

Attitudes and intentions to use mobile money in Africa: Do electricity supply and regulation matter?

Abidin Alhassan^{1*}, Leon Li^{*}, Krishna Reddy^{*}, Geeta Duppati^{*}

Abstract

This research provides preliminary results on context based factors that determines the adoption and use of mobile money (MM) in Africa. Using data from Research ICT Africa, International Telecommunication Union and the World Bank, the hypothesised research model tested the context based constructs such as the availability of electricity, enabling regulation and rural dwellings with the technology acceptance model (TAM) to determine how these constructs affect peoples' intentions and attitudes towards the continuous adoption and use of MM. Exploring these constructs using the structural equation modelling (SEM) technique, the empirical results suggest that the perceived availability of electricity is an important factor for the mobile phone functionality to enable adoption and use of MM. Perceived enabling regulation also show a correlation with individuals' intention to adopt and use MM. However, perceived rural dwelling is found to negatively correlate with individuals' attitudes and intentions to adopt and use MM. This is because of the inadequate or lack of mobile network and national grid systems in rural areas. The policy implication is that African governments' public-private partnerships (PPPs) can assist with the construction of the relevant infrastructure for shared growth.

Key words: mobile money, technology acceptance model, ubiquity, perceived rural

¹ Corresponding Author: Abidin Alhassan, telephone +64223459643. Email: aaa44@students.waikato.ac.nz

* School of Accounting, Finance and Economics (SAFE), Waikato Management School, University of Waikato, Hamilton, NZ.

1.0 Introduction

Mobile money (MM) is considered by many as the new service frontier for financial inclusion, especially in Africa. This innovation has created tremendous opportunities for both service providers and users. Prior research states that only 23% of adults in Sub Saharan Africa (SSA) living below 2USD/day possess a formal bank account (Demirgüç-Kunt et al. 2015). The mobile phone is offering opportunities of financial access to previously unbanked segments of the population. The increased penetration of mobile phones for MM among the poor of Africa has concerned policymakers and development experts, especially the poverty level of the people and the drivers for MM penetration (Aker and Mbiti 2010).

The findings of prior researchers have provided understanding of the key drivers in consumer adoption and acceptance of MM in Africa, with key reference to the M-PESA of Kenya. These observations, in particular, include factors such as network of agents, poor financial infrastructure development and vigorous marketing leading to the explosive adoption of MM. The high number of consumers adopting MM since the inception of the Kenyan M-PESA in 2007 provides assurance that consumers are willing to engage. The issue that need to be addressed is “*whether post-adoption attitudes and intentions will allow users to continue to use this innovation in the future*”, as in traditional financial inclusion models². Considering the significance of retaining the use of MM, it is necessary to identify the factors affecting continuous usage of MM in Africa. This proposition is the motivation for conducting this research.

² Empirical evidence of poor take up and inadequate continuous use of bank accounts in randomized control trials (RCTs) research are enough evidence of what happens if context based factors are not addressed before interventions and innovations are rolled out. More details can be found in (Dupas et al. 2012, Karlan, Ratan, and Zinman 2014)

This study contributes to literature by providing empirical evidence on critical context based factors (modelled using TAM) that leads to the long-term continuous adoption and usage of MM, especially in rural Africa. To the best of our knowledge, this is the first research that critically examines the context based factors in the African context. Given the high practical relevance of prior empirical work (Schierz, Schilke, and Wirtz 2010), this research develops and tests an integrative model of factors determining consumers' adoption and use of MM services. MM costs that comprise of service pricing, supply of electricity for mobile phone functionality, mobile network infrastructure development, regulation, and income disparities are essential determinants of the continuous current and future adoption and usage beyond the endogenous factors of agent networks and marketing. An in-depth study that includes these factors may lead to greater consumer acceptance when the cost implications of this innovation are relatively lower compared to the traditional alternatives such as money transfer through banks and informal mechanisms through bus drivers in the long run (Schierz, Schilke, and Wirtz 2010). The preliminary results show that electricity availability, which denotes ubiquity is a significant factor for the continuous adoption and usage of MM in Africa, and that perceived cost of MM is still in the agreed threshold compared to the traditional money transfer mechanisms, such as, banks and informal systems. Moreover, perceived income disparity is not a significant factor that determines the continuous adoption and usage of MM in Africa³. In regard to perceived enabling regulation for MM, the results suggest that enabling MM regulation is a significant factor for MM adoption in Africa.

The rest of this paper is formulated as follows: Section 2 reviews the relevant literature; section 3 provides the hypotheses development, research model and method for testing these

³ This is true when we reflect on the number of mobile phones in Africa that defy the poverty nature of the African people. See Aker and Mbiti (2010) for more on this.

hypotheses for this study; section 4 describes the data, measurement and the empirical results; section 5 discusses the results and policy implications; and section 6 provides the conclusion.

2.0 Literature review

2.1 Review of related literature

A lack of access to instruments and means through which the poor can improve their lives has been identified as hampering the progress made by the poor to escape poverty. For instance, exclusion from the financial system is seen as an impediment for the poor to improve their lives (Demirgüç-Kunt, Honohan, and Beck 2008). As a result, the introduction of MM has been seen as best alternative to reducing poverty. Donner and Tellez (2008) contend that mobile transactions in developing countries enable users to do three main things: store value in an account, convert cash into and out of the bank account and transfer stored value between accounts. Ideally, MM enable easy transfer of e-money in a secure, convenient and with less costs. This is likened to the creation of a “pseudo account” when a person purchases an e-money from an agent (Aker and Mbiti 2010).

Empirical studies on the adoption of MM have recently grown in the literature. For instance, Murendo et al. (2018) in their study of social network effects on MM adoption in Uganda find that MM adoption is positively influenced by the size of the social network with which information is exchanged controlling for correlated effects and other information sources. In addition, they find that the effect of the social network is particularly pronounced for non-poor households. Gosavi (2018) who look at MM and firms access to finance in Eastern Sub-Saharan-Africa (SSA) indicate that firms that adopt and use MM are more likely to obtain loans or lines of credit after controlling for a large number of firm-level characteristics and using a newly introduced measure to identify access-to-finance status of the firms. (Gosavi 2018) also show that the firms that use MM are more productive than other firms in the region.

Hanafizadeh et al. (2014) look at mobile-banking adoption by Iranian bank clients and find that adaptation with life style and trust are the most significant antecedents explaining the adoption of mobile banking. A study that look at alternative banking services provision for the poor by Hinson (2011) argue that the poor can be offered banking services through the use of mobile technologies if the traditional financial setting does not allow the poor to access to financial services. By proposing a mobile banking model, Hinson (2011) conceptualized the key ways by which mobile phone technology can be used to increase pathways to banking access for poor people. Alalwan, Dwivedi, and Rana (2017) study the factors influencing adoption of mobile banking by Jordanian bank customers using an extended UTAUT2 with trust. The results show that behavioural intention is significantly and positively influenced by performance expectancy, effort expectancy, hedonic motivation, price value and trust. They maintain that a successful implementation of mobile banking largely depends on the extent to which customers are fully motivated to adopt mobile banking. Chaouali, Souiden, and Ladhari (2017) find in their study that intention of adopting mobile banking is determined by attitude toward mobile banking, which in turn is determined by attitude toward success, attitude toward failure, and attitude toward learning to use mobile banking, in which the last three attitudes are significantly influenced by general self-confidence and cynicism.

MM as a new innovation can empower poor people to improve their lives and escape poverty. Studies has demonstrated how MM innovation has helped to stabilize and secure the domestic money transfers for improved standard of living. Jack and Suri (2014) find that households that adopt M-PESA are better able to absorb shocks and experience improved consumption than their peers who do not use it. Aker et al. (2016) compared the use of MM and physical cash remittances in a drought crisis in Niger. In randomly selected households, they find that those who used MM to send and receive money enjoyed lower variable costs, better diets and depletion of fewer assets compared to those households that send physical cash.

Evidence of high costs leading to slow take-up of MM has been documented (Evans and Pirchio 2014, Gencer 2011). For instance, in Botswana the cost per transaction is (\$1.07) while in Ghana it is (\$0.25). When the costs of transactions become lower, it translates directly into good savings for the poor. This coupled with the safety and fast delivery becomes an advantage for poor to use as a better alternative to traditional forms. In addition to extending financial services to the poor, mobile money is expected to improve productivity by increasing the efficiency and lowering the cost of transactions, improving security, generating new employment opportunities, and creating a platform on which other businesses can grow.

Another factor that influence the adoption and growth of MM in Africa is the flow of rural-urban migration which creates a latent demand for money transfer. Mas and Morawczynski (2009) contend that poor alternatives for domestic remittances and lack of technology driven alternatives created a gap in the Kenyan domestic remittance market and the introduction of M-PESA therefore filled the gap.

The MM system as an electronic device can only function if there is electricity. Therefore national grid coverage becomes an important component to the continuous use of mobile phones for financial services. As mobile phone hardware costs continue to drop, the share of spending on energy for its functionality increases. High energy costs become a barrier to low-cost financial access. According to Rubin (2017) the expansion of digital technologies is fundamentally changing when and where we need energy. Most of these devices need constant, reliable electricity, and increasing demand for mobile network coverage, most important in rural and remote areas, requires electricity services to reach beyond the traditional grid.

Regulatory frameworks of MM ensures effective competition and availability of recourse for customers and players. Competition in the MM sector have brought efficiency,

effectiveness of service provision and associated costs for recourse (Aker and Mbiti 2010, Jack and Suri 2011, 2014).

Though a number of studies have empirically look at MM adoption using different variables and constructs, none has attempted to consider how energy needs of mobile phones can directly influence the adoption of MM especially in SSA. This study uses this variables and other to critically understand how context-based factors influences the adoption and intention to use MM in Africa.

3.0 Methods and hypotheses development

3.1 Theoretical perspectives

Davis (1985), argues that technological system user motivation can be used to predict the use of the system, which in turn is directly influenced by an external stimulus consisting of actual system's features and capabilities. He proposed the technology acceptance model (TAM) which can be considered the most influential extension of the theory of reasoned action (TRA) and the theory of planned behaviour (TPB) (Fishbein and Ajzen 1975). Accordingly, TAM has five attributes or concepts that help to predict the acceptance of a system by an individual. These includes: perceived ease of use, perceived usefulness, attitudes toward use, intention to use, and actual use (Davis 1989).

According to Bagozzi (2007), the TAM model is too parsimonious and should be expanded by factors particularly relevant to the specific technology under investigation. Also, integrating variables from related theoretical perspectives can provide a better understanding of consumer acceptance (Nysveen, Pedersen, and Thorbjørnsen 2005). Thus, consistent with other studies, we regard the TAM as a starting point of our research and extend it with additional constructs important to MM acceptance (Schierz, Schilke, and Wirtz 2010).

3.2 Research model and hypothesis development

Davis (1989) refined the TAM (after the conceptual model in which he talked about the system features and capabilities, user motivation, and actual system usage) by suggesting that user's motivation can be explained by three factors: perceived ease of use, perceived usefulness and attitude towards using the system. This is defined as the degree to which using a technology is positively or negatively valued by an individual. Attitude in turn positively affects consumers' adoption and usage intention (Davis 1989, Davis, Bagozzi, and Warshaw 1989). In our model, we use the percentage of subscribers per 100 inhabitants as the proxy for attitude towards the use of MM. This proxy is important in the sense that the percentage of people who actually subscribe to any mobile company will determine their attitudes to adopt and use the system.

The first hypothesis:

H₁ : There is a positive relationship between individual attitude towards continuous adoption and the intention to use MM.

The attitude of the user in turn was considered to be influenced by two major beliefs: perceived usefulness and perceived ease of use, with perceived ease of use having a direct influence on perceived usefulness. Kleinrock (1996) argues that most people are “nomads” when it comes to technology and this can be identified with mobile phones and Africans who are always on the “go” for economic activities. A person, who leads a busy life such that he/she is always on the move, will be more likely to adopt a MM enabled mobile phone compared to one who leads a sedentary lifestyle. MM effectiveness therefore rely on its ubiquity (Kleinrock 1996), and this can only happen if the functionality of the mobile phone such as having electricity to charge it is available. As electricity generation is well below full capacity in most parts of Africa, it is important to consider how that can affect the functionality of mobile phone usage. Rural dwellers who have no electricity will find it difficult to adopt and use MM, compare to those in urban areas. Therefore, the mobility-related needs that serve as the driver for adopting MM (Kakihara and Sorensen 2002) may affect its usage if national grid is unavailable. Perceived usefulness, which is believed to be directly influenced by perceived

ease of use means that MM service is available for everyday activities anytime anywhere. In accordance with this line of reasoning, we argue that MM can obtain a dominant channel position in product/service categories for financial inclusion, where the use of mobile applications offers customers indisputable mobile value by grasping the very essence of the combination of mobility, technology and lifestyle (Kakihara and Sorensen 2002) but only if there is availability of power to charge it constantly (Rubin 2017). We therefore proxy perceived usefulness as ability to use mobile phone and MM at anytime and anywhere by the percentage of people with access to the national grid. The Ubiquity of the MM system can only be made possible if electricity availability matches the use of mobile devices for financial services. Based on this, we propose our second hypothesis:

H_{2a} : There is positive relationship between perceived usefulness (ubiquity/grid) and attitudes towards continuous adoption and usage of MM.

H_{2b} : There is positive relationship between perceived usefulness (ubiquity/grid) and intention to adopt and use MM.

To model for perceived ease of use, we take inspiration from the work of Swanson (1982), who provided evidence that perceived ease of use and perceived usefulness of technology were both important behavioural determinants. Swanson hypothesised that potential users will select and use information reports based on a trade-off between perceived information quality and associated cost of access. Information quality here similar to perceived usefulness and cost of access similar to perceived ease of use. Comparatively, Mathieson, Peacock, and Chin (2001) and Luarn and Lin (2005) indeed find that perceived financial resources (costs) are important behavioural intention to use an information service and mobile banking respectively. Venkatesh, Thong, and Xu (2012) argue that the cost and pricing structure may have a significant impact on consumers' technology use. In our model, we considered the price value

to be the prices of prepaid mobile voice as the cost of MM in Africa⁴ to be the proxy for perceived ease of use (perceived costs), defined as the extent to which a person believes that using MM will cost money (Luarn and Lin 2005). We anticipate that financial costs can influence the behaviour and intention to universally adopt and use MM in Africa, especially if costs continue to rise. Based on the above, we proposed our next hypothesis:

H_{3a} : There is negative relationship between perceived costs and attitudes towards continuous adoption and usage of MM.

H_{3b} : There is negative relationship between perceived costs and intention to adopt and use MM.

According to Field and Field (1997) Several pricing studies have found that customer characteristics may influence willingness to pay (WTP), which in turn can influence attitudes and intentions towards adoption of MM. These differences in WTP may depend on demographic or behavioural characteristics. The demographic variables include age, gender, income, marital status, education, and geographical location. To add to that, Venkatesh, Thong, and Xu (2012) contends that facilitating conditions is hypothesised to influence technology use directly based on the idea that consumers can vary significantly across mobile devices. Venkatesh, Thong, and Xu (2012) emphasize that effect of facilitating conditions on behavioural intention can be moderated by age, gender, and experience. In our case, we propose that facilitating conditions and WTP for adopting and using MM can be affected by gender (female), age, income disparity, experience (education) and rural dwelling as supported by Field and Field (1997). Older consumers and females turn to face difficulty in processing information or using technology and thus may require more support compare to young consumers (Venkatesh, Thong, and Xu 2012). For income disparities, richer consumers will turn to adopt MM more than poor consumers due to the effect of purchasing power and WTP.

⁴ Due to the unavailability of consolidated MM transfer prices, we are sure that using the voice prices will be closer to the MM transfer costs.

With experience (education), this can also moderate the relationship between facilitating conditions such as regulation and attitudes towards adoption. Greater experience can lead to greater familiarity with the technology and better knowledge structures to facilitate user learning, thus reducing user dependence on external support. Finally, the lack of mobile network infrastructure and electricity in rural areas can moderate the attitude to adopt MM. In line with these views, we hypothesize the following:

H₄ : There is negative relationship between perceived female and attitudes towards adoption of MM.

H₅ : There is negative relationship between perceived old age and attitudes towards adoption of MM.

H_{6a} : There is positive relationship between perceived income disparity (rich) and attitudes towards adoption of MM.

H_{6b} : There is positive relationship between perceived income disparity (rich) and perceived usefulness (ubiquity) of MM.

H_{6c} : There is negative relationship between perceived income disparity (poor) and attitudes to adopt and use MM.

H_{7a} : There is positive relationship between perceived education level and attitudes to adopt and use MM.

H_{7b} : There is positive relationship between perceived education level and enabling regulation to use MM.

H_{7c} : There is positive relationship between perceived education level and perceived income disparity (rich) to using MM.

H₈ : There is negative relationship between perceived rural dwelling and attitudes to adopt and use MM.

Liu, Kauffman, and Ma (2015) argue that market competition, cooperation, and regulation act as key accelerators of industry changes, while new mobile payments innovation has the potential to transform it. In the financial services sector, financial institutions are closely connected to consumer welfare, so regulators are extremely cautious about how disruptive technological innovations may change the market:

H_{9a} : There is positive relationship between perceived regulation and attitudes towards adoption and usage of MM.

H_{9b} : There is positive relationship between perceived regulation and intention to adopt and use MM.

Figure 1 provides the hypothesised research model, indicating the direction of mediation

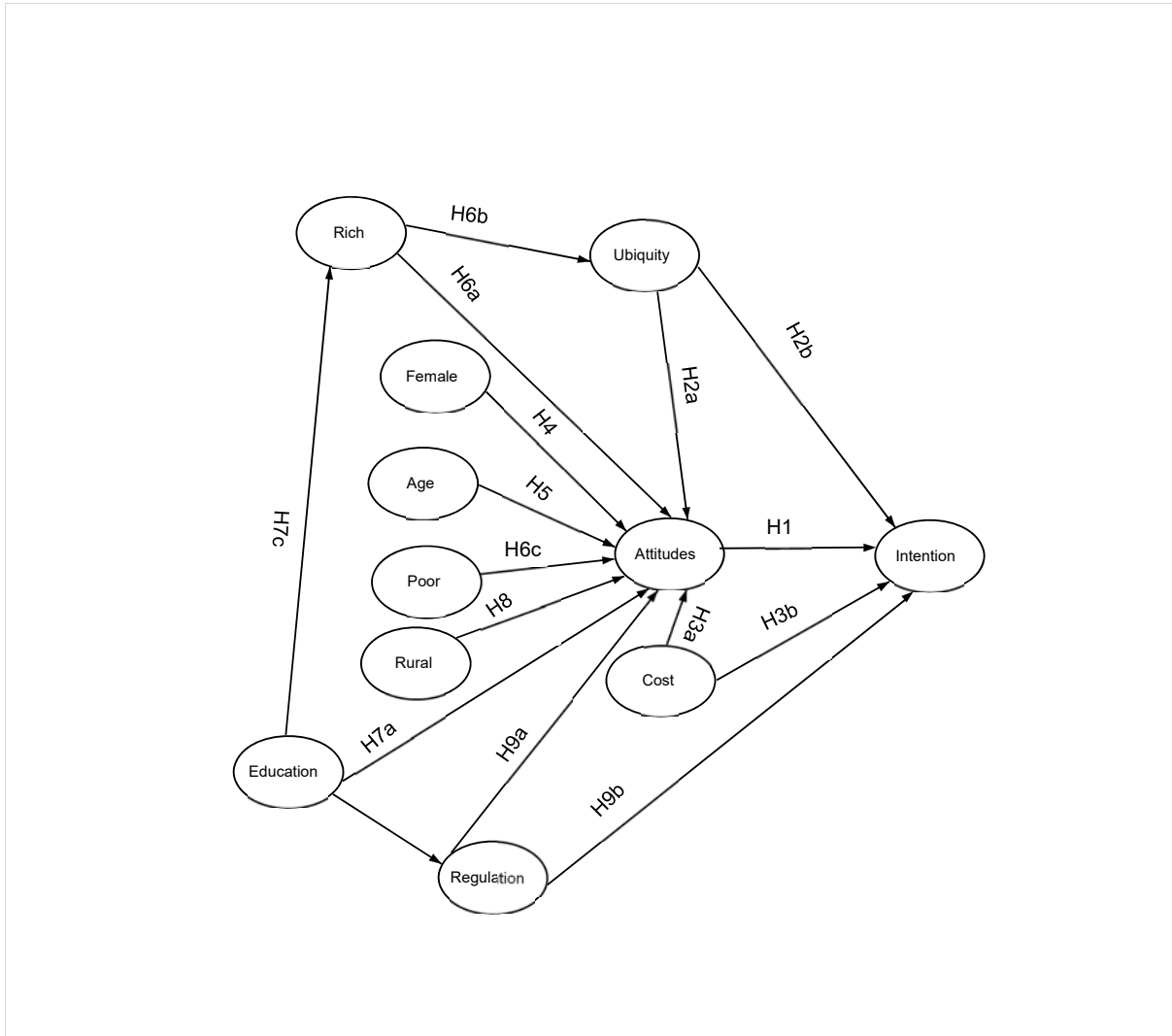


Figure 1. Research model

3.3 Research method

Two most widely used statistical methods to test mediated effects in secondary data are multiple regression analysis and structural equation modelling (SEM) analysis. Multiple regression analysis uses methods such as stepwise regression and progressive adjustment to detect mediation effects. Baron and Kenny (1986), argue that the assumption for inclusion of variables in multiple regression analysis is that variables should be normally distributed, given the explanatory variables and that measurement errors and multicollinearity are assumed to be

absent when dealing with two or more explanatory variables. Furthermore, all variables included in a multiple regression analysis must be observed measures. These assumptions cannot be supported with the type of data we are using for the studies. Because not all of the data are directly observed in a survey, we cannot guarantee that the data is free from measurement errors or that there is no multicollinearity presents in the explanatory indicators.

For the above reasons, we proposed to use the SEM for the empirical estimation. SEM analysis is arguably the most effective way to test mediated effects when data requirement are met. As multiple indicators are used, SEM construct measurement models for the theoretical concepts hypothesised (Li 2011) and allows for multiple indicators of latent variables which are more realistic representation of the variables under study (Schierz, Schilke, and Wirtz 2010). When measurement error is a concern as in our data, SEM uses multiple indicators to overcome it. For this study, all the constructs were estimated using SEM with maximum likelihood. The rationale been that each explanatory and dependent variable may be associated with measurement error in contrast to OLS regression, that is based on the assumption that variables are measured perfectly (Bollen 1987).

4.0 Data, measurement and empirical results

4.1 Data

The main data for the study is taken from the Research ICT Africa (RIA) Network, a non-profit organisation based in South Africa. RIA conducts research on ICT policy and regulation that facilitates evidence-based and informed policy making for improved access, use and application of ICT for social development and economic growth. The data on prices is gathered from mobile network operators across Africa on quarterly basis, and standardised using the OECD mobile pricing measurement (Cheapest prepaid mobile voice product by country (in USD)). The prices are based on 50 minutes of 30 calls based on user split between networks and peak / off-peak / off-off peak times; and 100 Short Messaging Services (SMS).

For a typical MM transaction, it involves the transfer of cash into e-money via text message or SMS. This e-money value is stored and can be retrieved (transferred back to cash) via mobile phone and designated network agent, bank or ATM. Customers pay (by buying airtime) for the use of the voice and SMS services through their mobile phones but also pay additional commissions for any amount sent or received through MM.

The percentage of mobile cellular subscribers for every 100 of inhabitants and the Percentage of population covered by mobile cellular network were taken from the International Telecommunications Unit (ITU). These data was cross checked with data from the World Bank and the differences are negligible. Data on the percentage of total population with electricity consists of the percentage of the country's population that are connected to the national grid, also taken from ITU and World Bank. We also used data on regulation of MM in Africa, but proxy this variable with data from the World Governance Indicators (WGI). Even though about 40 countries in Africa has enabling regulation for MM, we use the regulatory quality indicator from WGI that reflects the perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. Data on the individual characteristics for MM customers (proxy for facilitating conditions) were taken from the Global Findex database. These comprise age, gender (female), income and education. Finally, we got data for our rural variable from the World Bank's development indicators (WDIs). Overall, 40 countries that start MM operations are included in this study.

4.2 Measurement of variables

The measurement items were formulated based on theory, review of literature and modified to reflect the assumptions, propositions and hypotheses of context based themes. The items to measure attitudes towards continuous adoption and intention to adopt and use MM was taken from (Davis 1989, Davis, Bagozzi, and Warshaw 1989, Luarn and Lin 2005) and proxy in order to understand MM in the African context. Items for perceived ease of use (costs)

and perceived usefulness (ubiquity) were taken from the previously validated studies and modified to fit the specific technology under study (Luarn and Lin 2005, Rubin 2017, Swanson 1982, Venkatesh, Thong, and Xu 2012). With items based on facilitating conditions, we follow the studies of Field and Field (1997) and Venkatesh, Thong, and Xu (2012) on behavioural intentions to adopt mobile services. These facilitating conditions include individual covariates such as age, gender (female), income disparities and experience (education). Lastly, our proposed regulation item is taken from (Liu, Kauffman, and Ma 2015), in line with our modification strategy. The full items used in this study and their modification are listed in table 1.

[INSERT TABLE 1 ABOUT HERE]

4.3 Empirical results

To begin with, we conducted analysis of a hybrid model of the structural model, incorporating the measurement models and all of the paths specified in Figure 1. A set of goodness-of-fit indices (GFIs) was generated, indicating that the theoretical model predicted well the observed and latent input matrix (Li 2011). The goodness of fit measures for the structural model show satisfactory values as follows; Goodness of fit index (GFI) = 0.98, Root mean square error of approximation (RMSEA) = 0.061, the Bentler-Bonett normed fit index (NFI) = 0.95, the Tucker-Lewis index (TLI) = 0.96, the comparative fit index (CFI) = 0.92, the incremental fit index (IFI) = 0.92, and the coefficient of determination (CD) = 0.93, which are within accepted values (Bollen 1987).

After satisfying that the model is fit, we now show preliminary results on the context based factors that determine the continuous adoption of MM in Africa. Following Bollen (1987) on direct, indirect and total models in SEM, we show the direct paths among the key theoretical constructs in which items or factors in the hypothetical model in Figure 1 are either confirmed or rejected. In Figure 2, only the significant key theoretical constructs are included

in the model. The indirect effects can be computed by multiplying all of the direct links from one variable to another. The total effect is then the sum of the direct and indirect effects. Note that we show the standardised coefficients in Figure 2 and Tables 3 and 4 for easy comparison of magnitudes as the measurement of the variables were done on different scales. The standardized coefficients for each path closely approximate the effective magnitude usually shown by beta weights in regression. Thus low coefficients have limited substantive effect (Hair et al. 1995).

In support of H_1 , we find significant and positive relationship between individual attitude towards continuous adoption of MM and intention to use MM in Africa ($\beta = .41$; $p \leq .01$). Hypotheses H_{2a} and H_{2b} investigated the role of the availability of power (electricity or grid) with the construct name ubiquity, themed as an item for the perceived usefulness of MM on individuals attitudes and intentions for the continuous adoption and usage of MM in Africa. The estimation result show that there is a positive and significant relationship between ubiquity and individuals' attitudes towards the continuous adoption of MM and intention to use MM, thus confirming hypotheses H_{2a} and H_{2b} respectively ($\beta = .52$; $p \leq .01$, $\beta = .60$; $p \leq .01$). Similarly, hypotheses H_{3a} and H_{3b} specifically tested the role of perceived costs of MM, (construct for perceived ease of use) as a predictor of individuals' attitudes and intentions towards the continuous adoption and use of MM in Africa ($\beta = .01$; $p \leq .05$, $\beta = .03$; $p \leq .05$). The result predicted positive significant coefficients of weaker magnitudes contrary to the hypothesised constructs in the model. By this, the estimation confirmed that perceived costs of MM in Africa are still in the lower thresholds compared to traditional costs for money transfer via banks and informal. Using the number of females with MM accounts as a construct for females' attitude towards continuous adoption of MM, we find insignificant relationship between perceived female and attitudes towards adopting MM, thus rejecting hypothesis H_4 ($\beta = .00$; $p > .05$). The structural link from perceived age to the attitude towards continuous

adoption of MM is negative and significant ($\beta = -.04; p \leq .01$), supporting H_5 . Hypotheses H_{6a} to H_{6c} assessed the effect of income on two theoretical constructs, serving as mediator for perceived attitude towards adopting MM, and perceived usefulness (ubiquity). However, their coefficients were not significant enough to support the relationships ($\beta = -.04; p > .05, \beta = .02; p > .05, \beta = -.01; p \leq .05$) respectively. We therefore reject hypotheses H_{6a} to H_{6c} . Regarding the perceived education construct, hypotheses H_{7a} to H_{7c} tested whether perceived education (experience) is positively related to other range of constructs in the model, thus perceived attitude towards continuous adoption of MM, perceived enabling regulation for MM, and the perceived income disparity (rich 60%). The results supported two constructs with statistical significance (attitude and enabling regulation) and rejected the third mediating construct between education and income disparity (rich 60%) ($\beta = .40; p \leq .01, \beta = .02; p \leq .01, \beta = .01; p > .05$) respectively. We therefore confirmed H_{7a} and H_{7b} . The relationship between perceived rural dwelling and attitude to adopt and use MM was supported with a negative statistical significant coefficient of $-.36$, confirming that adoption of MM in Africa is significantly concentrated in urban centres ($\beta = -.36; p \leq .01$). H_8 is thus confirmed. Finally, the theoretical construct of perceived enabling regulation assessing the relationship between perceived attitude towards adoption of MM and intention to adopt and use MM are both positive and significantly supported ($\beta = .05; p \leq .01, \beta = .35; p \leq .01$) respectively.

To provide for stability of the results, we tested the correlation of the exogenous variables (see Table 4) to deduce the presence of multicollinearity. Berry et al. (1985) argue that for any specific empirical analysis, multicollinearity, which is correlation among explanatory variables can affect the stability of the empirical results. To avoid this, they suggested that as a rule of thumb, correlation among the explanatory variables should be below 0.8. The correlation table (see Table 4) show that the items are within the cut-off value of 0.8 indicating that multicollinearity is not a problem in our sample.

Since the sample is small and as a result measurement scale could affect the results of the estimation if items are found to be highly correlated with each other. For this effect, we tested the scale of reliability for the consistency of the data and items in our sample by looking at the detailed information of the Cronbach's alpha of the 11 items used. From Table 5, we see that the item-test correlation and the item-rest correlation all produce figures that are within limits of 0.8 for all the items. The overall α of 0.8 is an indication that items in the model are reliable and consistent to provide stable results.

[INSERT TABLE 2 ABOUT HERE]

[INSERT TABLE 3 ABOUT HERE]

[INSERT FIGURE 2 ABOUT HERE]

[INSERT TABLE 4 ABOUT HERE]

[INSERT TABLE 5 ABOUT HERE]

5.0 Discussion and policy implication

5.1 Discussion of results

We follow Bollen (1987), to examine the total effect and establish a ranking among the factors that determines the continuous adoption and intention to use MM in Africa. This is done by multiplying the coefficients along the paths (see Figure 2 and Table 6). As an example, the total effect for the intention to adopt and use MM when a person is educated, is calculated through the indirect effects (paths) of perceived regulation and perceived attitude towards adoption ($.02*.05*.48 + .4*.48 = .19$).

The most ranked determinant of MM in Africa is perceived usefulness, which denotes the mobility or ubiquity nature of it. In our model the proxy for the perceived usefulness is (the percentage of the total population connected to the national grid). In other words, we look at the percentage of the population who have electricity for the functionality of the mobile phone

device. This is particularly important for the fact that MM cannot function well if people do not have electricity to charge their phones. African people are known to be mobile (Kakihara and Sorensen 2002, Kleinrock 1996) in search for economic opportunities and the adoption and use of MM may allow them to facilitate financial transactions without needing bank branches. However, if access to electricity is limited (Rubin 2017), it can affect the number of people who may adopt and use MM. The costs involved in securing access to electricity may be high especially for the inhabitants of towns and villages that are not connected to the national grid. This happens where mobile phone users who are keen on making their mobile devices functional have to travel to long distances in order to get access to electricity and charge their phone devices.

We find that a person's attitudes towards MM is an important factor for the continuous adoption and intention to use MM in Africa. This factor is ranked second and confirms that the proxy for perceived attitude (percentage of mobile subscribers per 100 inhabitants) is a good measure. The data also provides evidence to this effect. For instance, the data for perceived attitude towards MM for South Africa, Mauritius and Ghana are 147.13%, 143.73% and 135.8% respectively. The perceived attitudes of people towards MM may thus be interpreted to reflect the easy, secure and fast nature, and the marketing strategies employed by the MNOs. In a deeper sense, it reflects the inadequate and underdeveloped nature of the payment systems in Africa.

Perceived age is the third ranked factor in our model. The result is consistent with the hypothesis for perceived age which sum up that adults aged 65years and over are less likely to adopt MM because of the technical knowledge associated with it. Also, age restriction for SIM card purchase in most of African countries may also become a hindrance in the intention to adopt and use MM (Zimmerman and Arnold 2013). This makes young people aged less than 18years who may have access to mobile phones to be out of the MM system.

Perceived enabling regulation (Liu, Kauffman, and Ma 2015) is another factor that is significant for the continuous intention to adopt and use MM. In the early adoption of MM in Africa (M-PESA), regulation was not considered to be of importance (Jack and Suri 2011). However, because of the reported consumer concerns about abuse by agents and operators, regulation has become paramount for parties to be able to have recourse and protection in times of abuse. One could also interpret the result for the fact that MM is a provision of financial service and as such cannot happen without proper regulation in place as in other traditional financial systems (GSMA 2016). Regulation is of essence to ensure that government revenue generation, in terms of taxes are properly secured and to allow effective competition in order to keep prices of MM services low for everybody.

The experience of people with the intention to adopt and use MM is as significant as the other factors. Education, which is the proxy for individual perceived experience is modelled to reflect the hands on experience of mobile phone use and its subsequent attitude and intention to adopt and use MM. User experience expresses the individual facilitating conditions by reducing dependence on external support to adopt and use MM (Venkatesh, Thong, and Xu 2012). This becomes feasible when compared between educated people and their non-educated counterparts for MM usage in Africa.

The sixth ranked factor for the determinants of MM is perceived rural dwelling. The result agrees with the hypothesis and literature that MM adoption and usage is concentrated in cities and urban centres (Aker et al. 2016, Aker and Mbiti 2010, Asongu 2015, Donovan 2012). Though rural adoption is encouraging, their comparisons with urban centre adoptions yields greater percentage differences. One could interpret the result to reflect the underdeveloped and lack of mobile network infrastructure, and lack of electricity in the rural areas of Africa (Mas and Kumar 2008, Rubin 2017).

Finally, perceived cost associated with the intention to adopt and use MM in Africa becomes the seventh factor in terms of rankings in our model. Comparing the transaction costs associated with MM services to that of traditional money transfer systems in Africa indicate that MM has advantages (Aker and Mbiti 2010, Jack and Suri 2014). The fast and secure nature of MM services can also be attributed to reduction in cost, where the benefits far outweigh the costs of transaction and use of informal systems (Aker et al. 2016, GSMA 2016, Jack and Suri 2011, Mas and Kumar 2008).

The other constructs in our model that has not produced any significant coefficients to warrant inclusion to the final model includes perceived income disparity (60% rich), perceived income disparity (40% poor) and perceived female. These items were measured by the percentage of rich people (60% rich) who have MM accounts, percentage of poor people (40% poor) who also have MM accounts, and the percentage of females with MM accounts respectively. However, according to the model estimation, their coefficients have given as larger p values that defy the empirical assumptions to confirm their inclusion in the final research model. The possible reason for these results may be as a result of measurement error. Future research may include these items to see their effects.

[INSERT TABLE 6 ABOUT HERE]

5.2 Policy implications

While the empirical results are preliminary for lack of data, it does have policy implications that are important for the overall MM services in Africa. In the first place the findings indicate that perceived usefulness (ubiquity) that proxy for the availability of electricity to enable the functionality of mobile phones is an important factor as far as MM is concern. The ability of people to charge their mobile phones to enable them to use it anytime and anywhere is an important first step towards intending to adopt and use MM. This means that energy infrastructure is a necessary component for the expansion of MM services to areas

that are yet to connect to such services. When power or energy is available, it may cut the cost of travel and the risk involved by rural dwellers who use MM but do not have the electricity to charge their mobile phone devices. Rubin (2017) emphasize that policy frameworks are gathering momentum in the international scene around the build-once approach to infrastructure development. An example of the build-once approach for Africa through the PPPs, would be electricity and mobile network operators (MNOs) sharing towers for their wires. Another being electricity and MNOs coordinating to lay wires under new roads. This policy framework will direct future ICT and energy transformation that has the capacity to further lower the costs of energy in the functionality of technology and MM services.

Enabling regulation also becomes important for MM services. From the introduction of M-PESA in 2007 until today, MM services in Africa has gone through tremendous transformations in terms of services provision and competition, consumer protection protocols, government and central banks' monetary policy frameworks and government revenue mobilization efforts through tax payments. As all these variables have implications for MM operations, it is only necessary that there is enabling regulation for smooth MM operations. Enabling regulation also implies that MNOs act in accordance with rules and regulations that govern their operations and seek to give the consumer, the needed protection in terms of redress of grievances. Central banks has the obligation to ensure that there are enough enabling regulations for the ever evolving and expansion of MM as technology keep transforming at all times. MM interoperability is still a long way to go for several African countries that has rolled out MM. The difficulty of interoperability has to do with the fact that enabling regulations are not complex and robust enough to overcome the ever evolving technology. For policy makers and regulators to achieve this path, broader consultation that will involve all stakeholders in the system to deliberate on the possible way forward is necessary.

6.0 Conclusion and future research

The research seek to understand the context based factors that are necessary for the continuous adoption and use of MM in Africa. With data from different sources, including RIA, ITU and the World Bank for 40 African countries who have adopted MM, we presented the preliminary results for the individual intentions and attitudes towards adopting and using MM.

The research model adopted the TAM with modification of local context factors to determine how these factors affect the continuous adoption and use of MM. Using the SEM, the results show that perceived usefulness (ubiquity/electricity) is an important factor to continue to adopt and use MM. This means that the ability of MM to be available anytime anywhere depends on the availability of electricity to charge the mobile phone used for MM. So people who do not have electricity invariably may be denied the opportunity to adopt and use MM. While this consumer characteristic cannot be influenced entirely by the consumer at all times, partnerships between MNOs and government can help improve electricity infrastructure especially for rural inhabitants.

Attitudes of consumers can be influenced by MNOs through their marketing and agent networks. The preliminary empirical results for the attitude construct (proxy: percentage of mobile network subscribers per 100 inhabitants) indicate that peoples' attitudes towards their intention for continuous adoption and use of MM are effective determinants of MM in Africa. MNOs can identify reference groups who can play important role in the diffusion of MM. Thus, the MNOs need to identify early adopters and stimulate their usage of MM services, so that they can serve as a reference facilitating broad diffusion in the future.

Age has also been identified to influence intention to adopt and use MM. As technology evolves, older people may not be able to embrace the technical capabilities of the mobile phone and so will be directly affected in adopting and using MM. With younger generations, government restrictions on access to SIM cards for people under 18years old may likely affect

their ability to adopt and use MM. MNOs can lobby to influence policy recommendations to effect changes for the below 18years group. Early adoption and use of MM can have long term impact on the business models of MNOs.

On regulation, the result show that individual intentions and attitudes towards the continuous adoption and use of MM depends on the enabling regulation. When people are aware that there are enough regulations that guide MNOs in their MM operations, people may trust the system and continue to use MM. Lack of proper regulation on the other hand can also hinder the progress made in the diffusion of MM in Africa.

Finally, lack of infrastructure (mobile network and electricity) can hinder the diffusion of MM to rural areas. As greater number of Africans continue to live in rural areas, it is only prudent that MNOs collaborate with governments to improve these infrastructure for shared prosperity.

There are several directions for future research that this research facilitates. First, the data used is secondary, with its attended measurement errors. Future research could decide to use primary data to test the model further and confirm the preliminary empirical results gathered in this research. Second, there may exist other context based factors that could further explain the continuous attitudes and intentions towards the adoption and use of MM. A fruitful direction for additional research would be to examine the earlier stages of the adoption process and incorporate additional data to capture the responses of those individuals who may discontinue the use of MM after evaluating and trying it. Finally, an important point to be made as far as this research is concern is that the results of the study are valid only for the African society, which is characterized by a very high penetration rate of mobile phones that has defied the poverty nature and lack of electricity. More empirical studies should be carried out in cross-cultural settings (with similar characteristics such as poverty, low electricity coverage and lack

of regulation) to widen our knowledge of the near future market potential for value-added services of MM.

References

- Aker, Jenny C, Rachid Boumnijel, Amanda McClelland, and Niall Tierney. 2016. "Payment Mechanisms and Anti-Poverty Programs: Evidence from a Mobile Money Cash Transfer Experiment in Niger." *Economic Development and Cultural Change* 65 (1):1-37.
- Aker, Jenny C, and Isaac M Mbiti. 2010. "Mobile Phones and Economic Development in Africa." *Journal of Economic Perspectives* 24 (3):207-32.
- Alalwan, Ali Abdallah, Yogesh K Dwivedi, and Nripendra P Rana. 2017. "Factors influencing adoption of mobile banking by Jordanian bank customers: Extending UTAUT2 with trust." *International Journal of Information Management* 37 (3):99-110.
- Asongu, Simplice. 2015. "The Impact of Mobile Phone Penetration on African Inequality." *International Journal of Social Economics* 42 (8):706-716.
- Bagozzi, Richard P. 2007. "The legacy of the technology acceptance model and a proposal for a paradigm shift." *Journal of the association for information systems* 8 (4):243-254.
- Baron, Reuben M, and David A Kenny. 1986. "The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations." *Journal of personality and social psychology* 51 (6):1173-1182.
- Berry, William D, William D Berry, Stanley Feldman, and Dr Stanley Feldman. 1985. *Multiple regression in practice*: Sage.
- Bollen, Kenneth A. 1987. "Total, direct, and indirect effects in structural equation models." *Sociological methodology*:37-69. doi: URL: <https://www.jstor.org/stable/271028>.
- Chaouali, Walid, Nizar Souiden, and Riadh Ladhari. 2017. "Explaining adoption of mobile banking with the theory of trying, general self-confidence, and cynicism." *Journal of Retailing and Consumer Services* 35:57-67.
- Davis, Fred D. 1985. "A technology acceptance model for empirically testing new end-user information systems: Theory and results." Massachusetts Institute of Technology, Boston.
- Davis, Fred D. 1989. "Perceived usefulness, perceived ease of use, and user acceptance of information technology." *MIS quarterly* (13(3)):319-340.
- Davis, Fred D, Richard P Bagozzi, and Paul R Warshaw. 1989. "User acceptance of computer technology: a comparison of two theoretical models." *Management science* 35 (8):982-1003.
- Demirgüç-Kunt, Asli, Patrick Honohan, and Thorsten Beck. 2008. *Finance for all?: Policies and Pitfalls in Expanding Access*: World bank, Washington D.C.
- Demirgüç-Kunt, Asli, Leora F Klapper, Dorothe Singer, and Peter Van Oudheusden. 2015. "The global finindex database 2014: Measuring financial inclusion around the world."
- Donner, Jonathan, and Camilo Andres Tellez. 2008. "Mobile banking and economic development: Linking adoption, impact, and use." *Asian journal of communication* 18 (4):318-332.
- Donovan, Kevin. 2012. "Mobile money for financial inclusion." *Information and Communications for Development* 61 (1):61-73.
- Dupas, Pascaline, Sarah Green, Anthony Keats, and Jonathan Robinson. 2012. *Challenges in Banking The Rural Poor: Evidence From Kenya's Western Province*. National Bureau of Economic Research.
- Evans, David S, and Alexis Pirchio. 2014. "An empirical examination of why mobile money schemes ignite in some developing countries but flounder in most." *Review of Network Economics* 13 (4):397-451.
- Field, Barry C, and Martha K Field. 1997. "Environmental economics: an introduction." *Sustainable Human Development Review* 105.

- Fishbein, Martin, and Icek Ajzen. 1975. *Belief, attitude, intention and behavior: An introduction to theory and research*.
- Gencer, Menekse. 2011. "The mobile money movement: Catalyst to jump-start emerging markets." *Innovations: Technology, Governance, Globalization* 6 (1):101-117.
- Gosavi, Aparna 2018. "Can mobile money help firms mitigate the problem of access to finance in Eastern sub-Saharan Africa?" *Journal of African Business*, 19 (3):343-360.
- GSMA. 2016. "The Mobile Economy-Africa 2016." London: GSMA, *G Intelligence - London*.
- Hair, Joseph F, Rolph E Anderson, Ronald L Tatham, and William C Black. 1995. "Multivariate data analyses with readings." *Englewood Cliffs, New Jersey*.
- Hanafizadeh, Payam, Mehdi Behboudi, Amir Abedini Koshksaray, and Marziyeh Jalilvand Shirkhani Tabar. 2014. "Mobile-banking adoption by Iranian bank clients." *Telematics Informatics* 31 (1):62-78.
- Hinson, Robert E 2011. "Banking the poor: The role of mobiles." *Journal of Financial Services Marketing* 15 (4):320-333.
- Jack, William, and Tavneet Suri. 2011. Mobile money: The economics of M-PESA. National Bureau of Economic Research. nber.org.
- Jack, William, and Tavneet Suri. 2014. "Risk sharing and transactions costs: Evidence from Kenya's mobile money revolution." *American Economic Review* 104 (1):183-223.
- Kakihara, Masao, and Carsten Sorensen. 2002. "Mobility: An extended perspective." System Sciences, 2002. HICSS. Proceedings of the 35th Annual Hawaii International Conference on.
- Karlan, Dean, Aishwarya Lakshmi Ratan, and Jonathan Zinman. 2014. "Savings By and For The Poor: A Research Review and Agenda." *Review of Income and Wealth* 60 (1):36-78.
- Kleinrock, Leonard. 1996. "Nomadicity: anytime, anywhere in a disconnected world." *Mobile networks and applications* 1 (4):351-357.
- Li, Spencer D. 2011. "Testing mediation using multiple regression and structural equation modeling analyses in secondary data." *Evaluation review* 35 (3):240-268.
- Liu, Jun, Robert J Kauffman, and Dan Ma. 2015. "Competition, cooperation, and regulation: Understanding the evolution of the mobile payments technology ecosystem." *Electronic Commerce Research and Applications* 14 (5):372-391.
- Luarn, Pin, and Hsin-Hui Lin. 2005. "Toward an understanding of the behavioral intention to use mobile banking." *Computers in human behavior* 21 (6):873-891.
- Mas, Ignacio, and Kabir Kumar. 2008. "Banking on mobiles: why, how, for whom?" *papers.ssrn.com*.
- Mas, Ignacio, and Olga Morawczynski. 2009. "Designing mobile money services lessons from M-PESA." *Innovations: Technology, Governance, Globalization* 4 (2):77-91.
- Mathieson, Kieran, Eileen Peacock, and Wynne W Chin. 2001. "Extending the technology acceptance model: the influence of perceived user resources." *ACM SIGMIS Database: the DATABASE for Advances in Information Systems* 32 (3):86-112.
- Murendo, Conrad, Meike Wollni, Alan De Brauw, and Nicholas Mugabi. 2018. "Social network effects on mobile money adoption in Uganda." *The Journal of Development Studies* 54 (2):327-342.
- Nysveen, Herbjørn, Per E Pedersen, and Helge Thorbjørnsen. 2005. "Intentions to use mobile services: Antecedents and cross-service comparisons." *Journal of the academy of marketing science* 33 (3):330.
- Rubin, Nilmini. 2017. Without energy, the internet is just a black hole: Creating energy solutions for information and communications technology. Washington DC.: Alliance for affordable internet.

- Schierz, Paul Gerhardt, Oliver Schilke, and Bernd W Wirtz. 2010. "Understanding consumer acceptance of mobile payment services: An empirical analysis." *Electronic commerce research and applications* 9 (3):209-216.
- Swanson, E Burton. 1982. "Measuring user attitudes in MIS research: a review." *Omega* 10 (2):157-165.
- Venkatesh, Viswanath, James YL Thong, and Xin Xu. 2012. "Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology." *MIS quarterly*:157-178.
- Zimmerman, Jamie M, and Julia Arnold. 2013. "Hope or hype? Five obstacles to mobile money innovations for youth financial services." *Innovations: Technology, Governance, Globalization* 8 (1-2):233-246.

Table 1: Variable description and source

Variable/ construct	Description/Measurement	Source
Intention to use MM	Given the opportunity the respondent will use mobile payment services, measured (proxy) as percentage of population with mobile network in a country	(Davis, 1989), (ITU, RIA, World Bank, 2017)
Attitude towards adopting MM	Degree to which using a technology is positively or negatively valued by an individual, measured (proxy) as percentage of mobile subscribers per 100 inhabitants	(Davis, 1989), (ITU, RIA, World Bank, 2017)
Perceived usefulness (ubiquity/grid)	How well consumers believe MM can be integrated into their daily mobile activities (ability to use mobile phone and MM at anytime and anywhere), measured (proxy) as percentage of population with electrification (national grid)	(ITU, RIA, World Bank, 2017)(Kakihara and Sorensen 2002), (Rubin (2017)
Perceived cost	Extent to which a person believes that using MM will cost money, measured (proxy) as price of prepaid mobile voice and SMS	(Luarn & Lin, 2005), (RIA,2017)
Perceived female	Likelihood that females may require more support to adapt to technology use than men, measured (proxy) as percentage of women with MM accounts	(Venkatesh, Thong, and Xu 2012), Field and Field (1997), (WDI ,2017)
Perceived old age	Likelihood that older consumers may turn to face difficulty in processing information or using technology, measured (proxy) as percentage of population ages 65 and above as percentage of total population	Field and Field (1997), (Venkatesh, Thong, and Xu 2012) (WDI,2017)
Perceived income disparity (rich)	Willingness to pay (WTP) for MM due to price value, measured (proxy) as percentage of mobile account ownership by the richest 60%	(Field and Field (1997) (WDI ,2017)
Perceived income disparity (poor)	Willingness to pay (WTP) for MM due to price value, measured (proxy) as percentage of mobile account ownership by the poorest 40%	Field and Field (1997) (WDI ,2017)
Perceived education	Better knowledge structures to facilitate user learning of MM, measured (proxy) as primary school completion rate as percentage of total population	(Field and Field (1997), (Venkatesh, Thong, and Xu 2012), (WDI ,2017)
Perceived rural dwelling	Lack of mobile network infrastructure and electricity, measured (proxy) rural population as percentage of total population	(Field and Field (1997), (WDI ,2017)
Perceived regulation	Enabling regulation offering support for MM standards, competition and innovation, measured (proxy) as ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.	Liu, Kauffman, and Ma (2015), (WDI ,2017)

Note: ITU = International Telecommunication Union, RIA = Research ICT Africa, and WDI = World Development Indicators.

Table 2. Mediation effects on individual attitudes towards adoption of Mobile Money in Africa.

Variable	SEM coeff	Chi-statistics
Intention to use MM	0.48*** (7.73)	$\chi^2 = .72$ $df = 1, p = .000$
Perceived usefulness (ubiquity/grid)	0.52*** (7.01)	$\chi^2 = .79$ $df = 1, p = .000$
Perceived cost	0.01** (-1.14)	$\chi^2 = .49$ $df = 1, p =$
Perceived age	-0.04*** (5.46)	$\chi^2 = .59$ $df = 1, p = .000$
Perceived regulation	0.05*** (3.56)	$\chi^2 = .68$ $df = 1, p = .000$
Perceived education	0.40*** (4.35)	$\chi^2 = .61$ $df = 1, p = .000$
Perceived income 60%	-0.04 (-0.42)	$\chi^2 = .37$ $df = 1, p = .641$
Perceived income 40%	-0.01 (-0.2)	$\chi^2 = 33$ $df = 1, p = .871$
Perceived female	0.00 (0.07)	$\chi^2 = .21$ $df = 1, p = .948$
Perceived rural dwelling	-0.36*** (-6.77)	$\chi^2 = .69$ $df = 1, p = .000$
Observations	40	
Overall R^2	.92	

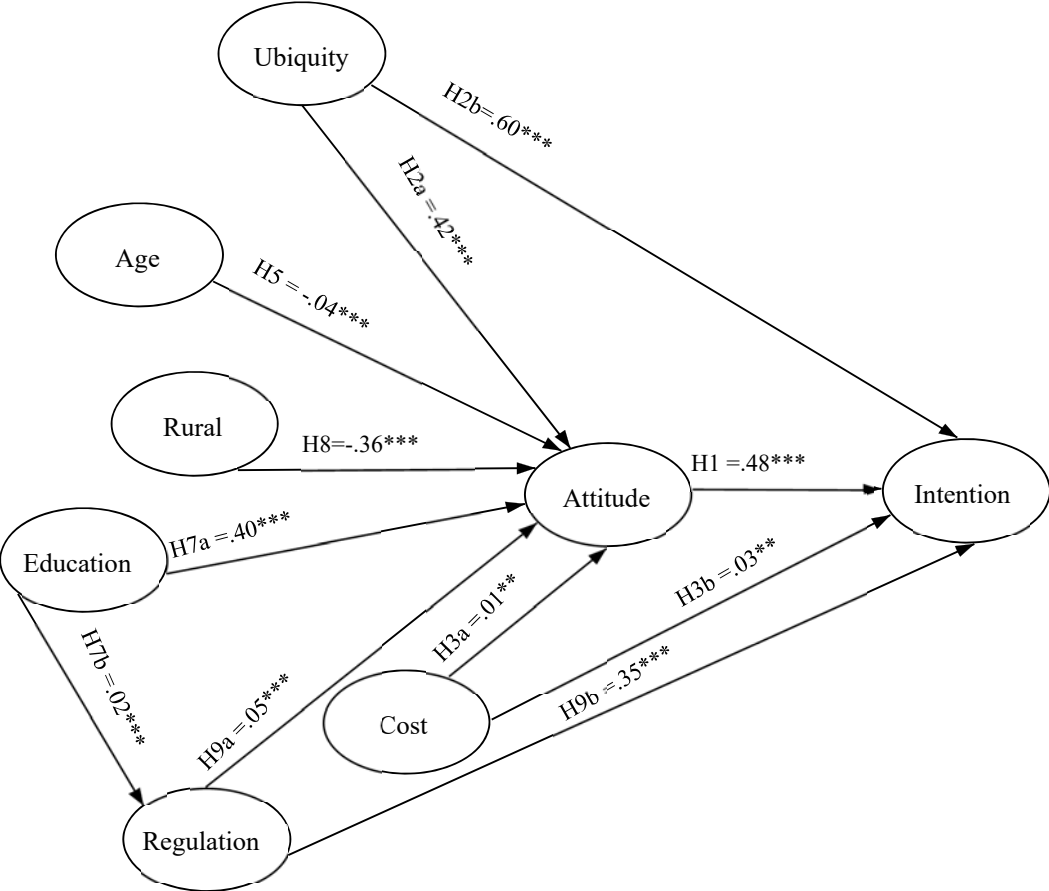
Note: SEM coeff = Structural equation model coefficient, t-values for standardized path coefficients are described in parentheses. The degree of freedom of 1 indicate that all constructs are unidimensional. SEM coeff = Structural equation coefficient

Table 3. Mediation effects on the individual intentions to use Mobile Money in Africa.

Variable	SEM coeff	Chi-statistics
Attitude towards adopting MM	0.48*** (7.73)	$\chi^2 = .72$ $df = 1, p = .000$
Perceived usefulness(ubiquity/grid)	0.60*** (7.01)	$\chi^2 = .87$ $df = 1, p = .000$
Perceived cost	0.03** (-1.14)	$\chi^2 = .41$ $df = 1, p =$
Perceived age	-0.04*** (5.46)	$\chi^2 = .59$ $df = 1, p = .000$
Perceived regulation	0.35*** (3.56)	$\chi^2 = .72$ $df = 1, p = .000$
Perceived education	0.40*** (4.35)	$\chi^2 = .61$ $df = 1, p = .000$
Perceived income 60%	-0.04 (-0.42)	$\chi^2 = .37$ $df = 1, p = .641$
Perceived income 40%	-0.01 (-0.2)	$\chi^2 = .33$ $df = 1, p = .871$
Perceived female	0.00 (0.07)	$\chi^2 = .21$ $df = 1, p = .948$
Perceived rural dwelling	-0.36*** (-6.77)	$\chi^2 = .69$ $df = 1, p = .000$
Observations	40	
Overall R^2	.92	

Note: SEM coeff = Structural equation model coefficient, t-values for standardized path coefficients are described in parentheses. The degree of freedom of 1 indicate that all constructs are unidimensional.

Figure 2. Results of the relationships in the research model



Note: *** = $p \leq .01$, ** = $p \leq .05$

Table 4. Correlations among the exogenous variables

Item	Perceived intention	Perceived attitude	Perceived usefulness (ubiquity)	Perceived cost	Perceived regulation	Perceived rural	Perceived age	Perceived female	Perceived rich	Perceived poor	Perceived education
Perceived intention	1.00										
Perceived attitude	.72	1.00									
Perceived ubiquity	.73	.74	1.00								
Perceived cost	-.20	-.09	-.18	1.00							
Perceived regulation	.64	.62	.43	-.29	1.00						
Perceived rural	-.60	-.71	-.63	-.14	-.15	1.00					
Perceived age	.57	0.59	.75	-.20	.42	-.42	1.00				
Perceived female	-.02	-.02	-.03	-.06	.30	.21	.13	1.00			
Perceived rich	.09	-.01	-.06	-.16	.14	.13	-.24	.02	1.00		
Perceived poor	.05	.01	-.01	-.13	.10	.11	-.22	-.13	.78	1.00	
Perceived education	.54	.052	.61	-.40	.45	-.24	.52	.16	.06	.08	1.00

The test from this table suggest that multicollinearity is not a problem among the constructs. All constructs are below the cut-off figure of .80.

Table 5. Scale reliability test of standardised items

Item	Obs	Sign	Item-test correlation	Item-rest correlation	Inter item correlation	Alpha
Perceived intention	40	+	.79	.72	.23	.75
Perceived attitude	40	+	.72	.76	.23	.75
Perceived usefulness (ubiquity)	40	+	.71	.75	.23	.75
Perceived cost	40	+	.52	.56	.28	.74
Perceived regulation	40	+	.64	.54	.25	.77
Perceived rural	40	-	.58	.46	.26	.78
Perceived age	40	+	.78	.73	.23	.75
Perceived female	40	+	.24	.08	.31	.82
Perceived rich	40	-	.30	.14	.30	.81
Perceived poor	40	-	.32	.17	.30	.81
Perceived education	40	+	.68	.58	.25	.77
Test scale					.26	.80

This table measure the internal consistency of the 11 items, showing how closely related the items are as a group. Item-test and Item-rest correlations show values below .8 are reliable and consistent. The alpha of .8 suggest that the items have high internal consistency.

Table 6. Total effect of factors on the intention to continue adoption and use MM

Factor	Total effect on intention to adopt and use MM
Perceived usefulness (ubiquity)	.80
Perceived attitude	.48
Perceived age	.44
Perceived regulation	.37
Perceived education	.19
Perceived rural	.12
Perceived cost	.03

This table calculates the total effect among the constructs. This is done by adding the direct and indirect paths. The construct with the highest value is ranked first in that order.