of advanced EC applications such as EFT and in particular ESCM. Defining ESCM as application packages such as inventory and production planning and control applications integrated throughout supply chain, we found that these technologies which are perceived to be the only costly type of EC applications are adopted by information intensive SMEs with CEOs who were aware of potential advantages of EC.

The findings of this research have several implications for governmental agencies, IS/EC consultants, and EC applications vendors responsible for entering SMEs to the e-business environment. To enhance the widespread adoption of EC applications, EC vendors are advised to target their products and services at SMEs with innovative CEOs having positive attitude toward advantages of EC adoption, as well as to cooperate with SMEs to jointly improve the compatibility of EC applications with specific characteristics of SMEs active in different industries. Furthermore, assuming adopting EC and entering to global e-business environment as a necessity for survival of SMEs, and concerning CEOs with less innovativeness and positive attitude towards EC adoption benefits, it is suggested that governmental agencies and EC consultants need to promote the attitude and innovativeness of CEOs through improving their awareness toward EC adoption (e.g. by providing training). In SMEs, as the innovativeness and attitude of CEOs toward EC adoption become more positive, their receptiveness of EC applications will be improved. In such circumstances, governmental agencies can play a significant role in promoting EC in this business type through providing gratis training programs and workshops particularly designed

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for and targeted at employees and CEOs of SMEs. In the context of Iranian SMEs, it means that relative public organizations such as the ministry of communications and information technology and the ministry of industries and mines need to address discussed issue through commencing some campaigns aimed at enhancement of CEOs' awareness regarding the advantages of EC on their businesses. On the other hand, and although prior research suggests that cost of EC adoption is still considered as a barrier within SMEs (e.g. in the USA and The Netherlands), EC adoption cost is not perceived to be a major barrier by Iranian SMEs. This finding can be rationalized as; pirated softwares are widely available and are believed to be used by the enterprises in Iran. However, we believe that it is mostly because of supports and financial incentives and grants provided by the government for EC institutionalization within Iranian SMEs (as the result of supportive plan termed "TAKFA" prioritizing ICT operational planning launched by the government since 2002). It has been revealed that as a result of this supportive plan, e-readiness of Iranian SMEs has been significantly improved (Fathian *et al.*, 2008). Our finding is very much in line with prior study by Tan *et al.* (2009) showing that due to the supportive incentives by Malaysian Government, SMEs in this country are not concerned with ICT adoption costs. Accordingly, this finding signifies that policy maker plays an important role in disseminating EC effectively across SMEs in developing countries. Therefore, EC-friendly policy ought to be developed to compensate for the inherent lack of necessary financial, legal, and physical infrastructures for the development of EC within SMEs in developing countries compared to their counterparts in developed countries.

### *7.2 Limitations and future research directions*

Our results must be interpreted in the light of the study's limitations. First, cross-sectional data of this research tend to have certain limitations when it comes to explaining the direction of causality of the relationships among the variables. We were not able to measure the perception of surveyed CEOs at the time of EC adoption. Although we tried to address this issue through requesting CEOs to ascertain their perceptions before EC adoption, we still cannot be quite sure that the respondents were able to backtrack their mind uninfluenced by the experience of EC adoption to what the state was before adoption of EC applications. Thus, it is suggested that a longitudinal study be undertaken to understand the adoption of EC and strengthen the direction of causality proposed by the model. Second, the study focuses only on the manufacturing SMEs in the central region of Iran; therefore, the generalizability of the study to other countries and business contexts becomes problematic. Finally, the research uses data provided by only one key informant per firm which were CEOs of surveyed SMEs. While we did not assess the opinions of employees which are also users of EC applications, it would have also been preferable to use two informants per firm to collect their opinions, as well as to incorporate employees' related factors in relationship with EC adoption within Iranian SMEs.

The findings of this study can serve as a benchmark measure of factors affecting EC adoption for future researchers in which, the same population of SMEs, or others, at different industry section, country, and times in the future can be examined. In addition, the presented research model of EC adoption in this research can be the foundation of hypotheses formulation for relative EC widespread researches in future. This study can be extended in several directions. As our study has only examined a subset

of the technological, organizational, and environmental characteristics, future studies can investigate whether other characteristics of these contexts, in particular characteristics of both internal users (employees) and external users (e.g. customers) are the potential determinants of EC adoption by SMEs. Moreover, it was found that cost of EC is not a significant determinant of EC adoption while SMEs are generally restricted regarding financial resources. With regard to the fact that in SMEs, IS adoption costs are usually underestimated and indirect adoption costs are mostly disregarded (Love *et al.*, 2005), in addition, as since imprecise IS adoption decision may imperil the survival of these businesses, future studies need to assess both perceived direct and indirect cost of EC adoption to test whether adoption cost is still not a significant determinant.

#### Note

1. According to the latest ITU report in 2010 (ITU, 2010) on ICT Development Index, Iran is considered as the 84th country regarding ICT development in 2008, which shows relative improvements in this ranking comparing 2007 (86th in 2007). This may suggest that Iran does not have appropriate infrastructure for effective e-business. However, this low ranking is mostly because of vastness and high geographical spread of Iran. For the same reason, the USA is 19th, China is 79th and India is 117th in this ranking. Moreover, it should be mentioned that Iran has experienced radical and revolutionary improvement in ICT infrastructure in 2009-2010 year.

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(The Appendix follows overleaf.)

**Table AI.**  
Operationalization of the  
constructs of EC adoption  
model

Label	Item	Source	
<i>Perceived relative advantage (1-5 scale)</i>			
PRA1	EC provides new opportunities	Al-Qirim (2007) and Grandon and Pearson (2004)	
PRA2	EC allows us to accomplish specific tasks more quickly		
PRA3	EC allows us to enhance our productivity		
PRA4	EC allows us to save time in searching for resources		
PRA5	EC allows us to improve our job performance		
PRA6	EC allows us to purchase products and services for the business		
PRA7	EC allows us to learn more about our competitors		
PRA8	EC allows for better advertising and marketing		
PRA9	EC provides timely information for decision making purposes		
PRA10	EC enhances the company's image		
PRA11	EC increases our profitability		
<i>Compatibility (1-5 scale)</i>			
Cbt1	EC is compatible with our culture and values	Al-Qirim (2007), Pearson and Grandon (2006) and Premikumar (2003)	
Cbt2	EC is compatible with our preferred work practices		
Cbt3	EC-created changes are compatible with our business		
Cbt4	EC security is compatible with us		
Cbt5	EC legal issues are compatible with us		
Cbt6	EC is compatible with our customers		
Cbt7	EC is compatible with our existing ECTI		
<i>Cost (1-5 scale)</i>			
Cst1	The cost of ECTI is high for our company	Al-Qirim (2007)	
Cst2	The amount of money and time of training for EC applications is high for our company		
Cst3	The maintenance and support fees for EC applications are high for our company	Thong and Yap (1995)	
<i>Information intensity (1-5 scale)</i>			
Int1	It is vital for our company to have access to reliable, relevant and accurate information		
Int2	Our company and its daily activities is dependent on up-to-date information		
Int3	It is very important for our company to have access to information quickly whenever information is required for business		

(continued)

Label	Item	Source
	<i>CEO s' IS knowledge (1-5 scale)</i>	
Cis1	I would rate my own understanding of computers (before my company computerized) as very good compared to other people in similar positions	Thong and Yap (1995)
Cis2	Regarding my understanding of IS, I know the effects of adopting new EC application over my company	
Cis3	Please indicate level of your IS experience <sup>a</sup>	
	<i>CEO innovativeness (1-5 scale)</i>	
Cim1	I have original ideas	Al-Qirim (2007) and Thong and Yap (1995)
Cim2	I would sooner create something new than improve something existing	
Cim3	I often risk doing things differently	
Cim4	I often have fresh perspective on old problems	
	<i>Competition (1-5 scale)</i>	
Cmp1	The rivalry among companies in the industry my company is operating in is very intense	Thong and Yap (1995)
Cmp2	It is easy for our customers to switch to another company for similar services/products without much difficulty	
Cmp3	Our customers are able to easily access to several existing products/services in the market which are different from ours but perform the same functions	
	<i>Buyer/supplier pressure (1-5 scale)</i>	
Prs1	Our industry is pressuring us to adopt EC	Al-Qirim (2007) and Saffu et al. (2008)
Prs2	Our customers and buyers are pressuring us to adopt EC	
Prs3	Our suppliers are pressuring us to adopt EC	
Prs4	Our distant partners' demands for better communications and data interchange are pressuring us to adopt EC	
	<i>Support from technology vendors (1-5 scale)</i>	
Sup1	Vendors actively market EC	Al-Qirim (2007) and Thong (2001)
Sup2	There are adequate technical supports for EC provided by vendors	
Sup3	Training for EC is adequately provided by vendors	
	<b>Note:</b> <sup>a</sup> The measurement instrument of this question is shown in Table AII	

Table AI.

**Table AII.**  
IS experience  
measurement instrument

	No experience	Little experience	Average experience	Good experience	Excellent experience
Using operating systems such as Microsoft Windows™, Linux and . . .	1	2	3	4	5
Using computer packages such as spreadsheet, word processing or data management	1	2	3	4	5
Building visual models on computers such as financial, statistical or graphical	1	2	3	4	5
Using internet and www to communicate and interchange data	1	2	3	4	5

Label	Factors								
	1	2	3	4	5	6	7	8	9
PRA3	0.790	-0.042	-0.015	0.009	-0.034	-0.020	-0.091	0.085	-0.050
PRA5	0.749	-0.010	0.057	-0.035	0.000	0.026	0.019	-0.002	-0.001
PRA7	0.739	-0.008	-0.009	0.015	-0.010	-0.038	0.023	0.044	-0.093
PRA6	0.729	0.008	0.021	0.023	0.060	-0.016	-0.045	-0.019	-0.019
PRA11	0.709	-0.046	0.056	0.176	-0.022	-0.032	-0.090	-0.181	-0.045
PRA9	0.703	0.048	0.056	-0.075	0.008	-0.104	0.025	0.009	0.059
PRA10	0.695	0.051	-0.056	-0.058	0.064	-0.059	-0.035	-0.063	0.094
PRA2	0.686	0.058	-0.011	-0.061	0.058	0.101	0.010	-0.091	-0.041
PRA4	0.659	-0.067	0.044	0.107	-0.005	0.108	0.057	-0.106	-0.097
PRA1	0.648	-0.003	0.059	-0.236	0.093	-0.016	0.103	-0.040	-0.038
PRA8	0.582	-0.055	-0.117	0.014	-0.104	-0.035	-0.055	-0.121	-0.081
CBT1	0.037	0.789	0.011	-0.074	0.016	0.129	0.069	-0.053	-0.055
CBT7	0.031	0.788	0.062	-0.073	0.004	0.001	-0.069	0.001	-0.005
CBT6	0.037	0.670	0.058	-0.066	0.006	0.140	0.070	0.076	-0.006
CBT4	-0.046	0.649	-0.084	-0.064	0.009	0.095	-0.011	-0.138	-0.074
CBT2	0.060	0.591	-0.170	0.083	-0.009	-0.138	-0.009	-0.115	0.048
CBT3	-0.058	0.589	0.026	-0.001	-0.070	0.027	-0.077	-0.025	0.065
CBT5	-0.082	0.579	0.218	-0.021	0.068	0.007	-0.029	0.058	0.046
Cinn1	0.062	-0.043	0.711	0.089	-0.002	0.095	-0.084	0.033	0.054
Cinn2	0.053	0.108	0.689	0.168	0.048	0.051	-0.106	-0.033	0.045
Cinn4	0.051	0.060	0.679	-0.083	-0.061	0.065	0.032	0.020	0.037
Cinn3	-0.063	-0.057	0.677	-0.165	-0.046	0.100	-0.008	0.020	0.003
Int2	0.020	-0.106	-0.019	0.862	-0.029	0.022	-0.035	0.036	0.045
Int1	-0.097	0.080	-0.008	0.756	0.102	0.001	0.047	-0.050	0.089
Int3	-0.026	-0.187	0.022	0.707	0.090	-0.019	0.006	-0.034	-0.008
Prs2	0.052	-0.091	0.045	0.035	0.733	0.059	-0.015	-0.081	-0.068
Prs1	0.015	0.007	-0.068	-0.043	0.716	0.006	-0.087	-0.006	0.147
Prs3	0.036	0.038	-0.091	0.124	0.672	0.083	0.034	0.057	-0.016
Prs4	0.003	0.033	0.061	0.036	0.630	0.150	-0.166	-0.082	0.062
Cst1	-0.012	0.094	0.041	-0.055	0.081	0.748	0.135	0.051	-0.091
Cst2	-0.006	0.010	0.110	0.084	0.188	0.727	-0.135	0.127	0.143
Cst3	-0.034	0.123	0.128	0.004	0.055	0.694	-0.075	0.034	0.031
Sup2	-0.034	-0.036	0.039	0.036	-0.033	0.022	0.796	-0.032	0.002
Sup3	-0.044	-0.061	-0.047	0.005	-0.133	0.047	0.757	0.049	-0.053
Sup1	0.043	0.040	-0.120	-0.027	-0.036	-0.126	0.671	0.079	0.092
Cis2	-0.015	-0.022	-0.045	0.010	-0.074	0.051	0.044	0.829	0.007
Cis1	-0.082	0.000	0.023	0.022	-0.042	0.073	0.082	0.754	-0.079
Cis3	-0.130	-0.138	0.054	-0.070	0.015	0.040	-0.028	0.558	0.070
Cmp2	-0.005	-0.123	0.032	0.173	-0.047	-0.090	0.007	-0.019	0.782
Cmp3	-0.147	0.054	0.014	-0.001	0.081	-0.012	0.079	0.024	0.767
Cmp1	-0.029	0.103	0.121	-0.041	0.105	0.341	-0.062	-0.002	0.531

**Table AIII.**  
Rotated factor matrix  
along with item loadings

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