

## AN EMPRICAL INVESTIGATION ON THE RELATIONSHIP BETWEEN TECHNOLOGICAL INFRASTRUCTURE AND GOVERNMENT REGULATIONS ON EFFECTIVE OPERATIONS OF M-PAYMENT SYSTEMS IN KENYA

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### Abstract

*Mobile phones have become potential and efficient way to communicate globally. Since its inception in Kenya, the Safaricom M-Payment service has gained a lot of popularity and has spread throughout the country. This wide spread has been made possible manly by M-Pesa agents who have distributed the service countrywide. Despite their enormous role in ensuring that the M-Pesa service becomes a success, the agents are faced by various constraints that act as impediment to their smooth and effective operations. This study sought to investigate the effect of government regulatory requirements and technological infrastructure based factors on effective operations of M-Payment agents in Kenya. Through Multiple-linear regression analysis, the study established that the operations of Safaricom M-Payment agents were significantly affected by the state of*

*technological infrastructure. The state of the technological infrastructure was found to be poor hence making the M-Payment network unstable. This study recommends that the Mobile Service Providers (MSP) need to improve on the stability of M-Payment network and addresses the errors commonly found in the M-payment service transactions. To this end, proper liability sharing between the M-payment Agents, mobile service provider and the customer should be clearly spelt-out to ensure smooth operation of M-payment agents.*

**Key words :** Mobile Payments (M-Payments), Mobile Devices, Wireless, M-Pesa Agent, Electronic Commerce, Mobile Commerce (M-Commerce).

## **Introduction**

The technology available on mobile phones has rapidly evolved over the past years. The concept of mobile commerce came into existence around the mid 1990's, which resulted in optimistic forecasting that by the year 2000, mobile commerce transactions would occur on a daily basis. With great sums of money being exchanged for UMTS licenses (3G) across Europe, early 2000 further experienced great confidence in the future of the mobile communications. The promised technological outcomes however did not live up to prevailing expectation, which impacted on the ability of Mobile Network Operators (MNOs) to deliver services. It was observed that the next major shift in the use of mobile payment will obviously be toward wireless and mobile commerce and may happen with the same start-up problems encountered by E-Commerce as in many ways M-Commerce is the continuation of E-Commerce with mobile devices (Keen and Mackintosh, 2001).

M-payment, relies at the forefront of this technological innovation and development. Mobile phones, which are in greater number in the market than any other device, can now be used as a channel to advertise, sell and buy products and services (Vodafone, 2008). The latest studies/trials of mobile payment technologies at mass market scale have increased prospects for mobile payment applications in more areas pointing to faster growth in the future (Nicolas, 2008). The major success of M-Payment has been that that it has created a highly popular, affordable payment service with only limited involvement of a bank (Hughes and Lonie, 2007).

## **Statement of the problem**

A mobile payment (M-Payment) service comprises of all technologies that are offered to the user as well as all tasks that the payment service provider(s) perform to commit payment transactions. Mobile payment services involve several parties for a direct transaction; the customer, the agent, and the service providers are involved. Many issues such as the power and the interests of the parties, legal and regulatory environment, and payment culture impact the orchestration of technologies and tasks into a mobile payment service may arise in the process of transactions. A mobile payment may be either payment for purchases where mobile payments compete with or complement cash, checks, credit cards, and debit cards or payments of bills/invoices which typically provide access to account based payments such as money transfers, Internet banking payments, or direct debit assignments (Ding and Hampe, 2003b). This leads to infrastructural, government regulatory and legal issues.

Mobile phone technology has become widespread, even in developing parts of the world, simpler and more prevalent than computers; mobile phones have become a potential and efficient way to communicate globally (UNCTAD, 2008). Despite their enormous role in ensuring that the M-Payment service becomes a success, the

agents' operations are affected by various factors that act as impediment to their smooth and effective operations. This study sought to investigate the effect of government regulatory requirements and technological infrastructure based factors on effective operations of M-Payment agents in Kenya.

### **Research Objectives**

- i. To establish the effect of government regulatory requirements on effective operations of M-Payment agents in Nairobi, Kenya.
- ii. To establish the effect of technological infrastructure on the operations of M-Payment Agents in Nairobi, Kenya.
- iii. To recommend ways in which the various challenges facing M-payment agents can be mitigated to enhance effectiveness in their operations.

### **Summary of Related studies**

In Kenya like the rest of the world, the ubiquitous mobile telephone has evolved from a simple communications tool to a multi-functional computing device. In addition to voice calls, modern mobile telephones also include text capability, cameras, contacts lists, calendars; e-mail access, Web browsing and much more. This increased functionality has made the mobile phone as common and intimate as, well, a wallet, purse, keys or money increasingly, individual Kenyans are adding payments for goods and services to the list of functions they expect from their mobile telephone. Mobile payments are the newest form of electronic payments which, in the business-to-consumer mode of E-commerce, also includes EFTPOS (Electronic Fund Transfer at point of sale), Smart Cards, and Credit Card Payments over the Internet, E-cash, and others. E-payment has been a popular payment method for consumers because it makes the need for cash on hand less crucial. Businesses benefit as well because funds can be transferred without having to handle or transport cash and coins. For both consumers and businesses, transactions can be more easily tracked and monitored (Srivastava, 2005).

Most mobile phones have an embedded chip that can be used to store value or provide secure authorization and identification that does not rely on a card reader, PC and modem combination or a POS terminal. Therefore, some experts believe that the mobile phone will replace even smart cards as a means of payment (Krueger and Bohle, 2001). The value proposition for mobile payments is derived from both the ubiquitous nature of the mobile phone and the potential for payments. In the latter case, mobile telephone operators already have billing systems that track payments. So mobile phones are especially well placed when billing small amounts (e.g., a parking meter, a vending machine) at low transaction costs. However, are consumers ready to embrace this new method of payment? What technological barriers affect the operation of M-Payment Agents? Are the consumers willing to embrace the new technology in the market? (Hinds, 2004).

The regulatory requirements are part of the external environment of the mobile payment business and thus outside management control. These include a number of state legislative and regulatory instruments and bodies that play a part in regulating the mobile commerce industries, including state acts such as the Telecommunications Act, Banking Act, Broadcasting Services Act, Corporations Act, Privacy Act, Electronic Transactions Act, Interactive Gambling Act, Spam Act, Trade Practices Act; whether such a regulatory framework will be sufficient for the needs of future mobile commerce models, given the cumulative advances in technologies and applications, other mobile commerce regulatory issues also relate to fair-trading and dispute resolution, content provision, tax collection, the use of camera phones and mobile payment systems.

The preference of payment instruments chosen at the real Point-of-Sale (POS) clearly influences the preferred payment method at the virtual POS (Krueger and Bohle, 2001). Changes in the commercial environment include the development of Internet and mobile networks into commercial channels, and the increasing automation and self-service orientation of payment services (Ondrus and Pigneur, 2005). Such changes in commercial transactions create needs for new or enhanced payment services and drive their development.

A study done by Lawrence et al., (2005) on three Australian M-Payment service providers revealed that the main reason for the collapse of one of the studied M-Payment service provider was the inability to successfully partner. The other two M-Payment service providers also demonstrated that partnering with banks and other mobile operators is vital for the success of these payment systems. Without such partners, mobile payment service providers are more likely to perish.

M-Payment service sits at the intersection of a number of important policy issues. Each issue is complex in its own right, and is often associated with a different regulatory domain: as many as five regulators (bank supervisor, payment regulator, telecommunication regulator, competition regulator, anti-money laundering authority) may be involved in crafting policy and regulations which affect this sector (Rawson 2005). The complex overlap of issues creates the very real risk of coordination failure across regulators. This failure may be one of the biggest impediments to the growth of M-Payment, at least of the transformational sort. However, even without the additional complexity introduced by M-Payment many of these issues require coordinated attention in order to expand access. It is possible; however, that M-Payment may be useful because the prospect of leapfrogging may help to galvanize the energy required among policy makers for the necessary coordination to happen (Lim, 2005).

Activity in the mobile financial services space around the world has ramped up a notch as more companies seek to bring to reality the vision of widespread usage of mobile devices to pay for goods and services. For various reasons, however, implementing this vision has been held back in practice: consumers are comfortable with existing payment options; the technology is not yet optimal; the end-user experience is cumbersome; and business models are still largely in flux (ITU, 2006b).

According to ITU, (2006c) Mobile payments are having a more penetrating impact in poorer economies than in mature ones, with market dynamics that are starkly different, especially in Africa. This is understandably due to a more constraining supply environment - one that is primarily cash-based, rife with antiquated regulations and burdened with a banking system that is geared to focus on the high end of the consumer market.

McKay and Brockway (1989) define IT infrastructure as the enabling foundation of shared information technology capabilities upon which business depends. They view IT infrastructure as the shared portion of the IT architecture. Earl (1989) defines IT infrastructure as the technological foundation of computer, communications, data and basic systems. He views IT infrastructure as the technology framework that guides the organization in satisfying business and management needs. Duncan (1995) refers to IT infrastructure as the set of IT resources that make feasible both innovations and the continuous improvement of IT systems.

Information technology (IT) infrastructure investment and management have become strategically important to mobile service providers since they face constant changing business and technological environments (Massey, Wheeler and Keen, 2000). Mobile service providers strive to take advantage of the IT capabilities that enable them to provide single-contact customer services and cross-selling opportunities.

The problem of inadequate access to affordable ICTs in most African countries is due to the poor state of Africa's ICT infrastructure, the weak policy and regulatory frameworks, and human resource deficiencies in these countries. Although African countries, in recent years have made some efforts to facilitate the ICT infrastructure deployment, roll-out and exploitation process in a number of areas (such as the sub-marine Fibre Optics Cable), Africa still remains the continent with the least capability in ICT and other related facilities (New Partnership for Africa's Development [NEPAD], 2002). The threat posed by the digital divide to the rapid development of African countries can on the whole be attributed to their inability to deploy, harness and exploit the developmental opportunities of mobile technology to advance their socio-economic development within the public, private and banking sector. The principal barrier to achieving the potential benefits of mobile technology in most sectors is often regarded as insufficient infrastructure and the high costs of investment. Further to this, lack of well-defined ICT frameworks has resulted to poor access to essential services by the citizens (McCormick and Kinyanjui, 2002).

According to Government of Kenya (2003), the major Information Systems and mobile technology challenges in the country consist of poor and inadequate information systems, inadequate IT infrastructure, limited skills in ICT, lack of appreciation of ICT, technology weaknesses exhibited by heavy reliance on inappropriate and obsolete technology, lack of skills on modern technology, lack of awareness of the changing technology, poor dissemination mechanisms between and among the various levels of enterprises, and poor technology linkages between the private and public sector institutions.

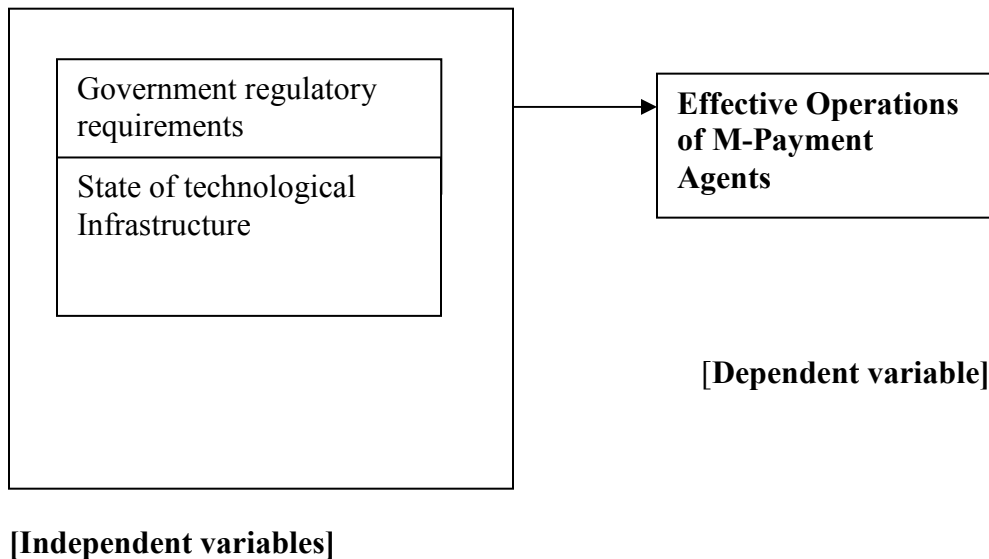
Physical Infrastructure underdevelopment such as Telecommunication and electricity are not available throughout the country, which negatively affect the development and adoption of M-Payment service. M-Payment's success is entirely dependent upon its network of agents scattered all across the country. These agents act as human ATM machines, converting e-money from your phone into hard cash, or vice-versa. One difficulty facing the businesses and other end users of M-Payment has been the scarcity of the agents and the poor state of infrastructure. According to Safaricom, there were 9,000 M-Payment Agents countrywide by the year 2008, which was not a sufficient number to serve the entire country. The scarcity of agents and poor state of infrastructure means that only few customers are able to use the service. In addition, Safaricom also suffered from the very problem that M-Payment set out to eliminate: it is hard to transport large amounts of hard cash around a country with an underdeveloped infrastructure. However Safaricom struggled to ensure that all of its agents have sufficient reserves of cash to cope with customer demands (Safaricom, 2008).

It is apparent that the penetration strategies for M- payment service have to be carefully researched to develop a successful M-Payment/M-Pesa. This research attempts to provide an insight into the key challenges and barriers surrounding the M-Payment agents, with a view to providing a framework for reassessing the future directions for a more successful M- Payment service market in Kenya.

### Conceptual Framework

The conceptual framework of this study is based on two independent variables namely; government regulatory requirements and infrastructure based factors. Figure 2.1 below shows how the independent variables affect operations of M-Payment Agents which is the dependent variable of the study.

**Figure 1. The Conceptual Model**



The Conceptualization Model in figure 2.1 show that the independent variables namely; government regulatory requirements and infrastructure based factors affect the effective operations of M-Payment Agents which is the dependent variable of this study. Therefore addressing the specific aspects of the independent variable leads to an effective and increased output of the M-Payment Agents which in term improves the satisfaction of M-Payment Agents.

### Methodology

This study adapted a descriptive research design and the researcher conducted a field study in Nairobi region. The target population was all the 1,202 registered M-Payment Agents operating within Nairobi region (Safaricom, 2008). Cluster and simple random sampling technique was used in this study. According to Kothari (2003), representative sample size should be in the range of 10% to 30% of the target population hence 10% sample percentage was chosen from each cluster. Therefore a total of 120 respondents were interviewed. This data was collected through administration of questionnaires to the respondents. Cronbach Alpha was computed to assess the reliability of the data collected while Kaiser-Meyer-Olkin (KMO) test and Barlett's Test were used to measure Sampling Adequacy and Sphericity respectively.

This study consisted of two main independent variables which included; government regulatory requirements and infrastructure based factors. Key techniques used to measure various variable included; ANOVA test, Regression Analysis, Likert scale, and descriptive statistics such as frequencies and percentage.

A Regression Model shown in below was developed to assess the influence of independent variables on the dependent variable while ANOVA Test was used to test for the significance of the regression model adopted in the study.

$$Y = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

**Whereby:** Y = Dependent Variable – Effective Operations of M-Payment Agents

X<sub>1-2</sub> - are the independent variables of the study: That is;

X<sub>1</sub> = Government regulatory requirements, X<sub>2</sub> = state of Infrastructure

$\alpha_0$  - is a constant

$\beta_{1-2}$  - are regression coefficients

$\varepsilon$  - is the Random error term

### Data Reliability Assessment

The researcher sought to assess the reliability and validity of the instruments used to measure the various variables in the study. To this end, Internal Consistency Measurement and Measure of Sampling Adequacy were computed as shown in the sub-sections below.

Table 1. Cronbach Alpha for Reliability Assessments

Study Variables	Number of items	Cronbach Alpha Values
Government regulatory requirements	5	0.6202
State of Infrastructure	6	0.8448

(Survey Data, 2010)

From these findings it can be concluded that the constructs are deemed to have adequate reliability for the subsequent stages of analysis since all the Cronbach Alpha values was greater than 0.6. (George and Mallery, 2003).

## Findings

### Effect of Existing Government Legislation

There are a number of state set legislative and regulatory Acts that regulates the mobile telecommunication industry. This study sought to establish whether the M-Payment agents were conversant with the contents of the various set legislative Acts that control mobile telecommunication and Money transfer services in the country. The findings show that most of the respondents were manly conversant with the Telecommunications Act as accounted for by 68.9%. Most of the respondents were not conversant with other legislative set Acts. This shows that most of M-Payment agents are not conversant with the state set legislative Acts that govern mobile telecommunication and money transfer services. Most of the respondents (70%) however affirmed that their M-Payment business was affected by Government regulatory issues.

Table1 Descriptive Results

Acts	Frequency	% of the Total
Telecommunications Act	73	68.9%
Banking Act	28	26.4%
Corporations Act	28	26.4%
Electronic Transactions Act	20	18.9%
Interactive Gambling Act	26	24.5%
Trade Practices Act	22	20.8%

(Survey Data, 2010)

### Overall Rating of the State of Technological Infrastructure

The respondents were expected to rated the overall state of infrastructure in the region.

The findings show that more than half of the respondents (56.7%) rated the overall state of infrastructure as fair. Very good, excellent, good and poor responses accounted for 10%, 8.3%, 13.3% and 11.7% respectively. This shows a neutral position by the respondent hence the need for improvement on the state of infrastructure in the region to enhance the efficient of the M-Payment business.

### Multiple Linear Regression Analysis

In order to come up with practical conclusion of this study, the researcher conducted a regression analysis. The findings are present in the table below

Table 2 Regression Results

Independent variables	Coefficients Beta ( $\beta$ )	T-Statistics	P-Values	Decisions
Constant	2.182	2.965	0.004*	
Government regulatory requirements	0.000	-0.011	0.991	Accept $H_0$
State of technological Infrastructure	0.052	2.015	0.033*	Reject $H_0$

(Survey Data, 2010)

The findings are presented in table above show that the independent variable namely; State of Infrastructure was statistically significant since their P-value were all less than 0.05 (5%) while Government regulatory requirements was not significant since its p-values were greater than 0.05(5%) as shown in the table. The variables that were found not significant were therefore removed from the model since they had no significant effect on the dependent variable. Therefore the new regression model appears as shown in equation below;

### A Multiple Linear Regression Model Two

$$Y = \alpha_0 + \beta_2 X_2 + \varepsilon$$

**Whereby;** Y =Dependent Variable – effective Operations of M-Payment Agents



$X_2$  = state of technological Infrastructure

$\alpha_0$  -is a constant

$\beta_1$ -is a regression coefficients

$\epsilon$  –is the Random error term

Based of the findings in table above and subsequent new model in the equation above it can be conclude that the effective operations of M-Payment agents is significantly affected by state of Infrastructure hence the need to devise strategies aimed at address this factor.

## Conclusions

Through Multiple-Linear Regression Analysis the study established that state of technological infrastructure was the most significant factors that affected the operations of the M-Payment Agents. The state of the infrastructure was found to be poor hence making the M-Payment network unstable. This lead to too many errors during M-payment transactions and delays in money transfers were also evident in the M-payment transactions resulting to inconvenience to customers. All these can be improved by addressing issues of infrastructure.

The M-Payment Agent were found to have adequate mobile devices needed for M-Payment transactions however most of them were provide by the mobile service provider (Safaricom). In addition, most of the M-Payment Agents were manly conversant with the Telecommunications Act. Other state set legislative Acts that control mobile telecommunication and money transfer services were not familiar to the M-payment Agents. Additionally the tax paid to the government by the M-Payment Agents was found to be excessive and discouraging to the business growth hence a need for a review.

## Recommendations

This study recommends that the Mobile Service Providers (MSP) need to improve on the stability of M-Payment network and addresses the errors commonly found in the M-payment service transactions. To this end proper liability sharing between the M-payment Agents, mobile service provider and the customer should be clearly spelt-out to ensure smooth operation of M-payment agents. This study found out that error in transaction often strained Agents and customer relationship since there was no clarity in liability sharing between mobile service provider, Agent and customers in case of loss of payments.

The Mobile Service Provider need also to address the cost associated with M-payment start up as well as the start up requirement since these were found prohibitory to M-Payment business. In additional the MSP need to address the security concerns of M-Payment Agent to make the business vibrant since most of M-Payment Agent complained that the M-Payment business exposed them to potential risks of robbery.

This study further recommends that the policy makers and government ministry especially the Ministry of Communication need to embark on effective operationalization and awareness creation of the various States set legislative Acts to enhance compliance by the business community. This study established that most of the M-Payment Agents were not familiar with most of the state set legislative acts that control mobile telecommunication as well as money transfers. Additionally the tax paid to the government by the M-Payment

transactions was found to be excessive and discouraging to the business growth hence a need for a review to encourage small business growth.

### Future research

Since a high level of dissatisfaction among the M-Payment agents was evident in the study. There is a future need to focus on the causes of this dissatisfaction with a view of coming up with workable strategies to enhance M-payment agents' satisfaction with their work.

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