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# Antecedents of Electronic Commerce in Developing Economies

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## ABSTRACT

One of the objectives of this article is to investigate the extent to which several factors that might affect electronic commerce (EC) usage are implemented and EC is used in a developing country. The article also aims to identify the factors that actually influence the use of EC in a developing country context. The author used annual survey data obtained over a 5-year period from 2009 to 2013 to test several hypotheses. This is probably the first article to assess the changes in these factors' effects on firms' usage of EC over several years. Findings suggest that there are major gaps in the implementation of these factors. There were no major changes or developments in technology availability and EC infrastructure over the five-year period. In fact, there was a general deterioration in the other factors that could facilitate EC usage. In addition, there were no changes in the extent to which EC was used over the same period. Implications of these findings for managers and researchers are discussed.

## KEYWORDS

Adoption and Usage Factors, Competitiveness, Developing Country, Electronic Commerce, Information and Communication Technologies, Survey

## INTRODUCTION

The new century has seen a revolutionary change in the way business and trade are conducted over electronic channels. Users in least-developed and developing countries are increasingly accessing the Internet via terminals and mobile devices. The use of the Internet and mobile applications are expected to increase exponentially in the future. This provides great opportunities to utilize the power of the Internet and other forms of information and communication technology (ICT) to advance the social and economic development of developing countries around the world. Despite evidence of productivity gains in several areas, companies in developing countries are not always maximizing the use of these technologies (World Trade Organization, 2013). Developing countries should fully embrace EC to realize several important benefits, including improved economic and social development, increase in productivity, reduction in operating costs for businesses, and integration of their economies with the international markets (Alyoubi, 2015; World Trade Organization, 2013). In fact, such gains are already being evidenced in some countries such as India (Turban, King, Lee, Liang, & Turban, 2015).

Even though EC has the potential to provide greater benefits to businesses and consumers in developing countries than in developed countries, this potential has not been fulfilled in many of these countries (Kshetri, 2007; Molla & Heeks, 2007; World Trade Organization, 2013). Several factors have been cited for the developing countries' failure to reap these benefits, including financial, legal, and physical infrastructure barriers to implementation (Kshetri, 2007; Tan, Tyler, & Manica, 2007;

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Abou-Shouk, Megicks, & Lim, 2013), as well as factors such as management attitudes and culture (Abou-Shouk et al., 2013).

Most of the literature on the adoption and use of EC consists of studies conducted in developed countries such as the US, Europe, and Scandinavia. The findings of these studies are not necessarily applicable to developing economies, since the factors driving the adoption of EC and the barriers to adoption differ across countries (Kartiwi & MacGregor, 2007). Previous studies on EC in developing countries have mainly been conducted in Latin America, Asia, and Africa. However, there is still a lack of systematic research on issues related to the e-readiness of small and medium-sized enterprises (SMEs) in developing countries (Fathian, Akhavan, & Hoorali, 2008; Huy, Rowe, Truex, & Huynh, 2012; Abou-Shouk et al., 2013). Such research on small island economies has been particularly missing from the literature (Molla, Taylor, & Licker, 2006). Therefore, the objectives of this study are:

- To investigate the extent to which several factors that might affect EC usage are implemented and EC is used in a developing country. The author does this by analyzing annual survey data obtained from firms in Northern Cyprus (NC) between 2009 and 2013. The analysis of yearly data allows researchers to detect developments or changes in the characteristics of the target population. To the author's knowledge, this is the first study in this area that used more than one year's data on factors related to the use of EC and EC usage.
- To determine the factors that actually influence the use of EC in a developing country over a 5-year period.
- To make policy and research recommendations based on the study's findings.

Understanding the determinants of EC usage in NC has both practical and research implications, which are discussed in more detail at the end of the article. The island of Cyprus is strategically located at the crossroads of three continents. This has allowed the southern part of the country, which has joined the EU in 2004, to become the EU's key trading hub in the Eastern Mediterranean, providing a point of exchange between Europe, Africa, and Asia. As a major transshipment centre, the island provides important benefits to manufacturers with European, Middle Eastern, and North African export activities, allowing them to streamline their supply chain activities (Cyprus Profile, 2015).

However, the economy of NC has not nearly fulfilled its potential after the division of the island in 1974. According to several UNDP studies conducted on behalf of the European Commission, the division between the two sides of the island has created big discrepancies between the two economies in terms of GDP growth and GDP per capita. There are also big differences between the two communities in terms of private sector development. The embargoes faced by NC restrict trade and investment opportunities. To close the gap between the two sides, the EU commission has offered grant programs to NC to help develop the private sector and improve its e-readiness. The UNDP studies also identified ICT development as an important factor for increasing the productivity of all sectors, especially high potential service businesses. Accordingly, the UNDP studies identified a number of strategies in 2005 to develop E-business and ICT in NC. Furthermore, it declared that a grant scheme would be set up to support organizations implementing projects in line with the proposed E-business and ICT strategies (European Commission, 2006).

This study's assessment of the factors influencing EC usage in NC over a 5-year period will create a better understanding of the effects of such EC and ICT initiatives over an extended period of time. With the ongoing negotiations gaining pace in 2015, the resolution of the decades-old conflict in the island will put the northern part of the island on the map for many European and other foreign companies doing business in the region. Therefore, understanding the EC climate in NC is important for both local and foreign firms. It can also help other developing countries in the region to formulate strategies to encourage adoption of EC and ICT to contribute to their economic growth.

In addition, since most of the previous empirical research in this area focused on developed countries, this study will contribute to efforts to develop stronger EC theories for developing countries.

This is especially important, since previous research suggests that IT adoption in developed countries may not transfer well to developing countries (Nasco, Toledo, & Mykytyn, 2008). To the author's knowledge, a similar study on NC firms has not been conducted before.

Since there are various terminologies and definitions in the literature associated with the use of Internet-based information technologies to conduct business (see Table 1 in the Appendix), it is important to define the terms used in this study. ICTs are defined as "a diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information" (Blurton, 1999). EC refers to "using the Internet and intranets to purchase, sell, transport, or trade data, goods, or services" (Turban et al., 2015). This study adopts this definition of EC and operationalize the EC usage construct with the five items found in the World Economic Forum's Global Competitiveness Survey (see Table 2 in the Appendix). This construct and its corresponding items are consistent with Turban et al.'s (2015) definition of EC.

## STUDY FRAMEWORK AND LITERATURE REVIEW

Tornatzky and Fleischer (1990) describe the technology–organization–environment (TOE) framework in their book *The Processes of Technological Innovation*. The TOE framework only represents one segment of the entire process of innovation, explaining how the firm context affects the adoption and implementation of innovations. The framework includes three types of contexts that are posited to influence technological innovation: the technological context, the organizational context, and the environmental context. The *technological context* involves both the technologies that the firm uses and the ones it does not, but which are available in the marketplace. The *organizational context* deals with the characteristics and resources of the firm, including organizational structure, communication processes within the firm, firm size, and slack resources. The *environmental context* includes industry structure, the availability of technology service providers, and government regulation (Baker, 2012).

According to several authors such as Zhu and Kraemer (2005), Pan and Jang (2008), and Sila (2013), the TOE framework is an effective model to analyze the factors affecting e-business use. Along with institutional theory and innovation diffusion theory, the TOE framework is one of the most frequently used frameworks in information technology (IT) adoption research (Sila, 2013). The framework is consistent with Rogers' innovation diffusion theory, which includes technological characteristics and firms' internal and external characteristics as drivers for technology diffusion (Zhu & Kraemer, 2005; Pan & Jang, 2008). In previous research that used this framework, the specific factors within each context varied across different studies (Teo Ranganathan, & Dhaliwal, 2006). In this study, these three contexts were operationalized as follows, consistent with the TOE framework and the relevant literature: technological context (EC infrastructure, technology availability), organizational context (capabilities, firm size), and environmental context (regulatory environment, intensity of competition).

A comprehensive review of the literature has revealed that a systematic analysis of the factors affecting EC adoption and usage in developing countries is still limited. The author summarized ten of such previous studies with similar objectives to this study in Table 1. Grandon and Pearson's (2004) survey of Chilean firms revealed several factors that differentiated EC adopters from nonadopters. These firms faced more external pressure to implement EC and had more financial and technological resources for implementation. They viewed EC as compatible with their preferred work practices and existing technology infrastructure. In addition, these firms perceived EC as beneficial to their firms and aimed to increase managerial productivity and support strategic decisions through adoption. Kaynak et al. (2005) specifically sought to determine the influence of these benefits on EC adoption with a survey of manufacturing SMEs in Turkey and found perceived benefits to be significant factors, in line with the findings of Grandon and Pearson (2004). Molla and Licker (2005b) used the PERM model to test the effects of a more comprehensive set of adoption factors within a developing

country context, which was later replicated and extended by Tan et al. (2007). This model consisted of factors related to both perceived organizational e-readiness and perceived external e-readiness.

Some of the other studies following these had different theoretical approaches to EC adoption and utilized a different (though overlapping to a certain extent) set of adoption factors. For example, Alam et al. (2007) utilized innovation diffusion theory, whereas Nasco et al. (2008) and Ghobakhloo et al. (2011) used the theory of planned behavior and the TOE framework, respectively. Among more recent studies in this area, Chan et al. (2012) and Oliveira and Dhillon (2015) analyzed the effects of several factors not only on adoption but also on routinization of e-collaboration tools in the supply chain. While Oliveira and Dhillon (2015) mainly relied on the TOE framework, Chan et al. (2012) derived these factors from multiple theoretical perspectives, including the TOE framework, interorganizational relationships, and the unified theory of acceptance and use of technology.

An analysis of Table 1 reveals that, even within such a small pool of empirical studies conducted in developing countries, studies differ from each other in terms of how they define EC adoption or usage, the theories used (if any), the set of EC factors tested or extracted, and the samples and methodologies utilized. In addition, the variables used were different even when the same theory was utilized (e.g., see Ghobakhloo et al., 2011 and Huy et al., 2012). Such inconsistencies across these studies limit the researchers' ability to make direct comparisons. The set of factors extracted from the Global Competitiveness Report surveys are consistent with the factors used in some of these studies and the general IT adoption literature. Unlike these studies, however, this study's approach allows for direct comparisons of EC usage factors and EC usage across countries and years, since the same survey is administered in over 140 countries every year. In fact, the author has not found other studies in this area, both in the developing and developed country context, that analyze the changes in the effects of EC usage factors over several years. The following section discusses these factors in more detail.

## Technological Context

### *Technology Availability*

The TOE framework suggests that the technologies used by a firm contribute to the adoption process, since they constrain the scope and speed of technological change the firm can implement. The technologies that are not currently being used by the firm also set the boundaries of potential technological improvements for the firm (Baker, 2012). A firm's response to radical technology may take several forms such as overlooking the technology, scrutinizing it, forming alliances to use the technology, experimenting with it on a limited basis, or adopting it (Srinivasan, Lilien, & Rangaswamy, 2002). Previous studies have shown that firms that are more proactive in their approach to IT assess new process innovations more systematically and are more likely to adopt them (Jun & Kang, 2009). Firms often analyze the opportunities and threats new technologies may pose to them and may adjust their strategies to either use these technologies or fend off the threats created by them (Srinivasan et al., 2002).

Since firms in developing countries are an integral part of the interdependent and competitive global business system, they have to use technology as a strategic tool to survive and grow as well (Sharif, 1997). However, their ability to do so is often inhibited by lack of available technologies, such as insufficient access to computers, software and hardware, and affordable telecommunications, as well as security issues and low levels of EC usage by supply chain partners (Kapurubandara & Lawson, 2008). Access to such technologies is considered to be a prerequisite to IT adoption in developing countries (Datta, 2011). Therefore, this study posits:

**H1:** Technology availability has a direct, positive effect on EC usage.

### *EC Infrastructure*

Telecommunication networks and facilities and IT infrastructure, including electronic data interchange (EDI), intranet, extranet, local area network, and wide area network, are important determinants of firms' technical competence and serve as enablers of e-commerce adoption (Zhu, Kraemer, & Xu, 2003; Chaabna & Wang, 2015; Kabanda & Brown, 2015). The extent to which firms have access to affordable infrastructure and the degree of use of multiple technologies such as teledensity, wireless, Internet, broadband and PCs, will determine the diffusion of e-commerce. On the other hand, high costs of Internet access for consumers will negatively influence search for information and online purchasing (Gibbs, Kraemer, & Dedrick, 2003).

According to the literature, the quality, availability, and cost of access to necessary infrastructure has inhibited EC adoption in most developing countries (Ghobakhloo et al., 2011; Hoque, Ali, & Mahfuz, 2015). The development of this infrastructure has also not been balanced. For example, countries such as India, Ireland, and Israel faced problems with adoption, because network connectivity or hardware development lagged behind software and support infrastructure (Datta, 2011). Studies conducted in two developing countries, Botswana and Ghana, found poor telecommunications infrastructure to be a barrier to e-commerce adoption in SMEs, as this greatly increased their costs of accessing ICT (Asare, Gopolang, & Mogotlhwane, 2012). Jennex, Amoroso, and Adelakun (2004) also reported that technical infrastructure was one of the most important factors for the adoption of B2B e-commerce by small companies in developing countries. Thus:

**H2:** The availability of EC infrastructure has a direct, positive effect on EC usage.

## Organizational Context

This context influences technology adoption and usage decisions through (1) mechanisms that link various internal subunits of the firm, thus promoting innovation; (2) informal linking agents such as product champions, boundary spanners, and gatekeepers; and (3) cross-functional teams and employees that have formal or informal links to other departments or to other value chain partners (Baker, 2012).

### *Capabilities*

Organizational structure has been linked to innovation adoption and implementation. Organizations with organic and decentralized organizational structures are more likely to *adopt* innovations, since they put more emphasis on teamwork and workforce fluidity and encourage lateral communication in addition to communication through the regular reporting lines. Moreover, an organization that implements an effective supply chain management system with cross-functional and self-directed teams rather than creating an organizational structure with rigidly divided functional silos becomes more receptive to innovation adoption. However, other research has shown that mechanistic and centralized organizational structures may be more suited to the *implementation* of innovations. Communication processes within an organization and the top management's ability to create a work environment that is open to change and innovation can either encourage or hinder innovation (Baker, 2012).

The IT literature suggests that organization-specific capabilities, such as technical capability, include resources that provide an organization with functionality, flexibility, and scalability. Technical capability also includes human IT resources accumulated through training, experience, and insight. These resources can have positive contributions to the IT adoption process (Garrison, Wakefield, & Kim, 2015; Maditinos, Chatzoudes, & Sarigiannidis, 2014; Gangwar, Date, & Ramaswamy, 2015). A recent study by Cui and Pan (2015) has also shown that focal capabilities (e.g., capability for sensing and responding to customers, capability for cooperating, capability for innovating) must be developed for EC implementation to be successful. These capabilities must be developed through the orchestration of resources in relation to the changing environment (Cui & Pan, 2015).

Developing countries have limited organizational financial, technological, and human resources compared to developed countries, making it more difficult for them adopt EC. These countries also have less experience with conducting electronic transactions and payments and managing mediated intra- and inter-business relationships in the online environment. Given these constraints, firm capabilities become very important for EC adoption in developing countries (Molla & Licker, 2005b). Adebanjo, Tickle, Lin, and Bourlakis (2016) find that some of the required capabilities for EC adoption in developing countries still lag behind those in developed countries.

Previous empirical literature explored the effects of various types of capabilities on EC adoption. Based on case studies of several brick-and-click companies, Daniel and Wison (2003) identified eight distinct dynamic capabilities that would be effective in implementing e-business. According to Koch (2010), several firm capabilities including inside-out, outside-in, and spanning capabilities are significant drivers of B2B electronic marketplaces adoption.

The implementation of e-business generally requires tight coordination and close cooperation between supply chain partners (Corsten & Kumar, 2005; Liu, Ke, Wei, & Kua, 2014). Empirical studies by Corsten and Kumar (2005) and Johnson, Klassen, Leenders, and Awaysheh (2007) suggest that purchasing teams and cross-functional teams, which may include representatives from both suppliers and customers, provide team-based boundary spanning capabilities that firms can help firms adopt e-marketplaces successfully.

**H3:** Capabilities have a direct, positive effect on EC usage.

### *Firm Size*

Firm size, operationalized as the number of employees in a firm in this study, is one of the factors that have been studied by a relatively large number of studies. The literature is still not in full agreement regarding the influence of firm size on technology adoption. Some studies (e.g., Zhu, Kraemer, & Xu, 2006) suggest that small firms are more agile and flexible than large firms and require less communication and coordination, as well as less influence, to obtain support for the implementation of new technologies. On the other hand, other studies take the view that large firms are better positioned to adopt EC because they have more slack resources, can achieve economies of scale more easily, are more able to handle the risk of investment, can exert more pressure on their trading partners to adopt the same technologies (Zhu et al., 2003), and have more champions than small firms to facilitate the adoption of innovative technologies (Johnson, 2010). However, recent empirical findings related to this argument are still mixed. For example, a recent study by Gono, Harindranath, and Özcan (2016) provided support for this argument and found a positive relationship between firm size and ICT adoption, while Jia, Guo, and Barnes (2017) found no significant relationship between size and firms' intention to continue to use Enterprise 2.0. White, Afolayan, and Plant (2014) contend that small firms find it challenging to adopt EC technologies, but this relationship is not necessarily a linear one. This study posits the following:

**H4:** Firm size has a direct, positive effect on EC usage.

## Environmental Context

### *Regulatory Environment*

Government regulation can have both positive and negative effects on innovation. For example, governments may mandate innovation for energy firms by requiring them to use pollution-control devices. On the other hand, strict safety and testing or privacy requirements imposed by governments may hinder innovation in some industries (Baker, 2012). Within the context of EC, significant factors related to the regulatory environment include regulatory legislation such as EC legislation and trade

and telecom liberalization (Gibbs et al., 2003). They also include regulatory support for firms, such as government and industry promotion of IT and EC, which may come in the form of technical support, training, and funding (Gibbs et al., 2003; Gibbs & Kraemer, 2004). On the other hand, lack of EC legislation can stall the growth of EC (Gibbs et al., 2003; Gibbs & Kraemer, 2004).

More governmental support is needed in developing countries for EC to reach its full potential (ITC Communications, 2013). Developing countries such as Algeria are still grappling with issues arising from the absence of a comprehensive regulatory framework (Chaabna & Wang, 2015). However, in other developing countries such as Egypt, the government plays a key role in all phases of EC penetration. It tries to strike a balance between regulation and industry self-regulation to create a business environment where EC thrives (Kamel, 2015). According to Molla and Licker (2005a) and Tan et al. (2007), government e-readiness in terms of legislation passed to regulate and support EC is positively related to adoption. Hence:

**H5:** Regulatory environment has a direct, positive effect on EC usage.

### *Intensity of Competition*

Industry structure analysis can involve an investigation of the intensity of competition and the presence of dominant firms within the value chain, which can help stimulate innovation adoption (Baker, 2012). Environmental hostility is related to the influence of the competitors' actions and industry cycles and can include competition in the areas of price, product, technology and distribution (Özsomer, Calantone, & Bonetto, 1997). The more competitive the business environment is, the more innovative firms need to be to outperform the competition (Myers & Marquis, 1969). For example, some of the previous studies (e.g., Grover, 1993; Chwelos, Benbasat, & Dexter, 2001) have shown that firms that operate in competitive business environments adopt EDI more than firms that operate in less competitive environments. Similarly, a more recent study by Mangla, Agarwal, and Pandey (2015) has revealed that firms operating in more competitive environments are more likely to develop comprehensive websites and use IT. Sila (2010) also found that pressure from competitors was a significant factor in the adoption of Internet-based interorganizational systems. In addition, Sila and Dobni's (2012) findings suggest that E-Leaders (firms with the highest level of B2B EC usage and integration) operate in a significantly more complex environment and have more pressure from competition than average. In contrast, E-Laggards (firms that have low levels of B2B adoption) have a lower level of competitive pressure than average. However, as firms increasingly adopt the Internet for interorganizational communications and other business-related activities, this puts pressure on other companies to do the same (Sila, 2013).

Since firms in developing countries have a smaller global scope, they tend to face less competition from international competitors than firms in developed countries (Xu, Zhu, & Gibbs, 2004). A case in point is the Ethiopian banks who have fallen behind on electronic banking adoption due to an absence of competition between local and foreign banks (Bultum, 2014). Thus, the following is hypothesized:

**H6:** The intensity of competition has a direct, positive effect on EC usage.

## METHODOLOGY

The World Economic Forum's Centre for Global Competitiveness and Performance prepares an annual competitiveness report, the Global Competitiveness Report, which provides an overview of the competitiveness performance of over 140 of the world's economies. The report claims to be the most comprehensive assessment of its kind globally and includes a profile of each economy and its corresponding global rankings on over 100 indicators (World Economic Forum, 2014).

Even though NC is not included in these rankings, the same survey used in Turkey is also conducted annually in NC by the Turkish Cypriot Chamber of Commerce. The survey methodology is consistent with that used for all the Global Competitiveness Report surveys conducted in other countries. The World Economic Forum requires that the Partner Institutes follow detailed sampling guidelines to capture a strong and representative sample. The survey sampling follows a dual stratification based on the size of the company and the sector of activity. The sampling guidelines specify that the Partner Institute should aim to collect a combination of random respondents with some repeat respondents for further comparative analysis. This improves the comparability of data across years (World Economic Forum, 2014).

In obtaining the NC data, every effort was made to make sure that the sample of respondents was as representative as possible of the national business sector. The average GDP of the country over the past 5 years was used to calculate a weight for each industry, representing each industry's estimated contribution to the GDP. These weights, along with the geographic distribution of firms, were then used to form the sample. Accordingly, the sample consisted of the following industries: Agriculture: 5%, Quarries: 1%, Manufacturing: 10%, Utilities: 2%, Construction: 10%, Consumer goods: 39%, Tourism: 10%, Telecommunications: 3%, Financials: 4%, Consumer services: 16% (Turkish Cypriot Chamber of Commerce, 2014).

The author identified the items used in this survey (see Table 2) that were relevant to this study based on the literature review discussed above. The World Economic Forum uses a 1-7 Likert scale for each item, where firms are asked to rate the extent of implementation or usage of each item in the country. The analyses included data from surveys conducted between 2009 and 2013. The author determined the global ranking of NC firms on each item by comparing the item averages for NC firms with those item averages and country rankings provided by the annual Global Competitiveness Reports.

## ANALYSES AND FINDINGS

First, the author screened the data to detect whether there were any outliers. The author also conducted several analyses to determine whether the residuals of the regression model violated any of the assumptions of multiple regression analysis (i.e., linearity, normality, no or little multicollinearity, no autocorrelation, and homoscedasticity). There were no issues with linearity, multicollinearity, autocorrelation, and heteroscedasticity. However, the normal probability plots and the normal quantile plots showed that the residuals of the regression model were not normally distributed with two of the variables—regulatory environment and capabilities—in 2013. Therefore, the 2013 data on these two variables were transformed using $\log_{10}$ transformation.

### Common Method Variance (CMV)

Since all data were collected from a single informant from each firm, it is necessary to address concerns regarding CMV, which may result in systematic error within survey research. The author investigated CMV by using Harman's Single-Factor (HSF) test. With this technique, all items from all of the constructs in the study are included into a factor analysis to find out if the majority of the variance can be explained by one general factor (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). The author conducted confirmatory factor analysis (CFA) in EQS 6.3 for Windows and loaded all the survey items into one latent construct for each of the five years. The following fit indices were obtained for each year (robust fit indices were used for years with multivariate nonnormal data):

2009: Satorra-Bentler scaled chi-square (S-B$\chi^2$) = 458.6796, df = 275, p = 0.00000, Robust CFI = 0.654, SRMR = 0.118, Robust RMSEA = 0.122, 90% Confidence Interval (CI) of RMSEA = (0.108, 0.134), Robust NNFI = 0.502.

2010: S-B$\chi^2$ = 494.3756, df = 299, p = 0.00000, Robust CFI = 0.515, SRMR = 0.124, Robust RMSEA = 0.112, 90% CI of RMSEA = (0.097, 0.125), Robust NNFI = 0.344.
2011: $\chi^2$ = 797.363, df = 324, p = 0.00000, CFI = 0.470, SRMR = 0.122, RMSEA = 0.135, 90% CI of RMSEA = (0.123, 0.146), NNFI = 0.425.
2012: S-B$\chi^2$ = 909.8167, df = 434, p = 0.00000, Robust CFI = 0.368, SRMR = 0.134, Robust RMSEA = 0.111, 90% CI of RMSEA = (0.100, 0.120), Robust NNFI = 0.323.
2013: S-B$\chi^2$ = 566.8680, df = 350, p = 0.00000, Robust CFI = 0.582, SRMR = 0.106, Robust RMSEA = 0.080, 90% CI of RMSEA = (0.068, 0.092), Robust NNFI = 0.549.

The above fit indices for all years indicate poor overall model fits. In addition, most items had nonsignificant factor loadings on the single latent construct. Therefore, these results suggest that CMV is not a significant issue in this study.

## The Competitiveness of NC Firms in Terms of Usage Factors and EC Usage

### *Technology Availability*

An analysis of the yearly data between 2009 and 2013 indicates that NC firms are mostly using new technology through licensing or imitating foreign firms. The country ranked 122nd in the use of latest technologies. In terms of firm-level technology absorption, its ranking was 120th.

### *EC Infrastructure*

Even though NC firms do not perceive big gaps in the country's ICT infrastructure, they do not find that these technologies are widely available and easily accessible. For example, the existing Internet bandwith in the country is neither widely preventing firms from carrying out their operations or undertaking new initiatives nor acting as a facilitating factor (the average competitiveness score on this item was 4.16 out of 7). The analysis also showed that Internet access in schools was mediocre (74th with a score of 3.91) and access to digital content in the country had an average score of 4.90. Thus, it could be argued that EC infrastructure in the country is not strong enough to support growth in the use of EC.

### *Capabilities*

An analysis of available data from 2009 till 2013 on various capabilities of NC firms suggest that these capabilities are not sufficient. First of all, the ability of these firms to innovate is poor. As Table 2 shows, they ranked 94th out of 141 countries in this category. Their production processes are underdeveloped (ranked 123rd) and rather than being technology- and information-focused, they use labor-intensive methods and old process technologies. Furthermore, NC firms do not use modern marketing tools and techniques (e.g., see Khatwani and Srivastava, 2015) (117th place). The degree to which they introduce new business models, organizational structures, or new designs to differentiate their products and services is also low (2.92 out of 7). In addition, local firms do not generally have control over international distribution and marketing (117th place) and management has little accountability to investors and boards (ranked 138th). NC firms also do not have sophisticated supply chains (e.g., strategic deals with suppliers, risk management, product standards, etc.) (2.73 out of 7).

### *Regulatory Environment*

This study's findings point to a general dissatisfaction among NC firms with the incentives provided by the government for the use of ICT in the country. They found government policies in this area to be unsuccessful (with an average score of 2.77 out of 7). The extent to which the government had a strategic plan for use of ICT to increase the overall competitiveness of the country ranked very poorly with an average score of 2.15 and the country's laws on ICT use were lacking with an average score of 2.08.

### *Intensity of Competition*

NC firms operate in a business environment isolated from international competition due to embargoes. This is reflected in their responses related to the intensity of competition in the country. The intensity of competition in local markets is very limited (111th place among 141 countries), and lack of product/service quality standards, safety and other regulations (excluding environmental regulations) hinders competition (average score is 2.90). Anti-monopoly policy in the country is also not at a sufficient level to promote competition (ranked 124th), and the fact that public enterprises are favored over private enterprises affects the latter's competitiveness negatively (95th place).

Factors related to the characteristics of customers, suppliers, and the industrial structure in the country adversely influence competition as well. Consumers base their buying decisions on the lowest price rather than performance characteristics (82th place), and the number of local suppliers (131th place) and their quality are low (131th place). In addition, well-developed and deep clusters in the country (firms specialized in a specific area, suppliers, producers of related products and services, and geographic concentrations of firms) are not prevalent (129th place). Corporate activity is dominated by a few business groups rather than spread over many firms (113th place).

### *EC Usage*

As can be inferred from the above discussion, the groundwork for the widespread adoption and diffusion of EC has not yet been laid in NC. The extent to which firms in the country use ICT to communicate and conduct transactions with other firms (3.62 out of 7) and create new work models and offer new products and services (2.82 out of 7), as well as to create new organizational models (2.51 out of 7), is limited. Similarly, the extent to which the firms in the country use the Internet in their work processes (3.37 out of 7) and to increase sales and reach new customers (3.19 out of 7) is inadequate.

## The Relationship Between Usage Factors and EC Usage

### *Pearson's Correlation*

The author conducted Pearson's correlation and multiple regression analyses to test the hypotheses. Pearson's correlation results (Table 3 in the Appendix) indicate that regulatory evironment was significantly, positively correlated with EC usage every year from 2009 till 2013. Technology availability was not significant only in 2011. Capabilities and the intensity of competition also had significant, positive relationships with usage every year except in 2009 and 2010, respectively. EC infrastructure had a significant positive relationship with usage in three of the 5 years (2009, 2012, and 2013). Firm size was not related to usage in any year.

The fact that capabilities factor was associated with usage in all years except in 2009 was probably due to the global financial crisis that started in 2008. The 2008-2009 Global Competitiveness report for NC (Turkish Cypriot Chamber of Commerce, 2014) states that the survey was conducted in NC at the end of 2008 and that, according to the survey findings, the business community in the country was 38% more pessimistic on average after the crisis compared to the pre-crisis period. Shifts in the correlation between intensity of competition and usage in 2010, between EC infrastructure and usage in 2010 and 2011, and between technology availability and EC usage in 2011, correspond to a period of dips in business confidence due to political instability and poor governance, high macroeconomic instability, and more difficult access to credit (Turkish Cypriot Chamber of Commerce, 2014). Future studies should include such factors related to environmental uncertainty as a moderator in their analyses to better explain the relationships between usage factors and EC usage.

### *Multiple Regression*

Multiple regression allows researchers to study the separate and collective contributions of one or more independent variables to the variation of a dependent variable (Tabachnik & Fidell, 1996). It

was the primary method used in this study, since it had the best fit for this study's research objectives. First, the author used multiple regression to estimate the simultaneous correlations among the six predictor variables and a single, continuous response variable named EC usage, a composite of five items related to various types of EC usage. The author conducted a separate regression analysis for each year from 2009 to 2013. The results are shown in Table 4 in the Appendix. As the table shows, technology availability was a significant factor affecting EC usage in three (2010, 2012, 2013) of the five years analyzed. Even though capabilities had a significant positive effect on EC usage from 2009-2012 inclusive, this relationship was negative in 2009. Regulatory environment was significant in 2012 and 2013. EC infrastructure and the intensity of competition were significant only in 2009 and 2013, respectively. Firm size was never significant. There may be several reasons why firm size was not significant. First, the fact that Internet-enabled technologies are cheaper to implement and operate than their predecessors may explain this finding, which suggests that the adoption and implementation of these technologies do not necessarily favor larger firms. Another possible explanation is that firm size affects different stages of EC implementation (i.e., initiation, adoption, routinization) differently and therefore future studies in this area should test the effect of firm size on each of these stages separately. The same reasoning can be used to explain the weak link between EC infrastructure and EC usage in that it is likely that the infrastructure needs are more critical in adoption than in usage. Weak support for the effects of the intensity of competition may be attributed to the absence of foreign competition in the NC market, resulting from the political and economic embargoes that the country faces. An alternative explanation is that, as Frohlich and Westbrook's (2002) findings suggest, firm size has a different influence on the EC technologies used on the supply side than those used on the demand side and therefore its effects on these various technologies must be investigated separately by future studies.

The $R^2$ values for the five multiple regressions ranged from 32.73% to 59.51% and suggest high values of explained variance for this research area. The results suggest that technology availability, capabilities, and regulatory environment had significant positive effects on EC usage on a relatively more consistent basis. Thus, hypotheses 1, 3, and 5 were partially supported, whereas there was weak support for hypotheses 2 and 6. Hypothesis 4 was not supported.

The author also conducted the same analyses between the six independent variables and each of the five usage measures (rather than their composite) to determine whether there were variations in results across these measures. The results shown in Table 5 in the Appendix suggest similar findings to the ones discussed above. Technology availability was only significant in 2010, 2012, and 2013. However, further analyses have revealed that it was mainly the fourth measure of EC usage (ICT use to create new work models and offer new products and services) that was consistently significant over these three years. Capabilities were significantly related to Internet use by firms in their work processes in 2009 (though negatively), to ICT use to create new work models and offer new products and services in 2011, and to ICT use to create new organizational models in 2011 and 2012. Consistent with the results obtained with the composite EC usage variable, firm size had no relationship with any of the five individual usage measures in any year. EC infrastructure was positively related to Internet use by firms in their work processes in 2009 and to ICT use to communicate and conduct transactions with other firms in 2012. In line with the findings obtained when a composite EC usage variable was used, regulatory environment and the intensity of competition positively affected several usage measures in 2012-2013 and 2013, respectively.

These findings suggest that there are no significant differences between the results obtained using an aggregate measure of EC usage and those obtained using individual measures of EC usage as dependent variables. However, the latter analyses have allowed the author to identify the specific types of EC that were significant in any given year. Overall, inconsistent results across years regarding the significance of a given usage factor points towards the presence of exogenous factors. This provides evidence for the importance of using yearly or longitudinal data and other control variables to assess the impact of various factors on EC usage.

### Testing the Effect of Time on the Level of Usage Factors and EC Usage

The author also conducted a series of one-way Analysis of Variance (ANOVA) analyses on five of the factors (firm size was excluded) and EC usage to determine whether there were any differences in the level of each of these factors and EC usage across the years 2009-2013. Table 6 in the Appendix indicates that there were indeed some differences in the levels of all of these usage factors, except EC infrastructure. This suggests that no major changes or developments in infrastructure have been witnessed in the country over the five-year period. Moreover, there were no changes in the extent to which EC was used over the same period.

For the four usage factors that displayed differences across years, the author conducted Tukey-Kramer tests to determine exactly where the differences lie. As Table 6 in the Appendix shows, there were no changes in technology availability from 2009 to 2013, except in 2011 when there was a steep increase. However, since there were no logical explanations for this increase, we treated it as an outlier. Fittingly, the regression results showed that the association between technology availability and EC usage in 2011 was nonsignificant. In addition, there were no differences in the intensity of competition across years, except in 2011 when the level was lower than all the other years. The fact that EC infrastructure and the intensity of competition each had significant positive effects on EC usage in only one of the 5 years analyzed is probably explained by this lack of improvement in these factors over the same period. The results also suggested that the firms' capabilities deteriorated from 2009 to 2012, and the state of the regulatory environment worsened from 2009 to 2013. The worsening of capabilities has resulted in a weaker effect on EC usage in 2012 and a nonsignificant one in 2013. The worsening of the regulatory environment also explains why this factor had a positive effect on usage only twice in 5 years.

## DISCUSSION AND IMPLICATIONS

### Implications for Practice

The study's findings suggest that regulatory environment, technology availability, EC infrastructure, and capabilities play a relatively more important role in the usage of EC. Given that there have not been many positive changes in the efficacy of the usage factors over the five year period from 2009 to 2013 and that some of them have even gotten worse, immediate action must be taken to rectify the situation. Based on the above findings, it is obvious that the government needs to set and act on long term plans and strengthen the required infrastructure to facilitate the adoption and diffusion of EC in NC. It must also pass laws on EC use and provide risk capital to firms to encourage them to adopt and use these technologies. In addition, data, Internet and value-added services are important drivers of business and national economic growth. Therefore, telecommunications liberalization policies must be put into effect in NC to help to increase competition, lower costs for firms to give them easier access to ICT infrastructure, as well as create new markets and services (International Chamber of Commerce, 2004).

A lack of commitment on both the government officials and top executives' part seems to lie at the root of the problem. Every few years, when a new government comes to power, it rehashes the same technology strategies and regulations developed before and releases statements to the media about the intended initiatives. However, most of these proposed initiatives are not usually implemented. For example, a proposed legislation to regulate online crime has not yet been passed for several years despite numerous cases of abuse. Such irresolute policies of the government may partly explain some of the shifts in the significance of the technology availability and regulatory environment factors over several years.

Successful implementation of EC initiatives is especially important if the negotiations on the Cyprus problem result in a solution, as NC will be unprepared to integrate into the European Union. If these initiatives are effectively communicated to firms and are fully implemented, NC will be better

positioned to follow the example of the southern part of the island in becoming a key trading hub and attracting foreign firms to improve their supply chain performance. As a United Nations Conference on Trade and Development report on EC legislation harmonization in Southeast Asian nations suggests, other developing countries are faced with similar problems (United Nations Conference on Trade and Development, 2013). The report argues that such legislations should not only be enacted but enforced as well. Therefore, the regulatory bodies must be more dedicated to the implementation of EC initiatives by identifying the challenges to the enactment and enforcement of new EC laws and taking the needed actions to resolve them. A close monitoring of the grants provided to firms for their EC and ICT projects is also required to ensure that they achieve the intended results.

Of course, firms are as much responsible for the improvement of the situation. They need to develop technology strategies and allocate the needed business and human resources for the integration of these technologies into their processes and collaborate with universities in R&D. In addition, these firms must improve their capacity for innovation and undertake initiatives to be more technology and information intensive. New steps toward institutionalization and contemporary methods of governance will further facilitate the realization of the needed changes. Firms also need to create supply chain relationships based on trust with their partners, increase collaboration and information sharing, and use information technologies to integrate with one another. These initiatives will create stronger foundations for the adoption and diffusion of EC.

## Implications for Research

Some of the findings of this study can also be generalized to other developing countries, since many of these countries face similar issues and have to deal with similar usage factors. The performance effects of EC usage, which is missing from the Global Competitiveness Report, could also be incorporated into future surveys. Although the performance outcomes of EC usage have been analyzed in various studies that utilized data from developed countries, there is still a gap in this research area within a developing country context. In addition, the role of contextual factors such as country culture and industry should be investigated in this context. This is probably the first study to assess the changes in TOE factors over several years and how they affect firms' ability to use EC. Different types of innovations, national/cultural contexts and industries may influence adoption and usage in different ways. This may warrant the use of different factors for the technological, organizational, and environmental contexts (Baker, 2012). In addition, there are a number of other frameworks and theories such as innovation diffusion theory, the resource-based view, institutional theory, etc., that could be used to analyze related hypotheses and extend this research (e.g., see Sila, 2015).

Potential areas of future research that would have important policy implications includes an analysis of those firms in developing countries that took advantage of grants targeting EC and ICT development in their countries. Information about the impact of these grants could be used to undertake further initiatives and set up grant programs for other developing countries.

Finally, the Global Competitiveness Survey is a unique tool for capturing important information at a global level. The data collected provides a rare insight into each nation's economic and business environment, as well as information about how it compares with other countries (World Economic Forum, 2014). The EC usage factors extracted from this survey can be used by practitioners to assess EC usage in the countries they want to do business in and by researchers who want to research EC usage factors in different countries. To test whether these results could be generalized to other developing countries, the study should be replicated using the World Forum data from other developing countries. Future studies should also investigate whether and how these factors differ across developed and developing countries. Since the Global Competitiveness surveys conducted in different countries use a common instrument and sampling method, this makes survey results obtained over the years across these countries directly comparable. As can be seen from Table 1, such direct comparisons are not currently possible due to differences in the operationalization of variables across different

studies. Furthermore, since all of these previous studies used cross-sectional data, they do not enable researchers to analyze the evolution of the EC environment in different countries over several years.

### Limitations

The sample in this study only consists of NC firms, which limits the ability to generalize the findings to other developing countries. However, this study does develop a standard framework, which researchers can use to analyze other developing and developed countries by using the Global Competitiveness survey. In addition, this study used single rather than multiple informants; using multiple informants would strengthen the validity of the data. This study also did not measure the actual behavior of the respondents and relied on their perceptions, a limitation common to all survey research. Since some of the EC usage items were not consistently used in the surveys every year, the author could only use the responses to the available items.

In addition, this study does not claim to have established causality between variables, as there are three criteria that must be met before one can talk about a causal relationship: temporal ordering, covariation of the cause and effect, and the existence of no other alternative explanations for the observed effect. Like all the other studies in this area, this study also does not meet all three criteria. However, the author based all the hypotheses on a previously validated framework by conducting an extensive literature review to strengthen the conclusions about the direction of the observed effects.

## CONCLUSION

This study addressed the issue of EC usage and factors affecting it in a developing country context by analyzing data collected from NC firms over a 5-year period. The findings show that factors from all three TOE components are significant in EC usage in a developing country context. Technology availability, capabilities, and regulatory environment were significant on a relatively more consistent basis over several years than EC infrastructure and intensity of competition. Firm size was never significant. However, the samples mainly consisted of SMEs and therefore large firms may not have been well-represented. Lack of goverment and executive commitment, as well as economic downturns, may explain some of the shifts in the significance of the effects of these factors on EC usage over several years.

In developing countries like NC, where foreign direct investment is limited, firms rely more heavily on financial and legislative support from their governments. They also need funding and guidance from external organizations such as the EU Commission to develop the required technology strategies, infrastructure, and organizational capabilities. Therefore, a more consistent policy approach would go a long way toward encouraging EC adoption and usage and realizing its potential benefits in these countries.

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# APPENDIX

## Table 1. Previous studies on factors affecting EC adoption/usage in developing countries

| Study | Objectives | EC definition | Theory/framework | EC adoption/usage factors | Methodology |
|---|---|---|---|---|---|
| Grandon and Pearson (2004) | To identify the variables that differentiate between adopters and non-adopters of e-commerce | Business activities conducted using electronic data transmission via the Internet and the WWW | - | Organizational readiness, compatibility, external pressure, perceived ease of use, perceived usefulness, organizational support, managerial productivity, strategic decision aids | A survey of 83 SMEs in Chile<br>Used discriminant analysis and t-tests |
| Kaynak, Tatoglu, and Kula (2005) | To investigate the EC adoption profile of SMEs and the factors affecting their willingness to adopt EC. | A composite index of the usage frequency of 14 EC application tools | - | Market development, efficiency of sales and promotion, ease of accessibility, cost reduction | A survey of 237 manufacturing SMEs in Turkey with internet connection<br>Used factor analysis, two-way ANOVA test and multiple regression analysis |
| Molla and Licker (2005b) | To explore the factors that affect e-commerce adoption in a developing country | A dichotomy of whether or not an organization has attained an interactive e-commerce status.<br>Respondents were asked to choose one of the following:<br>Not connected to the Internet, no e-mail;<br>Connected to the Internet with e-mail but no web site;<br>Static Web;<br>Interactive web presence;<br>Transactive web;<br>Integrated web | The perceived e-readiness model (PERM) | **Perceived organizational e-readiness (POER)**<br>Awareness, human resources, business resources, technology resources, commitment, governance<br>**Perceived external e-readiness (PEER)**<br>Government eReadiness, market forces eReadiness, support industries eReadiness | A survey of 150 South African firms<br>Used multiple discriminant function analysis |
| Tan et al. (2007) | To adopt and extend Molla and Licker's (2005b) PERM model | B2B EC | The PERM model | Same as those used by Molla and Licker (2005b) | A survey of 134 Chinese SMEs<br>Used discriminant analysis |
| Alam, Khatibi, Ahmad, and Ismail (2007) | To investigate the factors affecting the intention to adopt EC | Usage of the following applications based on a three-point scale: web page usage, selling of products, buying supplies, supplier replenishment, using the internet to purchase from vendors and conduct business transactions | Innovation diffusion theory | Relative advantage, compatibility, complexity, trialability, observability, security/confidentiality | A survey of 194 Malaysian manufacturers<br>Used factor analysis and multiple regression Analysis |
| Nasco et al. (2008) | To predict intention to adopt e-commerce | Not defined | The theory of planned behavior | Attitude, subjective norm, perceived behavioral control | A survey of 212 SMEs in Chile<br>Used hierarchical regression |
| Fathian et al. (2008) | To present a model that assesses the preparedness of non-profit SMEs in a developing country to adopt EC | ICTs | - | **Organizational features**<br>Skills and human resources, ICT management and policy, investment and financial support for ICT development, revenue on electronic services<br>**ICT infrastructures**<br>Information infrastructure, network speed and quality ICT services and support, ICT employment opportunities<br>**IT availability**<br>Internet availability and affordability, ICT in the workplace, people and organizations online<br>**Security and legal environment**<br>Security and encryption, legal environment and regulations | 168 surveys obtained from non-profit SMEs in Iran<br>Used factor analysis |
| Ghobakhloo, Arias-Aranda, and Benitez-Amado (2011) | To examine the factors that affect the decision to adopt EC | Initial EC adoption: measured by a single question based on a 1-5 Likert scale, where 1=more than four years; 2=next three-four years; 3=next two-three years;4=within one year; 5=current user<br>Post-EC adoption: measured by the number of EC applications used | The TOE framework | **Technological context**<br>Perceived relative advantage, perceived compatibility, cost<br>**Orgnizational context**<br>Information intensity, CEO's IS knowledge, CEO's innovativeness, business size<br>**Environmental context**<br>Competition, buyer/supplier pressure, support from technology vendors | A survey of 235 manufacturing SMEs in Iran<br>Used factor analysis, multiple regression analysis, and logistic regression analysis |

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**Table 1. Continued**

| Study | Objectives | EC definition | Theory/framework | EC adoption/usage factors | Methodology |
|---|---|---|---|---|---|
| Chan, Chong, and Zhou (2012) | To understand the factors that influence the diffusion of e-collaboration in supply chain management among SMEs | The adoption and routinization of e-collaboration tools in the supply chain | The TOE framework, interorganizational relationships (IOR), and unified theory of acceptance and use of technology (UTAUT) | Technology readiness, technology integration, geographic scope, managerial obstacles, competitive pressure, market trend expectations. trust, information sharing, partner power, performance expectancy, effort expectancy, social influence | A survey of 505 Malaysian firms Used multiple regression analysis |
| Huy et al. (2012) | To identify the factors driving the adoption of e-commerce | The purchase and sale of products and services by electronic means such as the Internet | An extended version of the TOE framework | Employees' knowledge of e-commerce, resources of the enterprise, strategic orientation of the enterprise, firm's globalization orientation, attitudes of managers towards innovation, knowledge of the new IT and of e-commerce, intensity of competition, support of industries, support of government, national IT infrastructure, suppliers and buyers behavior, perceived relative advantages, compatibility of the innovation, complexity of the innovation, perceived risk ,size of the enterprise | A survey of 926 SMEs in Vietnam Used factor analysis and logistic regression |

**Table 2. NC firms' competitiveness relative to other countries in the implementation of usage factors and in EC usage**

| Factor | 2009 Score[a] (Rank among 134 countries) | 2010 Score (Rank among 139 countries) | 2011 Score (Rank among 142 countries) | 2012 Score (Rank among 144 countries) | 2013 Score (Rank among 148 countries) | Average Score (Average rank among 5-year's average # of countries. i.e., 141) |
|---|---|---|---|---|---|---|
| **Technology availability:** | | | | | | |
| Use of latest technologies in the country | 3.99 (108) | 3.9 (127) | 5.86 (33) (Outlier) | 4.90 (74) (Outlier) | 3.75 (130) | 3.88 (122) |
| Firm-level technology absorption | 4.00 (113) | 3.8 (129) | 5.58 (27) (Outlier) | 4.60 (83) (Outlier) | 4.05 (117) | 3.95 (120) |
| **EC infrastructure:** | | | | | | |
| Effect of available Internet bandwith in the country on firms' operations and their ability to undertake new initiatives[c] | - | - | - | 4.12 | 4.19 | 4.16 |
| Internet access in schools | 4.00 (58) | 4.4 (44) | 3.06 (114) | 4.14 (72) | 3.94 (82) | 3.91 (74) |
| Access to digital content (text and visual content, software) from various platforms (cable Internet, wireless Internet, mobile network, satellite, etc.) | 4.24 | 4.90 | 5.59 | 4.73 | 5.03 | 4.90 |
| **Capabilities:** | | | | | | |
| Capacity for innovation | 2.88 (72) | 2.54 (103) | 4.25 (21) (Outlier) | 2.90 (90) | 3.10 (109) | 2.86 (94) |
| Production process sophistication | 3.16 (93) | 2.88 (113) | 2.43 (134) | 2.39 (138) | 3.15 (137) | 2.80 (123) |
| Use of modern marketing tools and techniques | 3.44 (104) | 3.40 (102) | 3.05 (122) | 2.93 (128) | 3.15 (128) | 3.19 (117) |
| Degree to which firms in the country introduce new business models, organizational structures, or new designs to differentiate their products and services [c] | - | - | - | 2.70 | 3.14 | 2.92 |
| Control of local firms over international distribution and marketing | 3.67 (97) | 3.93 (75) | 2.52 (142) | 3.16 (133) | 3.15 (137) | 3.29 (117) |
| Efficacy of corporate governance by investors and boards of directors in the country | 3.54 (129) | 3.06 (134) | 3.2 (141) | 3.20 (143) | 3.01 (147) | 3.20 (139) |
| Extent to which firms in the country have sophisticated supply chains (e.g., strategic deals with suppliers, risk management, product standards, etc.) [c] | - | - | - | - | 2.73 | 2.73 |
| **Regulatory environment:** | | | | | | |
| Extent to which government incentives to use ICT in the country have been successful [c] | 3.16 | 3.48 | 4.67 (Outlier) | 2.25 | 2.17 | 2.77 |
| Extent to which the government has a strategic plan for use of ICT to increase the overall competitiveness of the country [c] | 2.85 | 2.40 | 1.48 | 1.92 | 2.08 | 2.15 |
| Country's laws on ICT use (e.g., EC, digital signatures, consumer protection) | 3.15 (100) | - | 1.37* | 1.78* | 2.01* | 2.08 |
| **Intensity of competition:** | | | | | | |
| Level of competition in the local market | 4.06 (117) | 4.3 (102) | 4.18 (110) | 4.19 (116) | 4.46 (110) | 4.24 (111) |
| Nature of consumer buying decision in the country | 3.37 (82) | 3.25 (81) | 3.23 (83) | 3.30 (87) | 3.37 (77) | 3.30 (82) |
| Number of local suppliers | 3.95 (120) | 4.04 (122) | 3.4 (140) | 3.41 (141) | 3.82 (132) | 3.72 (131) |
| Quality of local suppliers | 3.68 (116) | 3.63 (126) | 3 (140) | 3.09 (142) | 3.49 (133) | 3.38 (131) |
| Extent to which product/service quality standards, safety and other regulations (excluding environmental regulations) hinder competition [c] | 3.15 | 2.61 | 2.40 | 3.45 | - | 2.90 |
| Extent to which anti-monopoly policy promotes competition in the country | 3.69 (81) | 3.15 (120) | 3.05 (127) | 2.60 (143) | 2.70 (144) | 3.04 (124) |
| Extent of market dominance (corporate activity) in the country | 3.44 (96) | 3.30 (138) | 3.14 (118) | 3.54 (83) | 3.03 (131) | 3.29(113) |
| Extent to which public enterprises are favored over private enterprises | 3.13 (67) | 2.78 (90) | 2.25 (127) | 2.76 (96) | - | 2.73 (95) |

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**Table 2. Continued**

| Factor | 2009 Score[a] (Rank among 134 countries) | 2010 Score (Rank among 139 countries) | 2011 Score (Rank among 142 countries) | 2012 Score (Rank among 144 countries) | 2013 Score (Rank among 148 countries) | Average Score (Average rank among 5-year's average # of countries. i.e., 141) |
|---|---|---|---|---|---|---|
| Prevalence of well-developed and deep clusters in the country (firms specialized in a specific area, suppliers, producers of related products and services, and geographic concentrations of firms) | 2.84 (117) | 2.66 (121) | 2.25 (139) | 2.53 (139) | 3.02 (131) | 2.66 (129) |
| **EC usage:** | | | | | | |
| Extent to which firms in the country use ICT to communicate and conduct transactions with other firms [c] | - | - | - | 3.45 | 3.78 | 3.62 |
| Extent to which the Internet is used by firms in the country to increase sales and reach new customers [c] | - | - | - | 2.90 | 3.47 | 3.19 |
| Extent to which firms in the country use the Internet in their work processes (e.g., to buy and sell products, to communicate with customers and suppliers)[c] | 4.04 | 2.49 | 3.93 | 3.00 | - | 3.37 |
| Extent to which ICT is used to create new work models, as well as offer new products and services [c] | - | 3.24 | 2.85 | 2.37 | 2.81 | 2.82 |
| Extent to which ICT is used to create new organizational models (virtual teams, telecommuting, teleworking)[c] | - | 2.90 | 1.88 | 2.58 | 2.67 | 2.51 |

[a]Scores are on a 1-7 scale (1= Very low competitiveness, 7= Very high competitiveness).

[b]Outliers have been excluded from the calculation of averages.

[c]Ranking data is not available.

**Table 3. Pearson's correlation to measure the relationship between usage factors and EC usage**

| Variables | 2009 Coefficient | 2010 Coefficient | 2011 Coefficient | 2012 Coefficient | 2013 Coefficient |
|---|---|---|---|---|---|
| Technology availability | 0.44* | 0.40* | -0.19 | 0.55* | 0.49* |
| EC infrastructure | 0.76* | 0.09 | 0.10 | 0.35* | 0.44* |
| Capabilities | -0.010 | 0.62* | 0.58* | 0.48** | 0.64* |
| Firm size | -0.36 | -0.09 | 0.06 | -0.04 | 0.11 |
| Regulatory environment | 0.36** | 0.35* | 0.57* | 0.55* | 0.54* |
| Intensity of competition | 0.75* | 0.16 | 0.53* | 0.52* | 0.70* |

* Significant at $p < 0.01$
** Significant at $p < 0.05$

**Table 4. The relationship between usage factors and EC usage**

| Factor | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|
| Technology availability | 0.161<br>(0.111) | 0.217**<br>(0.102) | -0.060<br>(0.062) | 0.251**<br>(0.099) | 0.247***<br>(0.084) |
| EC infrastructure | 0.648*<br>(0.115) | -0.014<br>(0.093) | 0.030<br>(0.067) | 0.145<br>(0.083) | 0.040<br>(0.095) |
| Capabilities[a] | -0.297**<br>(0.140) | 0.440***<br>(0.151) | 0.469*<br>(0.085) | 0.312***<br>(0.102) | 0.413<br>(0.902) |
| Firm size | 0.078<br>(0.137) | -0.024<br>(0.144) | -0.033<br>(0.238) | -0.084<br>(0.146) | 0.033<br>(0.122) |
| Regulatory environment[a] | 0.250<br>(0.217) | 0.216<br>(0.119) | 0.210<br>(0.105) | 0.286***<br>(0.104) | 1.604*<br>(0.432) |
| Intensity of competition | -0.045<br>(0.239) | -0.310<br>(0.211) | 0.113<br>(0.100) | -0.004<br>(0.152) | 0.408***<br>(0.122) |
| Sample size (N) | 81 | 73 | 81 | 90 | 97 |
| $R^2$ | 0.4950 | 0.3273 | 0.5951 | 0.4821 | 0.5099 |
| Adjusted $R^2$ | 0.4541 | 0.2662 | 0.5583 | 0.4447 | 0.4771 |

*$p < 0.001$, **$p < 0.05$, ***$p < 0.01$
[a]Capabilities and regulatory environment were transformed for the 2013 data to meet the assumption of normality. This is why the regression coefficient of regulatory environment is greater than 1 in 2013.

**Table 5. The relationship between usage factors and individual measures of EC usage**

| | ICT use to communicate and conduct transactions | Internet use to increase sales and reach new customers | Internet use by firms in their work processes | ICT use to create new work models and offer new products/services | ICT use to create new organizational models |
|---|---|---|---|---|---|
| Technology availability | | | | | |
| 2009 | - | - | 0.161 (0.111) | - | - |
| 2010 | - | - | -0.133 (0.126) | 0.475*** (0.157) | 0.468*** (0.150) |
| 2011 | - | - | -0.052 (0.132) | 0.038 (0.103) | -0.159 (0.092) |
| 2012 | 0.178 (0.149) | 0.368 (0.189) | 0.311 (0.185) | 0.314** (0.131) | 0.083 (0.133) |
| 2013 | 0.338* (0.125) | 0.064 (0.143) | - | 0.255** (0.116) | 0.252 (0.153) |
| EC Infrastructure | | | | | |
| 2009 | - | - | 0.648* (0.115) | - | - |
| 2010 | - | - | 0.068 (0.115) | -0.057 (0.143) | -0.071 (0.137) |
| 2011 | - | - | 0.286 (0.149) | -0.064 (0.116) | -0.144 (0.104) |
| 2012 | 0.592* (0.126) | 0.003 (0.160) | 0.075 (0.156) | -0.100 (0.111) | 0.156 (0.112) |
| 2013 | 0.138 (0.141) | 0.234 (0.163) | - | -0.023 (0.131) | -0.214 (0.174) |
| Capabilities | | | | | |
| 2009 | - | - | -0.297** (0.140) | - | - |
| 2010 | - | - | 0.245 (0.187) | 0.375 (0.233) | 0.328 (0.223) |
| 2011 | - | - | -0.001 (0.182) | 0.734* (0.142) | 0.590*(0.127) |
| 2012 | 0.226 (0.154) | 0.290 (0.196) | 0.283 (0.192) | 0.147 (0.136) | 0.614* (0.138) |
| 2013 | 1.01 (1.339) | 1.124 (1.542) | - | 1.028 (1.242) | -0.816 (1.644) |
| Firm size | | | | | |
| 2009 | - | - | 0.078 (0.137) | - | - |
| 2010 | - | - | -0.089 (0.178) | -0.036 (0.221) | 0.101 (0.212) |
| 2011 | - | - | -0.177 (0.526) | 0.231 (0.409) | -0.107 (0.368) |
| 2012 | 0.191 (0.220) | -0.546 (0.280) | -0.415 (0.273) | 0.194 (0.939) | 0.166 (0.197) |
| 2013 | -0.037 (0.181) | -0.173 (0.208) | - | 0.249 (0.168) | 0.119 (0.222) |
| Regulatory environment | | | | | |
| 2009 | - | - | 0.250 (0.217) | - | - |
| 2010 | - | - | 0.229 (0.147) | 0.153 (0.183) | 0.270 (0.176) |
| 2011 | - | - | 0.177 (0.226) | 0.259 (0.176) | 0.189 (0.158) |
| 2012 | -0.109 (0.157) | 0.554*** (0.200) | 0.292 (0.195) | 0.556* (0.138) | 0.135 (0.140) |
| 2013 | 1.590** (0.640) | 1.655** (0.738) | - | 0.795 (0.595) | 2.128*** (0.787) |
| Intensity of competition | | | | | |
| 2009 | - | - | -0.045 (0.239) | - | - |
| 2010 | - | - | 0.005 (0.260) | -0.369 (0.324) | -0.441 (0.311) |
| 2011 | - | - | 0.242 (0.221) | -0.046 (0.172) | 0.208 (0.154) |
| 2012 | 0.226 (0.229) | -0.267 (0.291) | -0.148 (0.284) | -0.062 (0.202) | 0.230 (0.204) |
| 2013 | 0.363** (0.182) | 0.086 (0.209) | - | 0.356** (0.169) | 0.887* (0.223) |

*p < 0.001, **p < 0.05, ***p < 0.01

**Table 6. ANOVA and Tukey-Kramer tests to analyze the differences in the level of usage factors and EC usage across the years 2009-2013**

| Usage factors | Source of Variation | Sum of squares | Df | Mean Square | F | P-value | F crit | Result | Tukey-Kramer test results | Conclusion |
|---|---|---|---|---|---|---|---|---|---|---|
| Technology availability | Between Groups | 205.7691 | 4 | 51.4422 | 32.4011 | 1.57E-23 | 2.39 | Significant | 2011 > 2009, 2010, 2012, 2013 | No change in technology |
| | | | | | | | | | | availability from 2009 to |
| | | | | | | | | | | 2013, except in 2011. |
| | Within Groups | 662.0579 | 417 | 1.5876 | | | | | | |
| | Total | 867.827 | 421 | | | | | | | |
| EC infrastructure | Between Groups | 10.0845 | 4 | 2.5211 | 1.8543 | 0.117613 | 2.39 | Nonsignificant | | Similar in all |
| | Within Groups | 564.2423 | 415 | 1.3596 | | | | | | years. |
| | Total | 574.3267 | 419 | | | | | | | |
| Capabilities | Between Groups | 34.6924 | 4 | 8.6731 | 8.7916 | 9.60E-07 | 2.4 | Significant | 2009 > 2011, 2012 | Worsening of capabilities |
| | Within Groups | 314.7017 | 319 | 0.9865 | | | | | 2012 < 2009, 2010 | from 2009 to 2012. |
| | Total | 349.3941 | 323 | | | | | | 2011 < 2009, 2010 | |
| | | | | | | | | | 2010 > 2011, 2012 | |
| Regulatory environment | Between Groups | 80.1915 | 4 | 20.0479 | 17.8184 | 1.63E-13 | 2.39 | Significant | 2009 > 2011, 2012, 2013 | Worsening of regulatory |
| | Within Groups | 468.0505 | 416 | 1.1251 | | | | | 2012 < 2009, 2010, 2011 | environment from 2009 |
| | Total | 548.242 | 420 | | | | | | 2012 < 2013 < 2009, 2010 | to 2013. |
| | | | | | | | | | 2010 > 2012, 2013 | |
| | | | | | | | | | 2009 > 2011 > 2012, 2013 | |
| Competitive intensity | Between Groups | 40.946 | 4 | 10.2365 | 18.3671 | 6.52E-14 | 2.39 | Significant | 2011 < 2009, 2010, 2012, 2013 | Lower level of |
| | Within Groups | 232.4052 | 417 | 0.5573 | | | | | | competition in 2011 |
| | Total | 273.3512 | 421 | | | | | | | compared to other years. |
| | | | | | | | | | | No differences across the |
| | | | | | | | | | | other years. |
| EC usage | Between Groups | 7.015 | 4 | 1.7537 | 1.7485 | 0.138961 | 2.4 | Nonsignificant | - | Similar in all |
| | Within Groups | 335.0013 | 334 | 1.003 | | | | | | years. |
| | Total | 342.0163 | 338 | | | | | | | |

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