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## **A Study on the Influencing Factors of E-Commerce Adoption Among Small Medium Enterprises in Democratic Republic of the Congo**

**Kinkani Batekele Hervé-Landry<sup>1</sup> Tumana Maseka Lopez<sup>2</sup> Gerendawele Ngbase Henry<sup>3</sup>**

<sup>1</sup>: School of Management, Wuhan University of Technology

<sup>2</sup>: School of Psychology, Central China Normal University

<sup>3</sup>: School of Economics and Management, University of Kinshasa

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**ABSTRACT:** *The purpose of this study is to explore the challenges or barriers to e-commerce adoption among SMEs in Democratic Republic of the Congo beyond the specific content covered in such interventions, and how infrastructural development might moderate those effects. The study also not only discusses that e-commerce adoption is imperative for the overall performance of SMEs, but also talks about how to mitigate the challenges. Qualitative as well as quantitative research methodology has been adopted in this study. A semi structured interview was conducted for getting an insight about e-commerce adoption. The researchers have found from the survey that there are different factors that affect the adoption of e-commerce which can be classified into three broad categories; technological, organizational and environmental factors. Although technological barriers are important challenges for e-commerce adoption in developing countries like DRC, but the importance of other barriers cannot be discriminated. Results of testing the model discovered two important findings: first, technological barriers, organizational barriers and environmental barriers have a direct negative relationship with e-commerce adoption. The results further show that technological barrier is the most determinant factor of e-commerce adoption followed by environmental and organizational factors respectively. Second, the moderating effects of infrastructural development was tested, which showed that the barriers have a more negative effect on e-commerce adoption for SMEs utilizing rural infrastructure than for urban SMEs.*

**KEYWORDS:** E-commerce adoption, technological barriers, organizational barriers, environmental barriers, small and medium enterprises.

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### **INTRODUCTION**

Electronic commerce, commonly known as e-commerce, is trading in products or services using computer networks, such as the Internet. It is undeniable that e-commerce has changed the way in

which business is conducted; it has not only changed the way people sell, purchase or deal with their customers and suppliers but it has also changed the business perspective from “production excellence” to “customer intimacy” (Macgregor & Vrazalic, 2005) and from being “agent of seller” to being “agent of buyer” (Achrol & Kotler, 1999), and the business focus from physical goods alone to a service, information and intelligence focus (Rayport & Jaworski, 2001). As a result, the new economy era - the information era - has been created. As of now, almost all both developed and developing countries are enhancing the diffusion and adoption of e-commerce. It is a pity that most African countries, including the Democratic Republic of the Congo are lagging behind in this.

The business trading landscape has shifted from brick-and-mortar to digital competition as a result of Fourth Industrial Revolution (4IR) demand and the introduction of new and improved technology (Koe & Sakir, 2020), a phenomena known as digitalization. As a result of digitalization, businesses and economies depend upon technology to survive and develop (Mthembu et al., 2018).

Digitalization is the process of integrating and utilizing digital technologies, also known as information and communication technologies (ICTs) (Pollitzer, 2018), to improve a business model and offer new chances for creating products and services while adding value (Gurau, 2021). ICTs have improved many aspects in various industries, including lowering production and labor costs in the manufacturing industry (Rafikov & Ansary, 2020) and increasing productivity and operational efficiency in agriculture (Andreoni et al., 2021), thereby improving overall business sustainability (Chauhan et al., 2021).

Businesses are facing difficulty adapting to ICTs due to challenges with IT infrastructure implementation and integration, the shift from traditional to digital-based market competition, financial resource constraints, and the uncertainty of whether these changes will result in profitability (Kiel et al., 2017). Furthermore, despite gains in ICTs (technologies), Murthy et al. (2021) contend that digitalisation has generated inequities between developed and poor countries, resulting in unequal development of the digital economy, which is currently dominated by wealthy countries. E-commerce is believed to be an ICT that can help developing countries outperform affluent countries by raising national GDP (Kabir et al., 2020).

E-commerce is defined by Koe and Sakir (2020) as conducting business transactions in a digital form or using the Internet. E-commerce provides businesses with the opportunity to grow and flourish (Koe & Sakir, 2020) and has been found to positively contribute to economic growth, independent of the level of development of a country (Kabir et al., 2020; Myovella et al., 2020). According to Mthembu et al. (2018), the most significant barrier to adopting and using e-commerce in developing countries is inadequate telecommunications, such as poor network quality, internet speed quality, and internet and bandwidth costs. Other challenges include customers' trust and security concerns about the use of their credit card information at online

check-outs (Alyoubi, 2015; Mthembu et al., 2018), as well as a lack of adequate education and technological skills for the e-commerce industry's development and sustainability (Mthembu et al., 2018).

A lack of managerial skills for online business environments (Sila, 2019), unfit and unreliable logistical networks, and insufficient or absent legal and regulatory policies governing e-commerce (Alyoubi, 2015; Cuzovic & Labovic, 2019) have been identified as potential barriers to adopting and using e-commerce in developing countries. Although these constraints have an impact on e-commerce adoption in developing countries, firms who do not adopt e-commerce would struggle to operate in a digital-based economy (Kiel et al., 2017).

Despite the number of obstacles that developing countries face when implementing e-commerce, the potential benefits are numerous. According to Lekmat (2018) and Myovella et al. (2020), e-commerce enables SMEs in developing nations to obtain access to worldwide markets, allowing them to broaden their reach. As a result, this expansion creates growth prospects in the form of enhanced industry knowledge, allowing these companies to develop new products or services and enter new markets. Koe & Sakir (2020) and Lekmat (2018) contend that SMEs see e-commerce as a way to improve their company operations and performance. The performance, which can be financial, operational, or non-financial, contributes to the company's (organization's) progress through process improvement (El-garaih et al., 2020).

Furthermore, in spite of the opportunities e-commerce presents, it also has poses certain challenges which are sometimes too much to handle for start-ups: internet is the backbone of e-commerce. For example, in many developing countries internet penetration is so far dismally low at 0.5 per cent of the population, penetration of personal computer (PC) as low as 3.5 per thousands of population and penetration of telephone only 2.1 per cent of population, ecommerce is not easily reachable remains to the common man (Rina, 2016).

The above paragraph clearly paints a picture that there is a huge digital divide between developed and developing countries in as far as diffusion and adoption of e-commerce is concerned. Many studies have therefore, recommended that it is incumbent upon governments to be vigilant in promoting diffusion and adoption of e-commerce. For example, one study by Eid (2011), indicates that the government's role in developing countries as an important one that facilitates the essential requirements for the development of e-commerce such as providing robust secure online payment options, ensuring a solid ICT infrastructure, providing educational programs and building up awareness using different means such as media and education institutions. Results of another study also show the significance of government promotion and support as a crucial factor (AlGhamdi et al., 2011). Molla and Licker (2005), state that the government demonstrates strong commitment to promoting e-commerce. The findings of this study will contribute in helping Congolese Government and other stakeholders to improve on how to use e-commerce. The results of the study will also contribute in offering insight into assessing challenges affecting promotion and adoption

of e-commerce in the Democratic Republic of the Congo. More importantly, this study will contribute in the body of literature on e-commerce in general and DRC in particular.

## **LITERATURE REVIEW**

### **E-commerce and SMEs**

#### **E-commerce and Internet**

The internet is now regarded as one of the most crucial networking tools and techniques. It is seen to have contributed to the dissemination of knowledge globally and is a necessary means for sharing experiences and knowledge, the dissemination of culture and knowledge and the creation of communication bridges between many developing and developed economies. The internet is one of the most useful and vital tools for many SMEs and large companies, especially in developed economies. E-commerce has become an essential channel for many businesses and could, therefore, be conducted via the internet (Mavimbela & Dube, 2016).

In 1960s it started with Electronic Data Interchange(EDI) this technology provided standards for exchanging data through electronic means, in this way it brought opportunity for companies that's may be situated in different countries that's electronically interchange documents, purchase orders, invoices and shipping notices among others. During the year 1979 online shopping was invented by an English man called Michael Eldritch that invention was known as teleshopping his system connected a modified TV to a real time processing computer through a domestic telephone line; however, the system did not become economically viable until the internet. In 1980 and 1990s implementation of B2B and B2C transactions with a great example of NISSAN's online customer credit checking was witnessed also in 1990 Berners Lee created the first World Wide server and a browser, successfully a connection between HTTP client e-commerce is about to change completely and taking over the world.

In the year 1994 and 2004 the great debuts i.e. yahoo, Google, Amazon, PayPal, EBay their stores and services consistent expansion of the internet giants and ecommerce business emerged as the easy ways. in 2004 payment card industry was formed in order to increase controls around cardholder data to reduce credit card fraud via its exposure During the year 2004 and 2009 another five years of ecommerce expansion was witnessed including mobile commerce that is (ecommerce evolution).

Kabango and Asa (2015) said that Information and communication technology (ICT) is radically transforming the way individuals, organizations, and governments work. The internet in today's information societies has become an essential channel that is used for dissemination of information, products, and services. People prefer to use the internet as a transaction tool in different areas, such as, learning, shopping, marketing, travel, trading, etc.

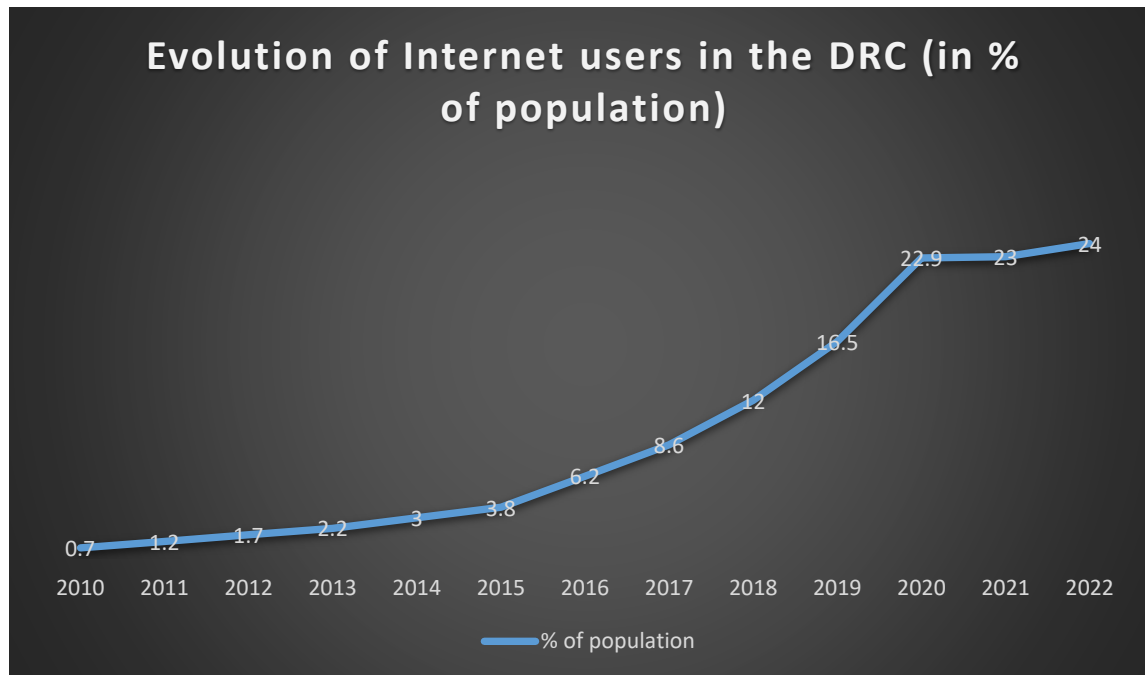


Figure 1: evolution of internet users in the DRC, World Bank, 2024.

### The Definition of E-commerce

The term e-commerce has become increasingly popular in our daily business and personal activities, yet it remains a relatively new concept for most developing economies.

According to Laudon and Laudon (2014, p. 87), e-commerce refers to the use of internet-based digital technologies to execute key business processes in various organisations. However, more recently, Birgul and Sona (2017) have argued that e-commerce is not just a web-based sales method; it is a transformation initiative for organisations that want to survive in today's digital world. While the Economic Encyclopedia (2002) defines e-commerce as an internet business, it means the purchase and sale of various goods and services via the internet, as well as the transfer of funds via banking channels and data to carry out these transactional activities. Also, e-commerce refers to the sale of physical products online, but it can also describe any commercial transaction via the internet. Thus, e-commerce could have a broad and narrow definition, as explained by many researchers in various stages and studies. For example, Rastogi (2015) defined e-commerce as the use of information technology and transactions among its stakeholders and competitors in an organization. Similarly, Basu, and Muylle (2011) defined e-commerce as an electronic transaction or any transaction received via internet technology. This includes the sale of different goods and services; online orders received by email or in digital format on which it is not necessary to make payment through the online channel. Turban et al. (2010) gave a more precise definition of e-commerce as “the process of buying, selling, transferring and exchanging different products and/or information using various computer systems related to ICT units, mainly extranet and

intranet networks (internet)". This definition is similar to that of Huseynov and Yildirim (2016), who defined e-commerce as the online process of business management through different computer networks. Therefore, e-commerce concerns different companies of different size, structure and location, which carry out their activities mainly based on a network of ICT; in particular, the internet (Ibrahim, Turyakira, & Katumba, 2018).

### **Use of ICT in E-commerce**

Carter and Belanger (2003), underlined the use of ICT to improve efficiency and access to government services across all stakeholders in G2C, G2E, G2G and G2B services. Additionally, governments have realized the importance of the internet and have undertaken critical transformations to use it to deliver public services, so that citizens can always access them regardless of their location (Abdulkarim, 2003).

Fang (2002), has defined e-government (part of e-commerce) as a method for governments to use the most innovative ICT services, particularly web-based internet applications. These applications are able to provide citizens and businesses with more convenient access to government information and services, to improve the quality of services and provide more opportunities for democratic institutions and processes. E-Commerce involves many issues such as trust, security, privacy, accessibility, familiarity, awareness, and quality of public services (Jaeger, 2003). For instance, the rapid growth of e-Commerce initiatives in the MENA (Middle East and North Africa) region reflects its compelling advantages, such as enhanced governmental performance, lower cost structure, greater flexibility, broader scale and scope of services, greater transparency, accountability, and faster transactions. However, getting people to be continually engaged in e-commerce services is a challenge since only with a few mouse clicks they will be moved away. An agreement seems to enhance better customer service and its consequent effect on online satisfaction.

Many institutions, such as the World Bank, the United Nations, Europe's Information Society DG, the Canadian Common Measurement Tool (CMT) of satisfaction, the European Customer Satisfaction Index and the American Customer Satisfaction Index, evaluate e-commerce progress and satisfaction using various methods and indices (Fitsilis, Anthopoulos, & Gerogiannis, 2010). Molla and Licker (2005b), in agreement with Molla and Licker (2005a), further say that Businesses implementing e-Commerce in developing countries face substantially greater challenges than businesses in developed countries due to the unreliability of the internet connection, the poor availability of accessing it due to the poor infrastructure, the high cost of doing so, and also the low level of ICT penetration throughout the country.

Molla and Licker (2005)'s research on countries in Southern Africa. They find that those influencing factors were not constant for firms in different stages. In the first stage, comparing with environment factors, the organizational factors are more influential. As time goes by, the resource advantages become less important, and e-commerce adoption is affected mainly by

environmental factors, together with the commitment and governance model that the firm puts in place.

Aleid (2009), carried out an investigation of different e-Commerce schemes in a number of countries with regard to culture, infrastructure and human behavior. They find that there are a number of factors that may inhibit the diffusion of e-Commerce into developing countries (e.g. infrastructure, security, e-Commerce laws). Miyazaki and Fernandez (2001) have identified the fraudulent behavior by online retailers as a key concern for Internet users and, therefore, e-Commerce users Rose et al. (1999) identifies hackers as an obvious security threat to e-commerce. Kabango and Asa(2015),analyze that this happens because the online availability and accessibility of the stored data of many corporations gives any hacker on the Internet the chance to steal data from these corporate databases.

According to Sathye's (1999) research, the use of online banking services, which is a good example of e-commerce, is new knowledge to many customers, and the lack of awareness of online banking is a crucial factor in preventing customers from adopting it. Howcroft et al., (2002) found that the issue of lack of awareness and knowledge of online banking services contributes ecommerce adoption challenges.

Suki and Ramayah (2010), studied user acceptance of the e-Government services in Malaysia. Their results indicate that the important determinants of user acceptance of the e-Government services are perceived usefulness, ease of use, compatibility, interpersonal influence, external influence, self-efficacy, facilitating conditions, attitude, subjective norms, perceived behavioral control, and intention to use e-Government services/system. Henry (2006) defines web accessibility as getting people to use, perceive, understand, direct and interact with the web.

## **SME**

The concept of SMEs, development, and entrepreneurship was introduced into the growth and development landscape in the late 1940s. At this time critical targeted policies (grants, aid credits, and individual tax systems) were implemented and support organizations for were created for such businesses by the governments of the economies. For example, a publicly funded SME agency was created for the first time in Japan in 1948, the US in 1953, India in 1954, Turkey and Pakistan in 1965, and Tanzania in 1966 (OECD, 2004). In terms of the size of SMEs, an examination of the literature found that until January 1996, they were considered to be those with less than 500 employees, with the following subdivisions:

- Micro-business (between one and nine employees).
- Small business (10–99 employees).
- Medium-sized business (100–499 employees).

Subsequently, in 1996 the European Commission proposed a new definition of SMEs based on the following quantitative criteria:

- Total number of employees in an SME.
- Annual turnover.
- Total number of business assets.
- The degree of independence of the business or the ownership over it.

### **Challenges Affecting E-Commerce**

Goldstein and O'Connor (2000), indicate that as far as developing countries are concerned, the main factors that prevent them from adopting e-business include the scarcity of ICT infrastructures as well as unfavorable political, economic, social and technological conditions. As a result, many of them end up adopting a “wait and see” approach, i.e. they keep waiting until they reach the “optimum level” in terms of ICT infrastructures (internet, computers, etc.) and other e-business related aspects (e-payment, logistics, etc.) before they would think to make e-business a major component in their economy. Yet another issue is the fact that many SMEs in developing countries do not see the great benefits in e-business and therefore do not commit all their efforts to it. They also assert that however embarking on this digital economy requires certain conditions to be met and unfortunately, many developing countries, particularly those in West-Africa suffer from lack of sufficient ICT infrastructures or are not adopting information technologies even if there is a clear advantage in using them.

As a result, the digital divide continues to deepen while reinforcing existing income and wealth inequalities within and between countries. Stephen Hawk (2004) indicate that developing countries, like those in West Africa, need to find a reliable way to embark on this digital economy or face the risk of being left far behind other nations who did, but how viable is e-business for these countries. Panagariya (2000) indicate that Electronic commerce offers unprecedented opportunities to both developing and developed countries. Developing countries are far behind developed countries in terms of information-technology infrastructure (ICT). Given the cost savings offered by Internet technology and relative ease with which it can be provided, they can now skip several stages of technological development through which developed countries had to go. Abarchi and Yong (2011) analyses that all theory aside, it is important to realize that e-business can become a viable solution if it can help resolve issues that matters the most in West-African developing countries.

### **Theoretical Framework**

The extant e-commerce literature offers several theories to investigate the determinant factors of e-commerce adoption by SMEs. The five most commonly used are the Theory Reasoned Action (TRA); the Theory of Planned Behavior (TPB); the Technology Acceptance Model (TAM); The



Diffusion of Innovation Theory (IDT); and the Technological, Organizational and Environmental Framework (TOE).

The Technology-Organization-Environment (TOE) framework was developed initially by Tornatzky, Fleischer, and Chakrabarti (1990) in order to describe the influence of contextual factors in adoption of an innovation. In this framework, there are three aspects of a firm's context that influence adoption of the technology innovation; these are technological context, organizational context, and external task environmental (industry) or as it more commonly called -environmental context. Technological context relates to both the internal and external technologies that are relevant to the firm, while organizational context pertains to the nature and the resources of the firm, which is proxied by firm size and the decentralization, formalization, and complexity of their managerial structure. Then, the environmental context refers to other parties surrounding the firm such as competitors, suppliers and government (Zhu et al., 2002). The TOE framework is chosen as the theoretical basis for the development of our research model. The research is mainly focused on the technological Organizational Environment (TOE) framework.

Technology-Organization-Environment (TOE) framework of Tornatzky and Fleischer (1990) assumes a generic set of factors to predict the likelihood of EC adoption. The theory suggests that adoption is influenced by technology development (Kauffman & Walden, 2001), organizational conditions, business and organizational reconfiguration (Chatterjee, Grewal, & Sambamurthy, 2002), and industry environment (Kewtha and Choon, 2001). Technological context describes that adoption depends on the pool of technologies inside and outside the firm as well as the application's perceived relative advantage (gains), compatibility (both technical and organizational), complexity (learning curve), trial ability (pilot test/experimentation), and observability (visibility/imagination).

Organizational context captures firm's business scope, top management support, organizational culture, complexity of managerial structure measured in terms of centralization, formalization, and vertical differentiation, the quality of human resource, and size and size related issues such as internal slack resources and specialization (Jeyaraj, Rottman, & Lacity, 2006; Sabherwal, Jeyaraj, & Chowa, 2006; Tornatzky & Fleischer, 1990). Environmental context relates to facilitating and inhibiting factors in areas of operations. Significant amongst them are competitive pressure, trading partners' readiness, socio-cultural issues, government encouragement, and technology support infrastructures such as access to quality ICT consulting services (Al-Qirim, 2006; Jeyaraj et al., 2006; Scupola, 2009; Zhu, Kraemer, Xu, 2003). TOE framework underscores Rogers' (1995) three groups of adoption predictors- leader characteristics relating to change; internal characteristics (centralization, complexity, formalization, interconnectedness, organizational slack and size), and external characteristics (system's openness).

### **Technological factors and E-commerce Adoption (Hypothesis 1)**

Premkumar (2003) evaluate that in SMEs' adoption of, the technology context is said to have high influence however the number of studies that have examined the technology context's influence on SMEs' adoption is very small. ICT Affordable high charges on data tariff plans has demoralized people from carrying out e-commerce in most of SMEs, limited number of internet provider in most of the country is also a challenge to e-commerce in Burundi and so many other factors which move hand in hand with this factors to affect e-commerce among SMEs. Thus it is hypothesized that:

*H<sub>1</sub>: Technological barriers negatively affect e-commerce adoption among SMEs in DRC.*

### **Organizational factors and E-commerce Adoption (Hypothesis 2)**

Owner's Support which is highly prioritized factor in the organizations' ICT adoption (Jeyaraj et al.2006) refers to whether or not the executives or the people in the Owner's Support of SMEs understand the nature and functions and therefore support the adoption of the same by means of communication as well as reinforcement of the ideas (Thong 1999; Ramdani et al. 2013) affecting the adoption of new information systems (Chang et al., 2006). This factor has been found to be critical in creating a conducive atmosphere for the adoption of new technologies and allocation of available resources for the adoption of new technologies (Lin and Lee 2005; Wang et al., 2010) since the implementation and adoption is usually a bigger project and a huge undertaking for the SMEs. The implementation involves integration of resources and re-engineering of the business processes, hence the support from owner support, mostly the decision makers in the case of SMEs, is very crucial.

Computer skills as Wetzel (1993) stated, even the faculty who have technical backgrounds may not use technology in teaching, if they do not have knowledge of how to use it correctly. Thus, technology is not used at an expected level, since they need help in how to use the technology effectively in teaching (Spotts, 1999). Rogers saw this knowledge as an essential variable in the innovation-decision process. To increase the adoption chance of an innovation, an individual should have a sufficient level of how-to-knowledge prior to the trial of this innovation. Thus, this knowledge becomes more critical for relatively complex innovations. Thus it is hypothesized that:

*H<sub>2</sub>. Organizational barriers negatively affect e-commerce adoption among SMEs in DRC.*

### **Environmental factors and E-commerce Adoption (Hypothesis 3)**

The environment factors that consist of Lack of competition level, Lack of regulation and Lack of ICT Support have been found to be influencing SMEs adoption. The environmental dimension represents the current operating environment of the firm. This will no doubt impact the organization as it adopts new information systems (Chang et al. 2006; Hsiao et al. 2009).

Competition in SME's industry positively affects the firm's adoption of ICT (Gatignon and Robertson 1989). When the competition in the industry is directly affected by the adoption of

innovation, the firm is more likely to go for such technology (Kuan and Chau 2001). ICT support which has been found to be one of the critical factors for the success of ICT (Delone 1988) and positive determinant of ICT adoption by organizations refers to the support available for the adoption of ICT (Premkumar and Roberts 1999). Since the availability of third-party support is growing and outsourcing is becoming more popular organizations are prepared to embrace new ICT since they are confident that enough third-party support is available. Thus it is hypothesized that:

*H<sub>3</sub>. Environmental barriers negatively affect e-commerce adoption among SMEs in DRC.*

#### **Moderating Role of Infrastructural Development (Hypothesis 4)**

Geographical location of SMEs can be a motivation or barrier to technology infrastructure development. In some regions of a country, technology infrastructures can be difficult to develop. On the other hand, the need for having such infrastructure is also significant for effective communication and trading among the widely spread parties ([Boerhanoeddin 2000](#); Minges 2002). Thus it is hypothesized that:

#### **H<sub>4</sub>.**

*H<sub>4a</sub>. Infrastructural Development has moderating effect on the relationship between technological factors and e-commerce adoption.*

*H<sub>4b</sub> Infrastructural Development has moderating effect on the relationship between organizational factors and e-commerce adoption.*

*H<sub>4c</sub>. Infrastructural Development has moderating effect on the relationship between environmental factors and e-commerce adoption.*

## **METHODOLOGY**

This study adopted a survey research design. Kraemer (1991) defined a survey research design as a research design used to quantitatively describe specific aspects of a given population by examining the relationships among variables. Survey research uses a selected portion of the population from which the findings can later be generalized back to the population. Similarly, William, (2006) stated that sampling is the process of selecting units (e.g., people, organizations) from a population of interest so that by studying the sample we may fairly generalize our results back to the population from which they were chosen.

The research design will be a survey that will be conducted on a sample of the SMEs owners in Kinshasa, the Capital City of DRC and the provinces of Kongo Central, Kwango, Kwilu and Haut-Katanga. According to Owens (2002), survey research design has the advantage of uniqueness since information gathered is not available from other sources, having unbiased representation of population of interest and standardization of measurement as same information is collected from every respondent.

### **Sample Size and Population**

The research population was selected using simple random sampling from SMEs in Kinshasa, the Capital City of DRC and the provinces. According to the records of the Municipality of Kinshasa, City Council, there are so many SMEs in the country; therefore, the researchers divided the SMEs population into two i.e. the capital city and the provinces were selected by using a simple random sampling to form a research sample. 200 self-designed questionnaires were prepared and 100 SMEs owners were interviewed from each division. Out of 200 participants, further interview was conducted depending on how they rated each variable. Therefore, a stratified sample was exercised on this activity as the researcher wanted the extra questionnaire to be answered by a specific group, however the researcher could not predict how many participants will be in each rank. In this research, e-commerce adoption was the dependent variable and the independent variables and mediating variable were; technological factors, organizational factors, environmental factors and infrastructural development which was included in the model as a mediator.

### **Correlation Analysis**

Simple **Correlation Analysis** is used to determine the nature and degree of linear relationship between two sets of data. The degree of positive or negative correlation between the bivariate data can then be determined by evaluating the Product-Moment Correlation Coefficient. It describes the strength of the relationship between the two sets of variables, which may be weak, moderate, strong, or nil. A statistical measure that has a more exact meaning is the **Coefficient of Determination** (denoted by  $R^2$ ) where  $R$  is the Coefficient of Correlation. That is, the Coefficient of Correlation is computed as the square root of Coefficient of Determination. In this study, SPSS was used to evaluate the Coefficient of Determination. However, Spearman's rank correlation coefficient will be adopted in this study and it is also appropriate to use Spearman's correlation when both variables are continuous and the formula is as follows:

$$R = 1 - \frac{6\sum d^2}{n(n^2-1)} \dots\dots\dots \text{(Equation 3.1)}$$

### **Regression Model Specification**

Multiple linear regression model is used to determine the nature and degree of linear relationship between two sets of data. The degree of positive or negative correlation between the multivariate data can then be determined by estimating the Coefficient.

Simple **Regression Analysis** provides a measure of the average relationship between two or more variables in terms of the original units of the data. They also involve multivariate data, in which there are pairs of variables each with its set of data values.

The research has used multiple linear regression models to determine the relationship of the independent variables with the dependent variable. Thus in deriving this relationship for the above topic we posit that:

$$Y = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + u \dots \dots \dots \text{(Equation 3.2)}$$

Where;

Y = E-commerce Adoption

X<sub>1</sub> = Technological factors

X<sub>2</sub> = Organizational factors

X<sub>3</sub> = Environmental factors

U = Error term

To evaluate the effect of infrastructural development on e-commerce adoption, we augment model one (1) with infrastructural development variable as follows:

$$Y = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \gamma Z + u \dots \dots \dots \text{(Equation 3.3)}$$

Z is infrastructural development. Subsequently, we sequentially introduce interaction terms between technological factors and infrastructural development into model two (3.3). This enables us to examine if the impact of technological factors on e-commerce adoption is conditional on infrastructural development. In other words, the sign and significance of the coefficient of such interaction term will reveal whether the impact of technological factors on e-commerce adoption depends on the infrastructural development. Incorporating this, we re-write model (3.3) as follows:

$$Y = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \gamma_1 [X_1 * Z] + u \dots \dots \dots \text{(Equation 3.4)}$$

Similarly, we sequentially introduce interaction terms between organizational factors and infrastructural development into model two (3.3) as follows

$$Y = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \gamma_2 [X_2 * Z] + u \dots \dots \dots \text{(Equation 3.5)}$$

Finally, we sequentially introduce interaction terms between environmental factors and infrastructural development into model two (3.3) as follows

$$Y = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \gamma_3 [X_3 * Z] + u \dots \dots \dots \text{(Equation 3.6)}$$

$\alpha_0$  = Slope coefficient of the model

$\beta$  = Beta coefficient of determination

$\gamma_1, \gamma_2$  and  $\gamma_3$  are coefficient measures of the mediating role of infrastructural development on the relationship between technological factors, organizational factors and environmental factors respectively on e-commerce adoption.

## RESULTS/FINDINGS

### Model Measurement

In summary, the Kaiser- Mayer-Olkin Test (KMO), which measures sampling adequacy, was done for each variable and the results showed acceptability. The average variance extracted (AVE) was also computed. In particular, the results of these statistical analyses showed that; (1) all the study variables exceeded the minimum standard of the KMO value of 0.6 and were significant in Bartlett's test of sphericity, (2) the items for each of the study variable exceeded factor loadings of 0.50 (Hair et al., 1998), and (3) all the study variables exceeded the acceptable standard of reliability analysis of 0.70 (Nunally and Bernstein, 1994 as cited in Cooper & Schindler, 2003). The statistical results confirmed the measurement scale of this research met the acceptable standard of reliability and validity analyses as given in Table 4-1 and Table 4-2 respectively.

Variables	No of Item	Cronbach's Alpha	KMO	Average Variance extracted
E-commerce Adoption	12	.903	.824	.835
Technological Barriers	4	.792	.687	.679
Organizational Barriers	4	.762	.757	.881
Environmental Barriers	4	.701	.645	.791

Table 4-1; Results of Cronbach's Alpha, KMO and AVE

Construct	Item	Loading
E-Commerce Adoption (ECA)	ECA1	.786
	ECA2	.860
	ECA3	.834
	ECA4	.703
	ECA5	.799
	ECA6	.688
	ECA7	.778
	ECA8	.711
	ECA9	.732
	ECA10	.803
	ECA11	.701
	ECA12	.753
Technological Barriers (TB)	TB1	.789
	TB2	.876
	TB3	.868
	TB4	.793

Organizational Barriers (OB)	OB1	.801
	OB2	.740
	OB3	.833
	OB4	.789
Environmental Barriers (EB)	EB1	.772
	EB2	.880
	EB3	.846
	EB4	.808

Table 4-2; Results of standardized item loading

### Correlation Result

Table 4-3 below illustrates the results of descriptive statistics and Pearson correlation analysis for the study variables. The table shows that the mean values for the variables are from 3.3809 to 4.0734, suggesting that the levels of e-commerce adoption, the level of technological barriers, as well as the levels of organizational barriers and environmental barriers are ranging between these echelons. The correlation coefficients for the relationship between the dependent variable (i.e., E-commerce adoption) and the independent variables were less than 0.90, which signifies that the data was not affected by any severe problem of collinearity (Hair et al., 2005).

Participants in the research reported a mean level of e-commerce adoption of 3.3809 (3 is the midpoint on the 5-point Likert-type scale used). Bivariate correlations of the predictor variables with e-commerce adoption were statistically significant and in the hypothesized direction. As illustrated in Table 4-3, technological barriers were negatively related to e-commerce adoption ( $r = -.361$ ,  $p < .01$ ). Thus, the first hypothesis (Hypothesis 1) was supported by the study. Similarly, organizational barriers and environmental barriers were also negative and statistically significant ( $r = -.171$ ,  $p < .05$ ) and ( $r = -.279$ ,  $p < .01$ ) respectively. Consequently, the second and third hypotheses were also supported by the research. In a bid to test for the fourth hypothesis, regression analysis was done to ascertain the moderating role of geographical location on the relationship between e-commerce adoption and the stated barriers. These tests results are shown in table 4-4.

Variable	Mean	Standard deviation	Pearson correlation analysis			
			1	2	3	4
1 E-Commerce Adoption	3.3809	.73955	(1)			
2 Technological Barriers	3.7331	.79487	-.361**	(1)		
3 Organizational Barriers	4.0734	.58773	-.171*	.288**	(1)	
4 Environmental Barriers	3.9181	.61382	-.279**	.258**	-.473**	(1)

Table 4-3; Descriptive statistics and correlation results for the study variables

Note:  $N = 177$ , Significant level: \* $p < .05$ , two-tailed,  $p < 0.01$ \*\* (2-tailed). Source: Authors computation from SPSS

### Regression Results

Infrastructural development is a dichotomous categorical variable which was proxied by geographical location. To examine the moderating effects, we coded infrastructural development as a dummy variable with rural infrastructure = 1 and urban infrastructure = 0 and tested the moderating effects of infrastructural development according to the methodology proposed by Jaja Suteja et al. (2016). The testing results are shown in table 4-5. As illustrated in model 2, the moderating effect of infrastructural development on the relationship between technological barriers and e-commerce adoption is significant. The adjusted  $R^2$  value for e-commerce adoption increases from 0.250 to 0.333. The significant coefficient indicates that infrastructural development has a negative ( $\beta = -.515, P < 0.01$ ) moderating effect on the relationships between technological barriers and e-commerce adoption, which means that technological barriers has a stronger negative effect on e-commerce adoption for SMEs utilizing rural infrastructure than for SMEs enjoying urban infrastructure. This result validates the acceptance of hypothesis 4a ( $H_{4a}$ ). Similarly, as shown in model 3, the moderating effect of infrastructural development on the relationship between organizational barriers and e-commerce adoption is significant. The adjusted  $R^2$  value for e-commerce adoption increases from 0.250 to 0.332. The significant coefficient indicates that infrastructural development has a negative ( $\beta = -.244, P < 0.05$ ) moderating effect on the relationships between organizational barriers and e-commerce adoption, which means that technological barriers has a stronger negative effect on e-commerce adoption for SMEs utilizing rural infrastructure than for SMEs utilizing urban infrastructure. This result validates the acceptance of hypothesis 4b ( $H_{4b}$ ).

Finally, as illustrated in model 4, the moderating effect of infrastructural development on the relationship between environmental barriers and e-commerce adoption is statistically significant. The adjusted  $R^2$  value for e-commerce adoption increases from 0.250 to 0.339. The significant coefficient indicates that infrastructural development has a negative ( $\beta = -.499, P < 0.01$ ) moderating effect on the relationships between environmental barriers and e-commerce adoption, which means that technological barriers has a stronger negative effect on e-commerce adoption for SMEs utilizing rural infrastructure than for SMEs enjoying urban infrastructure. This result validates the acceptance of hypothesis 4c ( $H_{4c}$ ) of the study.



Variable	Dependent variable (E-Commerce Adoption)			
	Model1	Model 2	Model 3	Model 4
Constant	1.552***	1.251***	-.803	-.844***
Technological Barriers	-.261*	-.531**	-.397*	-.365*
Organizational Barriers	-.490**	-.437	.118	-.322**
Environmental Barriers	-.407**	-.288*	-.212**	-.331**
(TB * Z)		-.515**		
(OB* Z)			-.244*	
(EB * Z)				-.499**
F	24.691**	25.496**	32.813**	32.782**
R <sup>2</sup>	.258	.344	.346	.353
Adj. R <sup>2</sup>	.250	.333	.332	.339

Table 4-4; Result of regression analysis

Note:  $N = 177$ , Significance at \* $p < .05$ , two-tailed. \*\* $p < 0.01$ , two-tailed; TB = Technological Barriers, OB = Organizational Barriers, EB = Environmental Barriers, Z = Infrastructural development. Source: Authors computation from SPSS

## DISCUSSION

The study examined how technological, organizational and environmental barriers serve as major challenges for e-commerce adoption among SMEs in Democratic Republic of the Congo and in the process explores the moderating role of infrastructural development between them. Following a line of investigation on the empirical data, the following findings are purported:

Hypothesis	Sig.	Decision	Rank
H <sub>1</sub>	( $r = -.361, p < .01$ ).	Supported	3 <sup>rd</sup>
H <sub>2</sub>	( $r = -.171, p < .05$ )	Supported	6 <sup>th</sup>
H <sub>3</sub>	( $r = -.279, p < .01$ )	Supported	4 <sup>th</sup>
H <sub>4a</sub>	( $\beta = -.515, P < 0.01$ )	Supported	1 <sup>st</sup>
H <sub>4b</sub>	( $\beta = -.244, P < 0.05$ )	Supported	5 <sup>th</sup>
H <sub>4c</sub>	( $\beta = -.499, P < 0.01$ )	Supported	2 <sup>nd</sup>

Table 4-5 Results of Hypothesis Test

First, technological barrier has a significant effect on e-commerce adoption. This finding is in conformity with previous studies demonstrating that technological factor can predict e-commerce adoption in least developed countries (Premkumar, 2003; Rogers, 1995). Technological barrier is the most significant determinant of e-commerce adoption intention. This finding indicates that technological barrier has a major drawback in e-commerce adoption. Thus, improving the technological environment of e-commerce applications can contribute in enhancing their adoption intention by SMEs in DRC. Particular proportions, such as “internet access,” ICT affordability,

ICT complexity, and perceived advantages of technology, are value propositions of e-commerce adoption (Rogers 1995; Thong 1999; Ramdani *et al.*, 2013). Consequently, to advance the service value of these factors, SMEs owners can expand on their intent in adopting e-commerce.

Second, consistent with previous studies (Lin and Lee 2005; Wang *et al.*, 2010), the negative effect of organizational factors on the adoption of e-commerce has been supported in this study. These findings imply that SMEs with a low level of ownership support, ICT experience, lack of available resources, and lack of computer skills are more averse to accepting e-commerce adoption. Thus, SME owners can consider these barriers as key factors to help develop and promote their inclination toward e-commerce adoption. ICT growth of SMEs is claimed to be deprived by technical knowledge and economic costs (Cragg and King 1993). Moreover, support from SME owners are relatively limited not because they don't want to provide support, but because they lack the experience and skills as most of the respondents are just diploma holders. Thus, SME owners can consider providing training for their employees to increase their capacity in e-commerce adoption.

Thirdly, concerning environmental factors; lack of competition among SMEs, lack of regulation, lack of ICT support in the environment, and lack of internet security have a negative effect on e-commerce adoption among SMEs in DRC. This finding indicates that SME owners care significantly about environmental barriers. The negative effect of environmental factors on e-commerce adoption has been validated by other studies (Chang *et al.* 2006; Hsiao *et al.* 2009; Al Ghamdi *et al.*, 2011). Thus government's role is important to facilitate the essential environmental requirements for the development of E-Commerce such as providing robust secure online payment options, ensuring a solid ICT infrastructure, providing educational programs, and building up awareness using different means such as media and education institutions.

Finally, the moderating effects of infrastructural development on the relationship between the stated barriers and e-commerce adoption have been examined. However, infrastructural development turned out to have main effects on the outcome. The results show that technological barrier has a stronger effect on e-commerce adoption for SMEs utilizing rural infrastructure than for their urban counterparts followed by environmental barriers and organizational barriers respectively. This finding supports that of previous studies, such as (Boerhanoeddin, 2000; and Minges, 2002). Earlier studies pointed out that infrastructural development of SMEs can be a motivation or barrier to technology infrastructure development. In some regions of a country, technology infrastructures can be difficult to develop just as in the case of rural region in Burundi and thus showing a strong negative effect on e-commerce adoption. In consequence, the findings draw attention to the relevance of infrastructural development in e-commerce adoption. An important policy implication emerging from this study is that business administrators should not underestimate the power of infrastructural development in influencing e-commerce adoption.

### **Implication to Research and Practice**

This study provides implications for researchers as well as for SMEs owners. For researchers, this study is likely to be among the first to look at the barriers to e-commerce adoption with a moderating effect of infrastructural development. Previous researches focused mainly on the barriers to e-commerce adoption and overlooked the significant role of infrastructural development in moderating the effects of those barriers on e-commerce adoption. This research fills this gap. Majority of the studies investigated barriers to e-commerce adoption were carried out on western societies and so far limited literature is available in Sub-Sahara Africa context. So, this research geared towards filling this gap by examining the extent e-commerce adoption is affected by technological, organizational and environmental barriers in DRC vis-à-vis that of other Sub-Sahara African economies. We found that technological barriers, organizational barriers and environmental barriers, all negatively influence e-commerce adoption intention. Finally, incorporating the moderating role of infrastructural development, the results show that SMEs utilizing rural infrastructure are more negatively affected by e-commerce adoption than urban SMEs. These factors were not tested in previous e-commerce adoption studies. This research therefore expands the e-commerce adoption literature as the finding indicates that the barriers may modify SMEs' utilizing rural infrastructure e-commerce adoption intention, which enriches e-commerce research.

Some important practical implications exist. First, the most burning task for e-commerce adoption is to improve on the barriers. Even though these barriers are difficult to overcome, they can augment e-commerce adoption intention. To highlight the importance of e-commerce adoption, the authorities in charge and SME owners can take measures in two folds. On one hand, they should increase technological readiness; improve the SME's organizational setup, and overall improvement in the business environment. For example, the authorities in charge can emphasize the convenience of e-commerce adoption to facilitate business activities. On the other hand, the authorities in charge should decrease SME owners' perception of e-commerce adoption. For instance, the government or authorities in charge can improve the business environment through certain mechanisms to reduce SMEs' aversion to e-commerce adoption.

Second, the results demonstrate that rural SMEs are more negatively averse to e-commerce adoption because of the level of infrastructural development in rural areas. Improvement in the barriers may change rural SMEs' reluctance of e-commerce adoption. The current barriers are a bit improved for urban SMEs, such as internet access, ICT affordability and ICT support in the environment, etc., but these barriers are less improved specifically in the rural areas for rural SMEs. Thus, these barriers should also be improved in rural areas to increase e-commerce adoption among rural SMEs.

## CONCLUSION

The study in essence sought to unearth the challenges faced by SMEs in adopting e-commerce in DRC and in the process accounts for the moderating role of infrastructural development on the relationship between the challenges and e-commerce adoption. The research contributes to e-commerce literature by exploring the relationship between technological barriers, organizational barriers, environmental barriers and e-commerce adoption in the DRC context.

Results of testing the model using a correlation and regression analysis discovered two important findings: first, technological barriers, organizational barriers and environmental barriers have a direct negative relationship with e-commerce adoption which supported all the hypothesis of the study. The results further show that technological barrier is the most determinant factor of e-commerce adoption followed by environmental and organizational factors respectively. Second, the moderating effects of infrastructural development were tested, which showed that the barriers have a more negative effect on e-commerce adoption for SMEs utilizing rural infrastructure than for those utilizing urban infrastructure. The authorities can offer more conducive business environment, and focus more attention to rural infrastructural development for SMEs' to expanding their e-commerce adoption intention.

## Future Research

This study has certain limitations as in any research. First and foremost, the research made up of 177 respondents in Burundi, the sample might not be adequate for generalization. Second, the research aggregated the barriers into three major group i.e. technological, organizational and environmental barriers. The disaggregation of these barriers may yield appealing result as the magnitude of each of will be measured.

Thirdly, this research only examined the moderating effects of infrastructural development. Other dichotomous categorical variables such as age, gender, education, and experience may also be considered. Finally, this research was conducted in Burundi. As the barriers to e-commerce adoption vary among countries across the globe, the conclusions might not be the same when the research model is applied to other countries. It is suggested that further researchers take the current constraints into consideration and use different measurement scales to measure the connection between the barriers and e-commerce adoption.

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