AN EMPIRICAL STUDY OF DETERMINANTS OF E-COMMERCE ADOPTION AMONGST MICRO, SMALL AND MEDIUM ENTERPRISES (MSMES) IN KENYA

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Abstract

This study is aimed at investigating determinants of electronic commerce (e-commerce) amongst MSMEs in Kenya. This innovation has become a key initiative among organizations globally with its determinants receiving significant attention in majority of developed countries compared to their developing counterparts. The study uses Technological, Environmental and Organizational (TOE) model including Roger's perceived characteristics of innovations to analysis commerce adoption factors among MSMEs. Data are collected through self-administered questionnaire using a sample consists of 540 MSMEs in Kenya. Analyzed is done using descriptive statistical techniques, non-parametric methods (chi-square), and logistical regression analysis. Findings demonstrate that, first employee level of IT capacity, level of education, age of firm and pervaded innovation characteristics of complexity, and relative advantage have a significant positive effect on e-commerce, second perceived innovation Compatibility, complexity, trialability, observability and security/confidentiality affect e-commerce adoption negatively and third age of owner/manager and business focus have no significant effect on e-commerce e adoption. The implications of these findings on e-commerce adoption are discussed in this paper and appropriate recommendations are presented.

Keywords: E-Commerce, Determinants, Environment, TOE, Perceived Characteristics of Innovations, Non-Parametric Methods, Logistical Regression Analysis

INTRODUCTION

According to Sabah et al. (2011) the growth and development of ICT and related services have enabled business organizations "to undertake transactions, share information, and collaborate across geographical boundaries and across computing platforms and networks". The authors further opines that as long as ICT development remains high and dynamic, it follows that issues related to its solutions such as e-commerce will continue to draw enormous attention by both academicians and practitioners. The study is premised on the continuing search for answers e-commerce adoption questions especially among the micro, small and medium enterprises (MSMEs).

The Research Problem

As earlier alluded to, Micro, Small and Medium-sized Enterprises (MSMEs) has remained a significant component of development of the world economies as well as the creation of gainful employed for the poor (Mutula & Van Brakel, 2007). Like for the larger counterparts, the growth and development of the sub-sector has been affected by changes in the business environment. For example the spiraling growth of information communication technologies (ICT) solutions have remained the single most important development affecting these business organizations. This has led to the relationship between uptakes of innovations by such enterprises to continue to attract attention in many countries (Jones & Beynon-Davies, 2011).

Turban et al., (2008) defines electronic commerce (e-commerce) as 'the process of buying, selling, transferring, or exchanging products, services, and/or information through e-mail, Internet, and the world wide web.' While majority of studies in the information and communication and Technologies (ICT) area and in particular ICT solutions such as e-commerce has been on developing countries (Duncombe & Molla, 2009; Olatokun & Kebonye, 2010, Parker & Castleman, 2009), inadequate attention has been given to developing countries (Molla & Licker, 2005). According to Spanos et al. (2002), uptake of information systems must be done in the context of obtaining specific organizational, technological and environmental factors which invariably differ significantly between countries. This, arguably, makes findings from developed countries inapplicable to developing countries. Further, there also limited understanding of the factors that drive or inhibit uptake of e-commerce among MSMEs in majority of developing countries Kenya included.

Adopting e-commerce by MSMEs especially in developing countries has not been easy (Jones, Packham, Beynon-Davies, & Pickernell, (2011) with the main solutions used being applications taking the form of simple technologies such as electronic mail (Mpofu et al., 2011). This study is therefore justified to the extent that it will address the issues such as a) insufficient

research on Sub-Saharan African countries except probably South Africa, 2) limited comprehension of nature of the determinants (drivers and inhibitors) of ecommerce adoption in developing countries.

Research Objectives and Research Hypothesis

Guided by the research problem above and supported by previous empirical discussion, this study seeks to investigate the determinants E-Commerce adoption among MSMEs in Kenya. Specifically, the study seeks to

a) Analyze the effect of the organizational, environmental and technological factors on e-commerce adoption;

b) Explain the effect of the interaction between e-commerce adoption determinants on likelihood of e-commerce adoption.

This study will therefore be principally explanatory guided by the following two key research hypotheses:

H_{A1}: There a statistically significant relationship between the likelihood of adoption and customer perception of organizational, environmental and technological determinants;

H_{A2}: There a statistically significant difference between the interactions of innovation perception determinants and the likelihood e-commerce adoption.

LITERATURE REVIEW

Previous E-commerce studies, by for example Cragg and King (1993), categorize the innovation adoption factors as drivers and inhibitors. Earlier these factors were had been classified, by Tornatzky and Fleischer (1990), as technological, the organisational, and the environmental contexts (TOE).

Technological Factors

Scupola, (2009) looked at technological factors affecting e-commerce adoption as those that are not only obtained from the nature and characteristic of the ICT but also as they are perceived by users of potential users. The latter dimension includes innovation attributes such as relative advantage (perceived innovation benefits and impact), compatibility (both technical and organisational), and complexity (ease of use or learning e-commerce) and security/confidentiality.

Regarding relative advantage, Jeon et al. (2006) defines this attribute as the perception of the characteristics of the technology as measured by time saving and effort, economic profitability and cost reduction. Contrary to the result by To and Ngai (2007) that perception of

relative advantage significantly affects adoption of e-commerce, that of Huy (2012) found that the attribute has no significant influence of the innovation adoption by MSMEs.

Result of a study by Grandon and Pearson (2004) shows that compatibility of the innovation with a firm's culture and values significantly affects the likelihood of the technology being adopted. The position was later confirmed by a study by To and Ngai (2007) which concluded that compatibility of the innovation n as an important pre-requisite for technology adoption.

Ratten and Ratten (2007) found a significant relationship between perceived observability and the adoption of e-commerce implying that the various beneficial operations of e-commerce may influence the decision by MSMEs to adopt the technology. The findings of this study, nonetheless, contradict those by previous researchers, for example, To and Ngai (2007), that observability which found no significant effect of the attribute on adoption of e-commerce.

Confidentiality and security have been discussed broadly both in academia and practice. Confidentiality is defined as the ability to control and manage information about oneself, while security refers to the ability to protect against potential threats. From the consumers' standpoint, security is the ability to protect consumers' information from information fraud and theft in the online banking business (Hua, 2009). Therefore, heightened security concerns could stop potential damages ensuing from insecure transactions, hacking, or poor access control to important data. Hesson and Alameed (2007) and Belkhamza and Wafa (2009) found that security and confidentiality issues and the system risks of e-commerce are the major determinants of adoption behaviour.

Lee et al. (2011) found a significant relationship between trailability and e-commerce adoption or intention to use. Trailability is defined as the degree to which an innovation could be tried out on a limited basis (Rogers, 2003). In other words, the test-drive of an innovation is provided by the technology's trailability and its ease of use. Trailability offers a chance for customers to evaluate an innovation such as e-commerce and its benefits. Thus, opportunities which allow latent adopters to have prior experience with a new innovation or product would reduce their fears and uncertainties. In addition, when a new idea or innovation is trailable, any doubt or vagueness associated it will be dispelled and hence an increase in the level of confidence in its use.

According to Rogers (2003), complexity is the degree of difficulty associated with understanding and learning how to use an innovation. Grandon and Pearson (2004) and Mahazir and Mohd (2012) found that perceived complexity is a vital factor influencing the decision to adopt e-commerce and that the likelihood of adoption of the innovation is inversely related to the perceived complexity variable especially amongst the MSMEs. The introduction of

new technology might require the employees to develop new skills in order to use the technology. Rogers (2003) contends that the new technology can be intimidating, particularly if it requires change in the existing businesses practices or acquisition of new skills. The measurement of perceived complexity or ease of use can be in the context of how e-commerce can be easily controlled, the degree of flawlessness, reasonableness, adaptability to changes, user friendliness, and how easy it is for one to become skillful in using e-commerce.

Organisational Factors

Empirical results supporting the influence of organisational characteristics suggest that the determinants of e-commerce adoption are employees' knowledge of e-commerce (Scupola, 2005) and the size of the enterprise (Zhu & Kraemer, 2005). These results are dissimilar to findings reported by Jeon, et al. (2006) with regard to the employees' knowledge of e-commerce and to reported results by Vilaseca-Requena, et al. (2007) with respect to the resources of the enterprise.

Huy (2012), in a study on the significance of organisational determinants as factors of adoption also found that employees' knowledge of e-commerce, size of the enterprise, and attitude of managers towards innovation were positive and statistically significant. Other findings also confirm the positive relationship between the attitude of managers towards innovation and adoption (Al-Qirim, 2007), but the relationship is not significant regarding knowledge of the new information technologies of e-commerce.

According to Dubelaar, et al. (2005), the level of education of the owner/manager has a positive and significant relationship with the likelihood of adopting an innovation. Similarly, Ramdani, et al. (2009) found that lack of knowledge was the main barrier to the use of e-commerce and ICT among MSMEs. Chang and Tung (2006) found that the CEO's knowledge of technology has a significant relationship with e-commerce adoption among MSMEs Nguyen (2009) also found a statistically significant relationship between the status of e-commerce in the SMEs and the perception of lack of knowledge as a barrier. These results support the view that having adequate education level by the owners or managers of MSMEs alone is not a necessary condition for such firms to adopt e-commerce, but they must also have relevant knowledge in ICT use.

Lun et al. (2012) found that organisational size, which is an indicator of the level of operational resources of the company, is positively and significantly related to e-commerce adoption. This is in line with earlier studies by, for example, Zhu and Kraemer (2005) and Adeyeye (2008). On ICT skills and experience by employees, Sparling et al. (2007) found that the higher the level of ICT skills, the higher the likelihood that a firm will adopt e-commerce.

That is, previous IT experience has been observed to be an important factor influencing the success of e-commerce adoption. Filiatrault and Huy (2006) found a significant relationship between types of business (governmental, local, or foreign organisation; characteristics of products; and number of product categories) and the likelihood of e-commerce adoption.

Environmental Factors

The external environment of the SME organisation also impacts some challenges to e-commerce adoption. It describes the realm of business engagement of the firm (Scupola, 2009). Huy (2012) found a positive correlation between e-commerce adoption and the manager's perception of the intensity of competition, support of industry pressure, supplier and buyer behaviour, and sector of business operations. These findings conform to those of prior studies by Al-Qirim (2007) and To and Ngai (2006) but are inconsistent with those of Jeon et al. (2006) and Vilaseca-Requena et al. (2007). It has widely been argued that the industry in which the firm operates influences the adoption of information systems, including e-commerce innovations. Service industries, retail industries, and the manufacturing industry were the key sectors that demonstrated a significant relationship with innovation adoption. The authors further established that usage of information systems varies not only across sectors but also within the constituent sub-sectors.

The role of market scope as a predictor of the adoption of e-commerce can be explained from two main perspectives. Firstly, internal coordination costs increase as firms expand their market reach due to increased administrative complexity and information processing. Secondly, external costs (search costs and inventory holding costs) would also increase with market scope; that is, when firms expand their market reach, they incur search costs, which include searching for consumers, trading partners, and distributors. Arguably, firms that serve broader markets are more likely to adopt e-commerce, thus SMEs with greater market scope are more likely to adopt e-commerce.

Vilaseca-Requena et al. (2007) has also established that there is a positive and significant relationship between competitive pressure and the adoption of e-commerce. The plausible argument for this observation is that if the innovation directly affects the competition, then the adopter will have an incentive to take up the technology. According to Vilaseca-Requena the greater the competitive pressure, the more likely that MSMEs will adopt e-commerce. There is also evidence that the growth of third-party information systems support has a significant influence on the likelihood of e-commerce adoption whereby the greater the external support, the more likely they will be adopted by SMEs,

Porter (2008) has suggested that the adoption of IT will change the competitive environment in three ways: through changing the structure of the industry, changing the rules of competition, and giving businesses new methods by which to gain competitive advantage over the competition. According to Sandy and Graham ((2007), intensity of competition is associated with the degree of e-commerce adoption and that competitive pressure is a critical factor influencing the extent of e-commerce adoption among MSMEs.

In contrast, Pan and Jang (2008) found that competition has very little influence on the adoption of new technologies or e-commerce in small enterprises. But a study by Thomas and Simmons (2010) produced contrary results. A relationship also exists between the intensity of competition in an industry and the degree of adoption of electronic commerce. According to Kinyanjui and McCormick (2012), ensuring competition and entry opportunities for other market players, particularly smaller ones, must be an on-going policy priority. Intensity of competition is measured by the number of competitors in a given sub-sector category.

Regarding information intensity, MSMEs in a more information-intensive environment are more likely to adopt e-commerce technology (Pavic, et al., 2007). For instance, these authors found that MSMEs in service-oriented industries are more likely to have higher information content in their products and services in comparison to SMEs in manufacturing-oriented industries. Hence, MSMEs that are oriented to the service industry are more likely to adopt e-commerce technology. Al-Qirim (2007), who investigated the impact of information intensity on the adoption of e-commerce among MSMEs, found that the information intensity was influenced by the adoption of the technology.

METHODOLOGY

The study was guided by a mixed research design of descriptive and explanatory nature. This design was considered useful since this study involved determination of the statistical significance of the relationship between the dependent variable (adoption of e-commerce) and explanatory variables (customer perception of innovation determinants).

To obtain a representative sample of target population consisting of 1,800 firms, defined as registered firms and conforming with Kenya Revenue Authority (KRA) tax compliance requirements, the firms were stratified as micro (1-9 employees), small-sized (10 – 49 employees) and medium sized (50 – 250 employees) resulting into a proportionately selected sample of 204 micro, 288 small and 48 medium totaling to a sample of 504 firms.

Data were collected using a self-administered questionnaire, which was mailed out to the consumers. In order to increase the response rate and thereby minimize the risk for non-response bias, A total of 386 returns were received by the deadline giving a 77% response

rate distributed as follows micro (144), small (203) and medium (34). In terms of variable measurement, while the adoption variable was dichotomous, the explanatory ones were both quantitative and qualitative (mostly Likert Scale).

Modeling and Model Specification

Data analysis consisted of descriptive, non – parametric methods and logistical regression with the latter being presented below.

By letting Y = e-commerce adoption, where Y is a binary variable with Y = 1 if the technology is adopted and Y = 0 otherwise. Consider a collection of n explanatory variables denoted by $X'' = \{x_1, x_2, x_3, x_4 \ldots \ldots x_n\}$/ Let the likelihood (probability) of a firm adopting s e-commerce is donated by:-

$$P(Y=1 \mid x_i) = \pi(Y) \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots 1$$

where $\pi(Y)$ is a nonlinear function of the best combination of the explanatory variables. The Logit of the multiple regression model is then given by:

$$Z = \beta_0 + \sum_{i=1}^{n} \beta_i X_i + \varepsilon \quad \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots 2$$

$$z = In\left(\frac{p}{(1-p)}\right)$$

where Z is defined as follows: $\ldots \ldots \ldots \ldots \ldots \ldots 3$

On the basis of 2, the logistic regression model is given by the following relationship:-

$$\pi(Y) = P[Y = 1] = \frac{e^{\beta_0 + \sum_1^{18} \beta_i X_i}}{(1 + e^{\beta_0 + \sum \beta_i X_{i=}})} \quad \ldots \ldots \ldots \ldots \ldots \ldots \ldots 4$$

From 4, the probability that Y=0, that is, the likelihood that a firm does not adopt e-commerce is given the effect of one or a combination of the explanatory variables = $1-\pi(Y)$ or simply:-

$$P[Y = 0] = \frac{1}{(1 + e^{\beta_0 + \sum \beta_i X_{i=}})} \quad \ldots \ldots \ldots \ldots \ldots \ldots \ldots 5$$

Noting that for theoretical and mathematical reasons, Logistic Regression Analysis (LRA) is based on a linear model of natural logarithm of the odds (the log.odds) in favour of $Y_i = 1$, then the log of the ratio of adoption and non-adoption of e-commerce as show below:-

$$In\left[\frac{P(Y = 1/X_1, X_2 \ldots X_n)}{(1 - P(Y = 1/X_1, X_2 \ldots X_n)}\right] = In\left[\frac{\Pi(x)}{1 - \Pi(x)}\right] \quad \ldots \ldots \ldots \ldots 6$$

From the theory of Logistical Regression Analysis 1 and 6 can be combined to produce:-

$$In\left[\frac{\Pi}{1-\Pi}\right] = \beta_0 + \beta_1 X_1 + ... + \beta_n X_n$$

………………………..7

ANALYSIS AND FINDINGS

In this study, an attempt was made to answer to the question: "What are the determinants of e-commerce adoption of e-commerce among Kenya's MSMEs. In order to do so, we performed both the non-parametric Chi-square tests of independence and logistic analysis (Table 1).

The Chi-square test was undertaken on the effect of organizational factors such as firm size as well as owners/manager's educational level, age, gender on e-commerce at 5 % level of significance. The study results demonstrate that except for year of establishment (p-value = 0.462) the rest of the organizational factors such as level of IT intensity use (p-value = 0.002) firm size (p-value = 0.000), owner/manager's age (p-value = 0.007), level of education (p-value = 0.000) and gender (p-value = 0.003) are statistically significant to the extent of their effect on e-commerce adoption.

Regarding the Logistic regression analysis, Table 1 shows the results of the test of the research model to determine if the significance of the coefficients supports the stated hypotheses. The resulting Likelihood ratio (=67.125) shows a strong relationship between the dependent variable and the independents variables. The Nagelkerde R square showed that about 87.2% of the variance was explained by the logistic model. The Hosmer and Lemeshow Chi-square (=131.275, p = 0.031) indicates that the logistic regression model is significantly different from a perfect model that correctly classifies all respondents into their respective groups

Overall, these results are in line with those of previous studies. For example, Ramdani, et al. (2009) found that one of the key predictors of adoption of innovations is firm size since it can be argued that larger firms larger the size of the business, the more likely e-commerce will be adopted by firms.

In terms of the importance/significance of effect of organizational, environmental and technological determinants our results derived from logistical regression analysis were in line with the results of previous studies. Among organizational characteristics the issue was employee's knowledge in IT, level of education age of owner/manager, Gender, Age of Firm, Business Sector and Size of Firm. Table 1 shows the regression results on e-commerce adoption and perception of selected organizational factors.

Table 1: Regression Results on E-commerce Adoption and selected the Critical Determinants

Explanatory Variable	Estimated Coefficient	P-Value
Organizational		
Employee level of IT capacity	+1.122	0.011*
Level of education	+1.451	0.000*
Age of owner manager	0.225	0.066
Gender	+0.268	0.019*
Age of firm	+0.012	0.049*
Business focus	+2.112	0.550
Business type	+2.001	0.035
Size of firm	+3.212	0.000*
ICT Capacity	+1.050	0.001 *
Technological		
Pervaded innovation Compatibility	.-2.080	0.020*
Pervaded innovation Complexity	-2.129	0.012*
Pervaded innovation Relative Advantage	+2.102	0.041*
Pervaded innovation Trialability	-1.101	0.030*
Pervaded innovation Observability	-1.610	0.011*
Pervaded innovation Security/confidentiality	-2.101	0.043*
Environment		
Supplier pressure	+2.221	0.022*
Sector of business operation	+1.111	0.000*
Competition intensity	+2.000	0.012*
Customer pressure	+1.010	0.015*
N	351	
Nagelkerke R-Square	0.872	
Hosmer and Lemeshow Chi-square	131.275	0.031
-2log likelihood	67.125	

* Significant at 5% level of significant

The regression model supports nine teen of the stated hypotheses either positively or negatively.

Positively Supported Determinants

Because the following measures were found to have significantly positive coefficients, this research suggests that the following factors support e-commerce adoption in Kenya's MSMEs:: employee level of IT capacity, Level of education, Gender, age of firm, size of firm, IIT Capacity, pervaded innovation Complexity, perceived innovation Relative Advantage, supplier pressure, sector of business operation, competition intensity and customer pressure

Negatively Supported Measures

Five measures were found to have significantly negative coefficients suggesting that these measures inhibit e-commerce adoption in Kenya's MSMEs: pervaded innovation Compatibility, pervaded innovation Complexity, pervaded innovation Trailability, pervaded innovation Observability, pervaded innovation Security/confidentiality. The **unsupported hypotheses:** The coefficients for five variables were not statistically significant and included: age of owner manager and business focus

DISCUSSION

The overall objective of this study was to assess the critical determinants explaining the e-commerce adoption amongst Kenya's MSMEs. In this section, we present a discussion of the results in three categories: Organizational, Environmental and Technological determinants. Towards the realization of the overall objectives, the study was specially designed to assess the effect of: organizational, technological and environmental on e-commerce adoption.

Category 1: Technological Constructs

While the results show positive and significant relationship between e-commerce and the attributes of relative advantage, compatibility, trailability and observability, there was a negative but statistically significant the relationships between e-commerce adoption and complexity nd security/confidentiality. The above results are in line with earlier studies, which found a significant relationship between the perception of the six innovation characteristics and the likelihood of e-commerce adoption. For example, relative advantage is one of the best predictors that are positively related to an innovation's rate of adoption (Alam et al. 2007). The advantages of e-commerce are viewed in terms of overall reduction in operating cost, market expansion, increase in customer base, and improvement of public relations. In addition, Alam et al. established that an innovation is more likely to be adopted when it is compatible with the individuals' job responsibility, value system, previous ideas, and existing business operations. Thus, when an innovation is perceived as relevant, both technically and financially, then the likelihood of adoption by the MSMEs will be higher.

On complexity (perceived ease of use, PEU) and security/confidentiality these are consistent with those from studies by Pavic, et.al. (2007) and Alam et al. (2007) found an inverse but statistically significant relationship between the two sets of variables and the likelihood of e-commerce adoption. The explanation for these results is that the more complex and insecure an innovation is perceived to be, the less likely it will be adopted. Thus, higher levels of perceived insecurity and lack of confidentiality are associated with decreased

intentions to adopt e-commerce. The results of this study on observability and the likelihood of adoption of e-commerce contradict those by Ratten and Ratten (2007) who found that observability does not affect the adoption of e-services. The immaturity of e-comerce among Kenya's MSMEs could explain the difference in result. On the other hand, the result on the relationship between perceived trailability or the degree to which an innovation is capable of being tried on a limited basis was consistent with earlier studies. Rogers (2003) found that trailability had a significant effect on using and adopting the innovation.

Category 2: Organizational Constructs

Firstly, this study tested the hypothesis that there was a significant relationship between firm demographic variables (size, age, business type, business focus, and ICT capacity) and e-commerce adoption. Results on firm age of the firm were consistent with findings by Lun and Quaddus (2011) and that is that organisation size has a positive and significant effect on e-commerce adoption. This supported by those in the study by Sparling, et al. (2007) larger firms were more inclined to have a more external business focus and higher ICT capacity which are incentives to e-commerce investments.   As was postulated by Filiatrault and Huy (2006) business type and focus, are critical for e-commerce investment decisions in terms of direction of the effect.

Regarding size of the firm and e-commerce adoption our study findings are in line with the earlier empirical studies reviewed in literature. For example, a study by Bharati and Chaudhury (2006) demonstrated that size of the organization has the potential to influence e-commerce adoption decisions.   Larger firms are known to have plenty of resources at their disposal while a small firm will find it very challenging to acquire such systems due to resource limitations. In addition, found that larger firms are more likely to adopt more complex e-commerce systems than their smaller counterparts

A core function of an owner/manager is to executive decisions on among others financial resources for investment and, acquisition of new technology. Evidence from literature demonstrates the significance of the owner or manager in the adoption and e-commerce amongst MSMEs (Stockdale & Standing, 2006). Other studies also show that a combination of owner/manager perspectives and attitudes is a critical impetus for adoption of innovation (Wilson et al., 2008). This study finding on gender was consistent with the results from a study by Alam et al, (2007) which established that there is higher likelihood of female-managed MSMEs adopting an innovation than those headed by their male counterparts. The explanation for this was that while males were more concerned with "hard" organisational issues whiles their female counterparts focussed on "softer". Contrary to our finds and that of Alam et al,

Laukkanen and Pasanen (2008), established that males are more likely than females to adopt e-services due to cultural factors.

A significant number of previous works support the results of our study. For example Looi (2005) found that an acceptable level of ICT and e-commerce knowledge of the owner or key manager can assist the MSME to adopt appropriate e-commerce activities in their business. In addition Montazemi (2006) also found that MSMEs appropriate level of ICT and e-commerce is a pre-requisite to making better managerial e-commerce decisions-making. Further, it is also necessary that the owner/manager and other key personnel in MSMEs attain an acceptable *level of education* in order to drive e-commerce activities in their firm. Consistent with the results, of our study, that by Sarosa & Zowghi, (2003), Dubelaar, et al.(2005) and later by Ramdani, et al. (2009) found that one of the criteria for successful e-commerce adoption amongst SMEs is the level of education. It is evident from these findings that higher level of education without the requisite technical ICT knowledge and skills may not adequately provide the necessary motivation for investment in e-commerce.

Regarding age of the owner/manager, our study shows an inverse relationship between age and the likelihood of e-commerce adoption. This is consistent with that by Talebi and Tajeddin (2011) who in their study of Iranian MSMEs, found that factors such as age had a significant but positive effect on innovation adoption and business growth. The reason provided for this observation was that firms founded or managed by younger owners/managers with higher educational levels were more likely to invest in new technology.

Category 3: Environmental Constructs

It was hypothesised in this study that there is a significant relationship between selected environmental variables (supplier pressure, sector of business operations, competition intensity, and customer pressure) and e-commerce adoption.

The results on information intensity, competition intensity, and customer pressure were consistent with findings from studies by Pavic, et al., (2007), Al-Qirim (2007) and To and Ngai (2007). These findings suggest that there is a higher likelihood of e-commerce adoption by firms operating in a business environment characterised by intense information needs and high customer and supplier/competitive pressure (Joen et al. 2006). On the other hand, even though it has been argued that the industry in which a firm operates influences e-commerce adoption (Al-Qirim, 2005), this study produced a contrary result. The nature of Kenya's MSME environment where firms operate in more than one sub-sector can be used to explain this observation.

CONCLUSIONS

The study made several conclusions on objective one. First, the e-commerce environment in Kenya's MSME sector had more knowledge-based than non-knowledge-based firms and that a greater proportion of these firms belonged to the small enterprises subsector. Second, majority of the owners/managers were young and had relatively higher educational levels. Third, the external environmental factors obtaining in the e-commerce environment, namely, customer pressure, supplier pressure, ICT capacity, and a competitive environment were considered as significant factors influencing decision-making especially so among the small and medium enterprises. Finally, the technological factors of perception of relative advantage, compatibility, complexity, trailability, observability, and security/confidentiality were considered as critical decision factors involving e-commerce adoption in Kenya's MSME sector.

On the second objective, the study concluded that the likelihood of e-commerce adoption was significantly affected by owner/manager's age, level of education, gender, age of firm, size of firm, and the firm's ICT capacity. Similarly, supplier pressure, sector of business operation, market focus, competition intensity, and customer pressure had a significant effect on e-commerce adoption decisions. The study further concluded that there was a significant relationship between e-commerce adoption and the technological factors of perceived compatibility, complexity, observability, trailability, and security/confidentiality.

Following results from the regression analysis, the study concluded that organisational factors (position in firm, age, level of education, firm size, age of firm and ICT capacity); environmental factors (supplier pressure, competitive intensity, sector or business operation, and customer pressure); and technological factors (perceived innovation characteristics) affect e-commerce adoption in different ways. For example, while level of education, age of owner/manager, business focus, perceived complexity and perceived security/confidentiality were inversely related to the likelihood of e-commerce adoption, a direct relationship existed between the likelihood of e-commerce adoption and gender, firm size, age of firm, perceived relative advantage, perceived compatibility, perceived trailability, and perceived observability. Similarly, a direct relationship was observed between the likelihood of e-commerce adoption and supplier pressure, sector of business operation, competition intensity, and customer pressure.

The study further concluded that interaction of the organisational factors with technological and environmental factors enhanced the magnitude of significance of the owner/manager's position without altering the direction of the effect. However, the direction of the effect of level of education changed from inverse to direct. The study concluded that interaction with technological factors enhanced the magnitude of significance of the effect of firm

size and business type on likelihood of e-commerce adoption but there was a decrease in the significance of the effect of age of firm, business type, and ICT capacity on e-commerce adoption.

According, the study the magnitude of the significance of the effect of relative advantage, compatibility, complexity, and operability increased while that of trailability diminished slightly. Further, there was a change in the direction of the effect of compatibility, trailability, and observability on the likelihood of e-commerce adoption while that of relative advantage, complexity, and security/confidentiality remained unchanged.

STUDY LIMITATIONS

It is recognised that this study had some limitations. Firstly, the study made cross-cultural references to studies undertaken internationally. Such reference may not have been entirely appropriate, but was inevitable due to the dearth of previous studies of e-commerce and its implications. Differences in the results of this study and those obtained elsewhere may be explained partly by the cross-cultural differences in socio-economic settings and MSMEs practices. Secondly, in terms of methodology, the study was designed to target a large number of e-commerce adopters across the sectors in Nairobi. Though this was largely met, research attempted to attain as high a response rate as possible, lethargy and lack of trust led to a non-response rate of 24 per cent. Further, the lack of understanding on the part of the respondents, especially among the micro and small enterprises, may have affected the accuracy of results as they relate to the concept of e-commerce and its place in the overall operations function within the firm. Least, the research design was cross-sectional rather than longitudinal which is more appropriate for adoption studies. However, the longitudinal research design could not have been possible in this study in the absence of relevant data.

RECOMMENDATIONS

From the practitioner's perspective, the study has highlighted the critical factors that influence e-commerce adoption. Because owner/manager's age, level of education, and gender are key factors for e-commerce adoption, the management and/or owners of MSMEs should take cognisance of such factors when designing organisational policies.

Regarding the perception of technology by the owners/managers, intervention programmes targeting attitude change should be instituted to enable firms to eliminate barriers to e-commerce adoption while at the same time enhancing the impact of the drivers of innovation uptake. The study indicates that for sustainable e-commerce adoption, emphasis must be placed on enabling firms to grow, creating relevant capacity building programmes for

owners/managers and employees, and improving the ICT infrastructure while at the same time taking cognisance of the effect of environmental factors.

This study sought to assess e-commerce adoption among Kenya's MSMEs in Nairobi. The study was limited to the use of the adoption model using longitudinal data. Due to this, limitation, it is recommended that future research be undertaken using extended diffusion models in the context of Kenya's MSMEs to enable the actual performance of the firms to be determined as a function of the extent of e-commerce adoption.

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