Using Mobile Technologies for eBusiness Infrastructure in Kenyan Rural Micro and Small Enterprises: Hype or Opportunity?

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Abstract

The number of mobile telephone subscribers has grown steadily (CCK 2009) since the liberalization of the Kenyan telecommunications sub-sector through the 1997 Communications Act (KCA 2008). This has seen increased Mobile technologies penetration in the rural areas. Mobile telephones are the first telecommunications infrastructure in most Kenyan rural enterprises. As has been seen in the case of Bangladesh (Lawson C & N Meyenn 2000), this has contributed to development through employment creation, access to services and increased access to information. With such a massive acceptance, mobile technologies create opportunities for Micro and Small Enterprises (MSEs) in rural areas to deploy an eBusiness infrastructure. These technologies also present a unique opportunity for Medium and Small Enterprises (MSEs) to overcome their institutional impediments to Internet access and e-payments by providing new services and technical capabilities such as effective and highly available voice communication, Internet access and e-payments transactions. Availability of these technologies is only an enabling factor. To positively impact an organization's performance, mobile technologies must appropriately match its eBusiness infrastructure requirements. However, appropriateness alone does not guarantee use. User acceptance is critical to successful implementation of any new technology. This study extends Task-Technology Fit (TTF) theory to incorporate acceptance as a factor that could influence the use of Wireless eBusiness

ISSN 1023-1757

infrastructure. The proposed model was empirically tested using questionnaire responses from MSEs in the rural town of Nanyuki. The findings from the study suggest that appropriateness and acceptance do influence the use of wireless technologies to implement eBusiness infrastructure and that using wireless technologies to implement eBusiness infrastructure positively and significantly influences an organization's performance. It also found that affordability and risk factors have a moderating effect on the use of wireless eBusiness infrastructure. Consequently, the final modified model referred to as the 'Suitability of Wireless eBusiness Infrastructure' (SWeBI) model has the power to explain use of wireless technologies to implement eBusiness infrastructure and could help practitioners to take efficient measures to improve its use in Kenyan rural MSEs.

Keywords: Wireless Technologies, eBusiness, Task-Technology Fit, Micro and Small Enterprises, user acceptance.

Introduction

There is no doubt that the explosive growth of cellular networks has an enormous impact on the livelihood of many Kenyans. Mobile telephones represent the first telecommunications infrastructure in most Kenyan rural homes and enterprises. Statistics show that mobile network coverage is predominantly urban with data from the Communications Commission of Kenya (CCK 2009) indicating that cellular networks have a national coverage of about 84% of the population but only about 33% of geographic coverage. This may require government intervention in expansion of the cellular networks to underserved areas that are usually regarded as not commercially profitable by service providers. Kenya is predominantly an agricultural country. The efficiency of the economy will be enhanced should farmers being able to efficiently communicate with their prospective buyers. Availing cellular networks to the farmers could easily transform the way they market their agricultural produce.

While mobile telephones traditionally mainly offer just voice communication the introduction of value added services such as mobile payments, mobile banking, Internet and data access could enhance the way

business is conducted and at the same time create new business opportunities. Mobile telephones and related services have created new livelihoods through creation of professional and non-professional jobs.

Problem Statement, Objectives and Research Questions

Most of the Kenyan population live in rural and remote areas and only a small fraction of these had access to telephones before the cellular network coverage was expanded there. Today, most rural areas have mobile telephone networks which come with a number of developmental benefits in terms of employment creation, access to services and increased access to information, hence contributing significantly to economic growth. This research has been motivated by the significant benefits mobile telephones have brought to disparate and geographically remote population in Kenya and seeks to explore how this expanding mobile phone infrastructure can be harnessed to support an enterprise-wide eBusiness infrastructure and benefit MSEs by facilitating use of eBusiness applications. The aim of this study is to determine the appropriateness of wireless technologies for implementing an eBusiness infrastructure in MSEs by evaluating whether the wireless technologies meet MSEs' eBusiness infrastructure requirements. The following research questions guided the study:

1. Does the extended Task-Technology Fit describe the utilisation of wireless technologies in implementing an eBusiness infrastructure?
2. Does utilisation of wireless technology in implementing an eBusiness infrastructure result in higher MSE performance?
3. What are the drivers and barriers to utilising wireless technologies to implement an eBusiness infrastructure in Kenyan MSEs?

Literature Review

The literature review covers three components of this study. The first section presents the scope of mobile technologies in the study, the second section presents a discussion on the theories applied in this study while the final section gives an overview of MSEs in Kenya and a review of the direction the research in use of Information and Communications Technologies (ICTs) in Kenyan MSEs has taken over the last few years.

Wireless Technologies

Mobile telephones are mostly used for voice communications, short message services and personal information management using calendars, reminders, scheduling, etc. The capacity to offer additional advanced services such as money transfers, accessing bank accounts, and paying bills, receiving special promotions and stock quotes, Internet access as well as initiating purchase or sales transactions has increased the level of mobile telephone usage over the last few years.

M-Payment is the transfer of money using mobile devices such as a mobile telephone to make payments for goods and services. The services of mobile payments are offered through Safaricom's (M-Pesa 2009) M-Pesa services and Zain's (Zap 2009) Zap services. Wireless Local Area Networks (WLANs) allow users to transmit and receive data within a range of 30-50 meters. Most organizations are using WLAN due to its flexibility, convenience and increased reliability. With the absence of cables, there is increased mobility, reduced installation time and cost savings when performing installation in difficult-to-wire areas. Bluetooth is also used to connect devices autonomously in a relatively small area within a radius of ten meters within personal workspaces. WLAN and Bluetooth allow enterprise information to be quickly accessed and transmitted within the enterprises hence increased productivity.

Wireless Metropolitan Networks (WMANs) provide mobile broadband wireless access network that meets the needs of business within a ity. In Kenya the use of Worldwide Interoperability for Microwave Access (WiMAX) technology to provide ubiquitous broadband access for wireless data, voice and video services is now common in major towns and cities. The wireless network is accessed through mobile devices such as telephones and PDAs, and desktop systems connected to a wireless Internet access device such as a fixed wireless desktop telephone or a wireless data modem.

There is also use of mobile technologies such as the HealthTrack! (2009), and Open Data Kit (2009) in the Kenyan health services for data collection purposes. Such tools could be useful to the MSEs' traders as they distribute their products in the rural areas to collect and manage data pertaining to their sales, deliveries and future orders while monitoring their stocks back at their stores.

Task-Technology Fit

As with any choice and implementation of technology, the question of choosing the right technology at the right time is always pertinent. The main aim of the Task-Technology Fit model by Goodhue and Thompson (1995) is to match the capabilities of the technology to the demands of the particular task. It is the degree to which features of a technology match the requirements of the task and the abilities of the individuals involved with the task. Goodhue and Thompson (1995) specified the TTF construct as consisting of the following variables: data quality, locatability of data, authorization to access data, data compatibility between systems, training and ease of use, production timeliness, systems reliability, and information systems relationship with the user.

Task Technology Fit is the relationship between task requirements, technology functionality, technology experiences and task knowledge (Benford & Hunton 2000). Benslimane, Plaisant & Bernard (2002) validated TTF on web-based procurement from corporate buyers from organisations operating in various industries in Canada. They concluded that a better fit between the tasks required during the procurement process and Internet websites' functionalities leads to a higher level of web usage, which then leads to an improved performance for users. Gagnon *et al.,* (2004) validated TTF and found reasonably good fit between the task and individuals utilizing the administrative support systems in a university setting. D'Ambra and Wilson (2004) introduced an uncertainty factor in the TTF to investigate the adoption of the World Wide Web for international travel. Staples and Seddon (2004) found out that TTF could explain performance in both mandatory and voluntary use. Norzaidi and Intan Salwani (2008) carried out a study to test whether TTF predicts Intranet usage in Malaysia and found that TTF could significantly predict usage if task and technology were matched.

This study aims to test the fit between wireless technologies and eBusiness infrastructure within MSEs. To the knowledge of the researcher TTF has not been validated in the context of IT adoption in Kenya and proposes that the model may be suitable for investigating the appropriateness of wireless technologies in implementing an eBusiness infrastructure in Kenyan MSEs.

Technology Acceptance

The Unified Theory of Acceptance and use of Technology (UTAUT) proposed by Venkatesh, Morris, Davis and Davis (2003) consolidates constructs from eight user acceptance models. Unlike other user acceptance models UTAUT takes into consideration the fact that some systems are mandatory and others are voluntary. UTAUT has four constructs. These are Performance Expectancy, Effort Expectancy, Social influence, and Facilitating conditions. The four constructs are independent variables influencing the dependent variables behavioural intention to use and usage. Gender, age, experience with the system and voluntariness of the system have indirect influence on the dependent variables through the four core constructs hence they have a moderating effect. UTAUT has an accuracy of 70% in predicting user acceptance of information technology innovations, Venkatesh *et al.,* (2003), which all the previous models were not able to successfully do. This is why UTAUT is regarded a superior model. This paper extends the TTF model with UTAUT constructs.

MSEs in Kenya

In Kenya, MSEs are defined as those non-primary enterprises (excluding agricultural production, animal husbandry, fishing, hunting, gathering and forestry), whether in the formal or informal sector which employ 1-50 people (ICED 1999). Micro-enterprises are those that employ 10 or fewer workers and small enterprises are those that employ 11-50 workers. The business activities of MSEs include manufacturing, trade and service provision. The National Baseline Survey (ICEG 1999) revealed that there were 1.3 million MSEs in Kenya by 1999 compared to 910,000 in 1993, reflecting a 7% increase per year. The survey also revealed that: 66% of the enterprises are located in rural areas. In terms of operations, the survey established that 13.4% of the enterprises are in manufacturing; 64.3% of the enterprises are engaged in trade while 14.8% of the enterprises are in services provision. In 1999, MSEs employed 2.4 million people (ICEG 1999) compared to 7.9 million people in 2008 (Republic of Kenya 2009) are presented in figure 1 below. The 1999 MSEs contributed 18% to GDP (ICEG 1999) while the Economic Survey of 2003 (Republic of Kenya 2003) shows that the MSEs contributed 18.4% in the year 2002. This implies that,

with the help of appropriate technologies and technical support services, MSEs can contribute immensely to the growth of the Kenyan economy.

MSEs and Information and Communications Technology Research

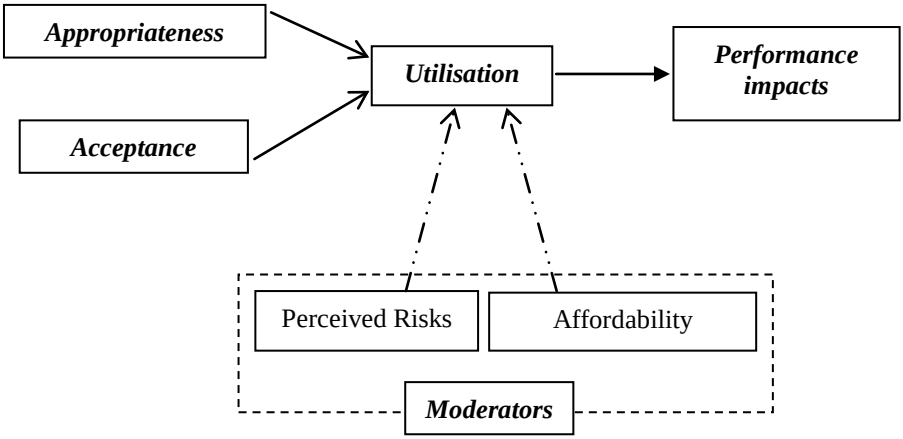
Research on mobile telephone use in MSEs includes a study on changes to social and business networks (Donner 2007). The status of e-commerce in Kenya has been studied by Mureithi (2000), Mulli (2004) and Kiiru (2002). The Kenya country e-preparedness report (Atac 2003) also highlights ICT access issues between late nineteen ninety's and the year 2003. A further review of published literature on MSEs shows that, to date, a number of studies conducted on MSEs focus on the sector's contribution to the economy in terms of employment, income, and gross domestic product such as the National Baseline Survey (ICEG 1999). Other studies focus on access to credit (Aketon 2007), and government policy and strategy frameworks (ACEG 2006; Ronge *et al.* 2002). Most of the current research focuses on ICT access and usage. There has been no known research, to the knowledge of the researcher, which has studied the use and impact of wireless networks on e-business usage in Kenya. This study seeks to address this research gap.

Research Methodology

The research model used to guide the study is shown in figure 1. This model is grounded in the streams of research focusing on Task-Technology Fit and Technology Acceptance drawn from a literature review to provide a richer understanding of the appropriateness, acceptance utilisation and performance impacts of using wireless technologies in implementing an eBusiness infrastructure in Kenyan rural MSEs. This model was designed to incorporate the essential measures to test appropriateness and user acceptance as well as moderating variables from the preliminary study. Venkatesh, Morris, Davis and Davis (2003) adapted the measures of appropriateness from the Task-Technology Fit model by Goodhue and Thompson (1995) while the measures for User Acceptance are from the Unified Theory of Acceptance and use of Technology (UTAUT) proposed. Utilization measures are usage of voice calls, text messages, m-payments, m-banking, data networks, Internet access and information management using

calendars and reminders. From the preliminary study, affordability and perceived risks had a moderating effect on use of mobile technologies. Performance impacts were measured through improved productivity, improved communication and coordination, reduced coordination costs and faster transactions.

Figure 1: Research model



Each item in the model had a corresponding set of questions. The questionnaire was composed of thirty-five unambiguous questions that were easy for respondents to complete. Each item on the questionnaire was measured on a five-point Likert scale whose end points were 'strongly agree' (5) and 'strongly disagree' (1). A list is presented here as table 1.

To test the research model, a survey was conducted using a questionnaire to gather the necessary information from Nanyuki town. Nanyuki town was purposely selected for this study because it has all the characteristics of a Kenyan rural town. Nanyuki is a town lying on the equator and North West of Mount Kenya. Climbers and backpackers often visit it on their way to or from Mount Kenya. Mount Kenya is the highest mountain in Kenya and the second highest in Africa (after Mount Kilimanjaro). Economic activities in the Nanyuki consist mainly of tourism, trade and agriculture (particularly in the horticulture and ranching). Other

economic activities include small-scale industries in textile and food processing.

Table 1: Constructs and their measures

Model Construct (Items)	*Measures*	*Adapted from*
Appropriateness (10)	Quality of data, locatability of data, Ease of use, Training, Timeliness, System reliability, Relationship with users	TTF (Goodhue and Thompson 1995)
	Mobility: employees can access same services from any where	Use context (preliminary study)
Acceptance (7)	Perceived usefulness, Social influence (Enabling Business Environment)	UTAUT (Venkatesh *et al.* 2003)
Moderators (7)	Risk factors, Cost factors (Affordable prices) of using wireless eBusiness infrastructure	Barriers to use (preliminary study)
Utilization (4)	Use and frequency of using wireless technologies	TTF (Goodhue and Thompson 1995)
Performance impacts (4)	Improved productivity and efficiency, reduced operation costs, improved communication and coordination, improve effectiveness	TTF (Goodhue and Thompson 1995)

Data Collection and Analysis

The survey results were analysed using SPSS 15.0 for Windows® and Microsoft Excel 2003®. MSEs in Kenya operate under similar conditions and have uniform characteristics. The questionnaire was administered to 60 enterprises in Nanyuki town. 54 responses were received. After eliminating incomplete responses, 50 usable responses were selected as the sample, an

overall response rate of 83.33%. Such a good response rate was attributed to the ample response time given to the respondents to complete the questionnaire and the follow-up telephone calls made to the respondents in order to encourage their participation. Another contributing factor could be that most of the respondents are the owners or the managers of these enterprises.

The following table gives the demographic breakdown of respondents by gender, age, education and the roles of the respondents within the enterprises.

Table 2: Demographic characteristics

Overview of respondents		**Frequency**	**Percentage**
Gender	Male	32	69.57
	Female	14	30.43
Age	18-24	14	30.43
	25-34	20	43.48
	35-44	6	13.04
	45-54	6	13.04
Education Level	High School	2	4.35
	Diploma	12	26.09
	Professional Course such as CPA	6	13.04
	College certificate	8	17.39
	Undergraduate degree	16	34.78
	Postgraduate degree	2	4.35
Role of the respondents	Managers	36	72
	Computer systems support staff	8	16
	Sales	2	4
	Accountants	4	8

Using mobile payments and mobile banking makes it easier to conduct business, and almost all enterprises in the study have used it. The number of enterprises using eBusiness applications is also relatively high, implying that the uptake of eBusiness applications in the rural Kenya is gaining acceptance. This could also be attributed to adequate infrastructure provided by wireless technologies, which has proved to be highly beneficial

to the enterprises. Table 3 gives an overview of the use of mobile technologies in MSEs in Nanyuki as at 2009.

Internal consistency is used to assess the consistency of results across items within a test. Cronbach's Alpha is one of the most widely used diagnostic measures of internal consistency. Cronbach's Alpha was calculated for the six core constructs and the results are presented in table 4. All the constructs exhibited a Cronbach's alpha above the 0.7 acceptable levels as reported by Hair *et al.* (1998). The results show that the questionnaire was a reliable measurement instrument.

Table 3: Use of wireless technologies

Mobile phone to	Make calls and send messages (SMS)	100%
	Checking and paying utility bills such as Water and Electricity bills	42%
	M-banking (checking account balance, Bank SMS alerts and notifications)	38%
	Receive SMS advertisements and promotional materials	100%
	Send SMS advertisements and promotional materials	10%
	Checking stock prices, alerts and quotations	74%
	Business information management using calendars, reminders, contacts and schedules	96%
	Make mobile payments (M-Pesa or Zap)	64%
	Access internet	22%
Wireless desktop phones to access the Internet (Telkom - CDMA)		16%
Wireless Modem to access internet		48%
Wireless Broadband Internet Access – Safaricom 3G, Orange 3G+ technologies		12%
Wi-Fi for Wireless Local Area Network		8%
Bluetooth to connect devices		2%

Table 4 shows that the research instrument was reliable, with each of the constructs achieving a Cronbach alpha measure greater than 0.8.

Table 4: Reliability analysis

Construct	Reliability (Cronbachs's α)	Mean**	St. Deviation
Appropriateness	0.924	4.08	0.944
User Acceptance	0.939	3.68	0.741
Utilisation	0.812	4.36	0.563
Affordability	0.953	3.62	1.107
Perceived Risks	0.895	3.44	1.195
Performance Impacts	0.952	4.24	0.657

Answers to Research Questions

The primary purpose of this study was to investigate the extent to which wireless technologies meet the eBusiness infrastructure requirements of Kenyan rural MSEs. The outcome of the study highlights that appropriateness and user acceptance directly influences utilization of wireless eBusiness infrastructure while utilization has a huge positive impact on performance of MSEs in rural areas. Wireless technologies consist of data networks, cellular Internet and mobile payments. This provides the necessary infrastructure for eBusiness applications usage by allowing Internet access, mobile payments and ease access to enterprise data. The potential of wireless technologies to facilitate internal business process automation, procurement and supply chain management, marketing and sales processes management and e-commerce and customer relationship management, all, which require faster access to current and up-to-date information, is significant. The cost of using and maintaining the systems seems to be a key aspect of choosing to use wireless technologies to implement eBusiness infrastructure.

The entrepreneurs also consider after-sales support as a major factor affecting the decision to continue using a particular vender's service. When a new provider emerges and offers the same services at a better price, greater quality coupled with efficient support and a faster response to down time, this provider wins over all the existing users. The entrepreneurs seem to be using the word of mouth to share their experiences in using a particular wireless technology and eventually influencing other users' decision to use the technology.

Another major issue that seems to determine the use of wireless technology is access to information. There is lack of awareness on all the benefits of using wireless technology in implementing eBusiness infrastructure in some MSEs. Most entrepreneurs depend on corporate marketers to get information about the available wireless technology services. This leads to use of technology on bases of first (sales person) come, first served or on who is convincing well enough. These marketers do not necessarily assess the technological and organisational issues necessary in acceptance and usage of their products before recommending the application of a particular technology. Their main catch is on costs and not the quality of their services as they are familiar with the limited budget and resource allocation for information technology related investments within MSEs. This creates a need to have the government subsidise infrastructure rollout in areas regarded as not being commercially profitable by most service providers.

Some MSEs considered affordability (cost of installation and daily usage) to moderate their use of wireless technologies while security and privacy risks are considered a priority while using wireless technologies.

Conclusion

The findings of the study demonstrate the suitability of wireless technologies to implement an eBusiness infrastructure in Kenyan Rural MSEs. MSEs in Kenyan rural areas are today using wireless technologies to implement eBusiness infrastructure leading to the existence of Smart MSEs. Smart MSEs manage their customer relationships, supply chains and core business operations using wireless technologies, making them more efficient, enhancing their productivity and improving on their internal and external communications.

Efficiency due to mobility, reduced installation cost and time, increase in employee's productivity and customer satisfaction are some of the benefits MSEs are enjoying as a result of implementing eBusiness using wireless technologies. Also reduced connection costs, ease of installation and maintenance make wireless technologies an ideal choice in implementing eBusiness infrastructure for most rural MSEs. All these benefits have a positive direct effect on MSEs' profitability and performance.

Using the research model developed in this study, the entrepreneurs can test any technology availed to them and decide on what bases to use the technology or not and establish which technology is suitable to be the enterprise's IT infrastructure. Wireless technologies faithful usage increases user's task performance when the technologies fit the required tasks and the user is sufficiently competent to use the technology. Wireless eBusiness infrastructure has increased competitiveness in most MSEs as they seek to improve how they operate in terms of quality of service, faster and cheaper transactions and efficiency. Wireless technologies have proved to be highly beneficial and have led to better organisational performance, hence they are not just hype but an opportunity for Kenyan rural MSEs to implement their eBusiness infrastructure

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