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The effects of ICT adoption on Small and Medium sized enterprises in Rwanda: A Case study of Kigali City

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Preface

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Research disseminated through this series may include views on economic policy and development, but the series will not take any institutional policy positions. Thus, any opinions expressed in this series will be those of the author(s) and not necessarily the Research Papers Series.

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The effects of ICT adoption on Small and Medium sized enterprises in Rwanda: A Case study of Kigali City

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Abstract

ICT adoption is an important field of study in various areas including small and medium enterprises (SMEs).This study examines the factors that influence the adoption and use of ICT by SMEs in Rwanda. It also examines perceptions of SMEs' employees and managements on adoption and use of ICT, assesses the level of awareness and skills of SMEs' employees and other variables which can be helpful in gaining valid outputs. It uses a specially designed structured questionnaire to collect data and uses t-test statistics to compare the mean difference between the level of awareness and adoption patterns of ICT facilities among SMEs. A regression analysis helps evaluate factors influencing ICT adoption choices in the SME sector and assess the perceptions of SMEs' employees towards ICT adoption. It uses the SPSS software to perform data entry and analysis. This study examines the relationship between ICT adoption and its five factors -- perceived benefits, perceived costs, ICT knowledge, external pressures and government support. The results show that perceived costs and external factors were insignificant in ICT adoption whereas perceived benefits, perceived costs and ICT knowledge were significant in ICT adoption. According to the results, perceived benefits had a strong and significant relation to ICT adoption and the relation between ICT knowledge and employees' skills about ICT adoption were also significant.

Keywords: Information communication technology (ICT), technology adoption, Small and Medium Enterprises (SMEs).

1. Introduction

The European Commission defines small and medium enterprises (SMEs) as organizations with less than 250 workers. The finances of a SME cannot exceed € 50 million as turnover, and/or €43 million on the balance sheet. In addition, the Commission of European Community stipulates terms of ownership, indicating that SMEs ought to be independent with less than 25 per cent of a SME being owned by outside interests (Diabate, 2014; Ngugi et al., 2013).SMEs are pillars of modern market economies and play an important role particularly in developing countries like Rwanda. As stated by Ghobakhloo et al., (2011) in today's technological progressions the implementation and application of IT is a significant driving force behind many socioeconomic changes(Dierckx and Stroeken,1999).As the utilization and commercialization of IT becomes more widespread throughout the world, the adoption of novel IT can generate new business opportunities and various benefits. Nowadays, both large organizations and SMEs are seeking ways to reinforce their competitiveness and improving their productivity (Premkur, 2003). Accordingly, within SMEs there is an increasing consciousness of the necessity to derive profits through investments in IT.

In most countries, SMEs are the dominant form of business organizations, accounting for over 90 per cent of the business population and they play a key role in driving sustainable economic growth and job creation. SMEs in Rwanda refer to micro as well as small and medium enterprises. Rwandan SMEs make up 98 per cent of the total businesses and account for 41 per cent of all private sector employment (MINICOM, 2015). SMEs in Rwanda face many macro-level challenges including limited transport and energy, lack of entrepreneurship skills, low levels of societal trust, limited access to financial institutions, challenges with contract enforcement and a weak education system. Bringing SMEs up to speed with the digital revolution is not just a matter of improving their quarterly profits, but also about creating growth and jobs. In the digital age, no business can thrive without better use of technology. Jeronimo and De Medeiros (2012) emphasize that SMEs grow two to three times faster when they embrace technology.

A study by BMG et al., (2015) found that almost all SMEs used the internet for business purposes but the intensity of the use varied with increasing size. The most common use of internet was being in touch with customers. While the use of e-commerce was increasing it was still much less prevalent: only 20 per cent of the turnover was delivered from this source in 2013and only 22 per cent of the businesses had e-commerce sales. A quarter of the SMEs reported that they did not possess basic digital skills; there was a positive link between digital skill level and turnover growth. SMEs have an attitudinal barrier towards developing an online presence, there is lack of awareness about the benefits and opportunities available and a lack of understanding about online security threats.

Embedding digital learning throughout the education system is a long-term solution but there is also clear need to enhance digital capabilities in the shorter term. A key to increasing capacities to take advantage of digital opportunities is through providing digital courses, awareness-raising initiatives through existing local private and third sector networks and improving cyber security.

In a competitive and changing environment, SMEs have changed their way of working by improving the quality of doing business so that they can compete in regional and global markets. Therefore, digital technologies play a significant role in SMEs' growth. The Government of Rwanda has come up with different policies and initiatives to facilitate technology in all sectors like Policy Vision 2020, NICI plans, EDPRS 1&2, a business sector strategic plan and ICT in the business master plan (Government of Rwanda,2006).

The Government of Rwanda wants to increase internet accessibility through an optic fiber covering all 30 districts as well as 4G penetration as these will help SMEs use technology easily. While the importance of digital technology for SMEs is acknowledged there is little system-wide data about how widely technology is being used by Rwandan SMEs. Overall, the reviewed studies show that technology is associated with moderate business gains. However, there are considerable variations in impact (Blok et al., 2002). Our study analyzes the use of technology in SMEs and explores the factors affecting technology adoption in SMEs in Rwanda.

According to a report by the Ministry of Trade and Industry (2010) the SME sector had the potential to lower Rwanda's trade imbalance. Rwanda's trade deficit grew from $229million in 2005 to an estimated $770millionin 2009. In 2010, the Government of Rwanda's (GoR's) vision was to increase the role of value-added exports to increase export revenue and reduce the import-export imbalance. GoR was dependent on external grants and borrowings for 48 per cent of the government expenditure GoR sought to reduce its dependency on foreign aid and debt by increasing the internal tax revenue. Tax revenues increased by 10 per cent in 2009 compared to the previous year largely from the collection of value added tax (VAT).

According to a study by the Institute for Policy Analysis and Research (2015), SMEs currently generate Rwf 4.9 billion in annual tax revenue. Of the estimated 72,000 SMEs in the country 25,000 are registered and of those registered only 24 per cent pay taxes on a regular basis. In addition to expanding the export sector, SMEs also represent a potential source of tax revenue and can thus help in reducing Rwanda's dependence on foreign assistance. SMEs in Rwanda have remained less competitive compared to its neighbors and if no effort is made to make them more competitive, this situation is likely to worsen with the full-fledged East African Community (EAC) common market, which Rwanda entered in July 2010. Making existing and new Rwandan SMEs more competitive in value added exports is therefore one among many actions necessary to reverse the country's trade imbalance and build competitiveness. By adopting ICT and implementing its use by encouraging SMEs to use ICT in their businesses their revenues can be increased and the economy can improve.

2. Problem statement

The Government of Rwanda has evolved an empowering environment to support SMEs and has attracted players with good local, regional and international experience in using innovations and technology to expand business activities and increase economic growth. However, a majority of the SMEs are struggling to increase productivity, organizational effectiveness, sustained competitive advantages and satisfactory rates of return on

investments. To increase SMEs' competitiveness in global markets, they should be financially sound and should be well connected to markets. This, however, is not going to be easy in an economy where traditional and informal practices of business management are still applied. It is evident from research that innovative technological strategies are a key resource for gaining competitive advantages, but this is challenging because some enterprises lack entrepreneurship and innovative skills. Consequently, many small businesses fail and close a few days after they start (Ndikubwimana, 2016). Many SMEs are realizing the benefits of using new digital technologies but some are late adopters or need specific support and guidance before they adopt digital technologies.

Although the government and other development partners have rolled out a number of initiatives as far as digital technology is concerned, there seems to be a huge gap in awareness among SMEs about the changes that are inevitably brought about by technology in terms of business growth and how they should adapt to this shift. The focus has shifted from whether or not to use technology to understanding which technologies can be used for what specific business purposes and also on investigating how they can best be applied in a range of contexts.

While SMEs in Rwanda are excited about the changes brought about by the use of technology in business there are also many challenges including lack of network infrastructure and slow or unstable wireless access. Some SMEs do not have the bandwidth to support internet activity in their businesses. This provides a great challenge in the communication process between staff members and the management. The other challenges are poverty, not enough knowledge and lack of training on how to use digital technology. In addition, ensuring that technology is used to enable and to advance effective business practices is also a big challenge. Hence, there is a need to investigate the effects of digital technology adoption in SMEs in Rwanda. The purpose of our study is to investigate SMEs' employees and management attitudes and perceptions about adopting and using technology in their businesses to come up with the factors that are hindering its adoption and use by small and medium enterprises.

3. Objectives of the study

General Objective

Our study examines factors affecting technology adoption for sustainable development and management of SMEs in Rwanda. The study is anchored on management theory and the technological determination theory.

Specific Objectives

The specific objectives of our study are:

1. To determine the factors affecting technology adoption in SMEs in Rwanda.
2. To determine the perceptions of SMEs' employees and managements about adopting and using technology.

Significance of the Study

The purpose of our study is to gain an understanding of the factors which influence the adoption and use of ICT by SMEs in Rwanda. It examines the relationship between ICT adoption and its five aspects -- perceived benefits, perceived costs, knowledge about ICT, external pressures and government support. The results of our study show that three factors are significantly important in the adoption of ICT -- perceived benefits, government support and knowledge about ICT-- whereas perceived costs and external pressures are insignificant in determining its adoption.

ICT involves the use of internet and internet access devices that have given SMEs the ability to do business anytime, anywhere. ICT includes a wide range of tools and practices including e-business activities; new strategies for doing business such as online selling and buying activities; different ways of advertising products by using websites; easy communication between SMEs and their customers; and exploring different markets all over the world which give them competitive advantages.

4. Literature Review

As technology has spread throughout the world, the practices and ways of working have changed. Digital technology is changing people's lives and is hence bound to lead to dramatic changes in businesses as well. To sustain and achieve sustainable development, reliable, potential, innovative and efficient tools such as the mobile phones, microcomputers, e-mail and the internet must be used (Ciriaci et al., 2013).

Theoretical and empirical studies have been carried out on ICT adoption which demonstrate its importance in generating positive outcomes in various organizations; transactions over the internet have helped in linking SMEs to global markets. Literature on ICT shows that its adoption, as proxied by transactions over the internet and use of different digital technologies has significantly improved the performance and productivity of SMEs.

Berger (2012) and Mingaine(2013) show that SMEs which employ a large number of people contribute to the national income. However, researches done in China, USA, Kenya and other African countries show that contributions of SMEs are not the same across all the enterprises (Mingaine, 2013; Mutwiri and Mingaine, 2014). Research on SMEs talks of a variety of descriptive variables that influence the adoption and use of digital technology such as e-commerce, computerization and inter-organizational systems(Ajonbad, 2015).The factors affecting the adoption of new technology include lack of knowledge, confidence, management, dependability and budget (Vilaseca, 2013). Lack of awareness and cost are critical elements in the general adoption and use of technology for SMEs. Lack of awareness includes many factors like uncertainties about the benefits of technology, lack of guidance and unfamiliarity with technologies (Premkumar and Roberts, 2010). Giovanni and Mario (2013) show that cost is mostly related to technological factors such as training, maintenance, information systems and software. According to Barua (2011) lack of a technological environment including lack of critical mass use, unavailability of ideal technology and e-

business infrastructure are major external hindrances obstructing technology adoption and use by SMEs. Kirby and Turner (2012) observe that a majority of external hindrances come from business related barriers.

Ritchie and Brindley (2010) show that there are three barriers in the adoption and use of technology by SMEs: external pressures (requirements of trading partners and competition from other players), organizational readiness and perceived benefits of the technology. The authors argue that perceived benefits form a key reason why many SMEs adopt and continue to use technology. Most adoption and use frameworks look like a general framework using the technology, the capabilities of the organization and the external environment as its key explanatory variables (Giovanni and Mario, 2013).

According to Muraya (2009), the external environment (suppliers, buyers, government interventions and competitive pressures) is a very crucial factor influencing adoption and use of technology by many SMEs. The author suggests that environmental and organizational characteristics are required for proper implementation of technologies in SMEs. Alila and Ove (2011) observe that as a primary external factor of technology adoption and use, the government's role is a very important factor in the integration of technology by SMEs. Ajonbadi (2015) notes that most of the government's rolesare related to financial support including direct support for developing an application and tax breaks on technology infrastructure.

According to Iacovou et al., (2009), SMEs need more financial support than big companies because of their structural characteristics such as weaknesses in market power and lack of experience. Vilaseca (2013) argues that due to the proliferation of ASPs and rapid development of a variety of technologies, outsourcing of technology is becoming suitable and is emerging as an influencing factor for many SMEs. Dixon et al., (2012) observe that the cost of technology is an important influencing factor in the adoption and use of technology by many SMEs. The authors argue that SMEs are less likely to adopt and use technology when their initial setting-up costs are high. Matlay and Weathead (2013) note that many SMEs in Africa often have a lot of difficulty when outsourcing for financial support. Therefore, these enterprises may consider adoption and use of new technologies to be expensive because of lack of financial support.

According to Paul and Pascale (2013), many SMEs in Africa face specific problems in formulating innovative strategies because of limited technological competencies and limited financial resources. A study conducted by Ghimire and Abo (2013) on unlocking the potential of small and medium enterprises in West Africa reveals that adoption and use of technology by SMEs depended on the owner being the decision-maker. The findings from this study indicate that technology adoption and use are positively related. The linkages between adopting digital technology and increased productivity are clear. However, despite the benefits of productivity, SMEs are slow to take the leap and invest in adopting new technologies (the Conference Board of Canada, 2014).While many SMEs are aware of the benefits of digital communication devices, applications and systems that transmit digital data to enable interaction and communication, some are choosing to be late adopters (ACMA, 2015). The reasons for this vary as some do not want to be guinea pigs and others find that information overload makes it hard to judge which technologies are the most suitable. SMEs

are also looking for guidance from trusted information sources like industry organizations to help them make choices. ACMA (2015) highlights that if you are a SME, digital technologies can benefit your business in a number of ways -- you may save costs, reach more customers and improve experience. But you need to feel confident in this brave new world.

Some empirical studies by Bartelsman and Doms (2000), Brynjolfsson and Yang (1996), Dedrick et al., (2003), Kohli and Devaraj (2003) and Melville et al., (2004) confirm the positive effects of ICT on firm performance in terms of productivity, profitability, market value and market share. These studies also show that ICT has some effect in terms of intermediate performance measures such as process efficiency, service quality, cost savings, organization, process flexibility and customer satisfaction. The introduction of ICT offers various new investment opportunities within local industries, particularly for SMEs.

According to holakia and Kshetri (2004), the specific factors that contribute to SMEs' involvement with the internet are prior technology use and the customer service sub-scale of perceived competitive pressures. Moreover, the relative importance of some of these predictor variables decreases as the level of internet involvement increases. Tarute and Gatautis (2013) confirm that ICT has an impact on improvements in external and internal communication and for best performances it is important to align ICT investments with internal capabilities and organizational processes.

Olise at al., (2014) examined the determinants of ICT adoption for improved SME performance in Anambra state, Nigeria. They found that there was a significant difference in the levels of awareness and adoption patterns of ICT facilities among SMEs. Capital base, turnovers and the asset values of the businesses investigated had a significant influence on ICT adoption. With respect to SMEs' output performance, SME owners' capital inputs, marital status and business experience had a positive and significant relationship with their output performance. Kabanda and Brown (2017) did a structural analysis of SMEs in Tanzania and found that the SMEs used websites in a limited way as they drew upon their understanding of websites as being incompatible with the Tanzanian cultural bargaining system, which is characterized by cash transactions and face to face to bargaining. Websites were viewed primarily as a platform from which SMEs could portray a sophisticated image and advertise/market their products. SMEs used mobile technology extensively, as they drew on the technology's ability to offer transactive capabilities, mobility and communication. Their findings also point to technological challenges which SMEs face from the environment, mainly from lack of supporting industry institutional support. SMEs hence established partnerships with international organizations that could support them in overcoming technological challenges. Partnerships with large ICT organizations required stringent conditions such as SMEs needing certifications to be affiliated. The study gives practitioners a better understanding of how SMEs perceive de-commerce in Tanzania amidst organizational and environmental opportunities and constraints, and thus helps practitioners to better design appropriate e-commerce context-specific policies and interventions that address SMEs' problems. This will ensure that available resources are used in a more effective manner without negative consequences.

5. Research Methodology

We adopted a cross-sectional approach to measure firms' responses regarding adoption of ICT. Data was collected from 250 respondents with the help of a questionnaire. The respondents included 50 senior executives, 50 middle-level managers and 150 workers; they were purposively selected from SMEs in service and manufacturing industries in Kigali city. A survey instrument was formulated to obtain feedback from SMEs in Rwanda, assessing their awareness, receptivity and adoption of ICT in their businesses.

In our research ICT adoption is the dependent variable. We analyzed the dependent variable to find out the answer or solution to the question: What makes a company adopt ICT in its business? For this we tested five independent variables -- perceived benefits of ICT, perceived costs of adoption, ICT knowledge and skills of the employees, external pressures and government support -- that are believed to have some influence on the dependent variable (ICT adoption) either in a positive or a negative way.

A packet of 250 survey instruments including a return envelope were sent to selected respondents from insurance, banking and finance, health and medical, education, tourism, logistics, professional management, IT related services and the advertising sectors. The response rate for the survey was 72 per cent (193 responses). Due to missing values for at least two sections of the responses 13 samples were discarded from this research and 180 samples were processed and analyzed. Bivariate frequency distribution of the respondents according to type of business, ownership of the company, respondent's position, computer ownership, internet access, length of internet access and the operating system was presented. Cronbach Alpha was the basic formula used for determining the reliability based on internal consistency (Kim and Cha, 2002).

The values of alpha for perceived benefits yielded a reliability coefficient of 0.826.

The total sample size was determined using Krejcie and Morgan's formula and the sample size of each SMEwas calculated using the proportion of its respective population:

(1) $$n = \frac{x^2 \times N \times P(1-P)}{(ME^2 \times (N-1)) + (X^2 \times P \times (1-P))}$$

1. where, $n = samplesize$
2. $x^2 = Chi - squareforthespecifiedconfidencelevelat\ 1\ degreeoffreedom$ $N = Populationsize$ P = $Populationproportion$ (.50 $inthistable$
3. $ME = DesiredmarginofError$ ($epressedasaproportio$n)

To test reliability, we used Cronbach's Alpha for comparing internal reliability between the variables and the formula used to test it was:

(2) $$\alpha = \frac{N.\overline{C}}{v + (N-1).\overline{C}}$$

Here, N is equal to the number of items, c-bar is the average inter-item covariance among the items and v-bar equals average variance.

6. Results and analysis

General information about the respondents

The profile of the responding companies includes type of business, ownership of the company, respondent's position, computer ownership, internet access, length of internet access and operating system. Our study provides the frequency distribution of each variable for the sample respondents. A majority of the surveyed companies were in wholesale and retail businesses (47.7 per cent). Most of the respondents' companies had local ownership (98.3 percent) or 159 out of 180 respondents.

More than 50 per cent (53.9 per cent) of the surveyed middle-managers (and below in rank) represented a higher percentage amongst all the 97 respondents. However, executives formed the second highest group in our study at 27.8 percent, followed by managers at 12.8 percent. Top level management such as CEOs and owners of companies were the least (5.6 percent or 10 out of 180 respondents).

Regression analysis

We analyzed the data using a multiple linear regression. The purpose of a regression analysis is to relate a dependent variable to a set of independent variables. We estimated the regression coefficient of independent variables on ICT adoption. The overall model is significant at the 1 per cent level. The independent variables explain 53 per cent of the variance in ICT adoption. Of the independent variables, perceived benefits (+), ICT knowledge and skills (+) and government support (+) were the only predictors statistically different from zero and had a significant and direct effect on ICT adoption intention. The remaining -- perceived costs (-) and external pressures (+) -- had no significant direct effect on ICT adoption intentions.

Discussion

According to our results, a perceived benefit has a strong, significant relation to ICT adoption. This was expected since literature has consistently shown that perceived benefits have a significant and positive influence on the ICT adoption (Bingi et al., 2000; Grover and Goslar, 1993; Wang and Tasai, 2002). Internet allows a company to cross international boundaries. However, the respondents did not find computers simplifying their daily business operations.

Use of ICT applications for business purposes brings numerous advantages for users. In our study most of the businessmen were curious to find out the benefits that they could gain through appropriate ICT implementation.

Perceived costs were found to have a direct impact on ICT adoption. One possible reason for this is that SMEs did not have all types of financial support. They did not have options to get financial support for ICT costs including investments in its implementation (networks, PCs, data storage, demonstration, servers, software/hardware and other peripheral devices). These conditions can lead to perceived costs of ICT adoption. The relation between employees' ICT knowledge and skills was significant. It is important for SMEs to determine their employees' knowledge and skills of ICT because this knowledge or previous experiences may influence an organization's decision to adopt ICT. Moreover, managers or owners knowledge or skills about ICT is increasing the opportunity of ICT use among businesses.

Reynolds et al., (1994) found that small business owners/managers were unlikely to adopt more sophisticated technologies if they were not familiar with the basic ones. This is supported by Mehrtens et al. (2001) who demonstrate that employees with technological skills in particular encouraged firms to recognize and implement ICT in their businesses. This is a principal internal motivating factor for businesses to adopt ICT. Past studies have also found that external pressures play a critical role in IT adoption by small firms (Beatty, 1998; Swatman and Swatman, 1991; Webster, 1994). However, our study found that external pressures had a positive relationship with ICT adoption intentions and this relationship was not significant. One possible reason is that Rwandan SMEs are not involved in global businesses so there is not much pressure from customers or suppliers to adopt ICT in their operations.

7. Recommendations

Our study shows that government support had a significant and strong positive relation to ICT adoption. This is also supported by Stoneman and David (1986). The impact of government policies and initiatives has direct and indirect stimulation to the supply of information which produces faster technology diffusion. For example, the Government of Rwanda wants to increase internet accessibility by implementing optic fiber covering all 30 districts which will help SMEs use technology easily.

Our study shows five significant indicators of SMEs' intention to adopt ICT in their businesses. Government agencies like RDB, RURA, the Ministry of ICT and other government agencies should create better awareness about the benefits of ICT to encourage a higher rate of adoption. This can be done by having seminars or induction sessions to allow SMEs to evaluate their new inventions.

To get a greater response to ICT adoption, it is recommended that the authorities should give certificates as a token and financial support for attending seminars. They could establish a close link with all SMEs and get continuous feedback from them to identify the problem areas and take necessary actions to rectify them.

Another way of enhancing the use of ICT in the SME sector is for the government to enforce standardized, consistent and uniform policies in all SME sectors, agencies or subsidiaries in implementing ICT systems. As the respondents in our study found ICT a complex system,

the system should be made user-friendly as not all users are familiar with computers and the internet, especially old SMEs.

Global ICT policies have become more mainstream in the last decade underpinning growth, jobs, increasing productivity, enhancing the delivery of public and private services and achieving broad socioeconomic objectives in the areas of healthcare, education, climate change, energy, employment and social development especially among SMEs. As such, the global ICT industry is fast changing as a result of emerging technologies and economic, social and business trends. As ICT applications and services are becoming ubiquitous, they are increasingly essential for ensuring sustainable economic development by enforcing use of ICT in business sectors. Hence, it is recommended that policymakers should emphasize policies and strategies for ICT implementation in all sectors and among SMEs as we have seen that in Rwanda SMEs form 98 per cent of the total businesses and account for 41 per cent of all private sector employment (MINICOM, 2015).

The Government of Rwanda, as well as other East African countries can also use this research to take into consideration the impact of ICT on SMEs' performance in designing, implementing and evaluating ICT policies and initiatives in the region.

8. Conclusion

The purpose of this study was to investigate the effects of technology adoption by SMEs in Kigali city. This study contributes to and extends our understanding of the internet as a medium for commercial use in the service arena, identifying the rationale for SMEs adopting or rejecting ICT. From a managerial viewpoint, our findings provide support for investment decisions and for decisions relating to the development of internet services that address and take the concerns and needs of companies into consideration.

A multiple regression analysis showed that perceived benefits, ICT knowledge and skills and government support were significant elements of ICT adoption. Our model explained 52 per cent of the variance in SMEs' intentions to adopt ICT. As the Rwandan government grows in importance in doing business worldwide, an understanding of the factors that influence SMEs' adoption of ICT is valuable.

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