

Consumer acceptance and continuance of mobile money: Secondary data insights from Africa using the technology acceptance model

Abidin Alhassan

Waikato Management School
University of Waikato, New Zealand

Leon Li

Associate Professor of Finance
Waikato Management School
University of Waikato, New Zealand
leonli@waikato.ac.nz

Krishna Reddy

Senior Lecturer of Finance
Management and Legal Studies
Toi Ohomai Institute of Technology, Rotorua, New Zealand

Geeta Duppati

Senior Lecturer of Finance
Waikato Management School
University of Waikato, New Zealand

Abstract

This research provides empirical results on context-based factors that determine the use of mobile money in Africa by employing a unique secondary data which provides a new perspective on the technology acceptance model (TAM) application. The hypothesised research model tests the context-based constructs to determine how these constructs affect peoples' intentions and attitudes towards the continued use of mobile money. Exploring these constructs provides an understanding of the insights into the marketing campaigns and growth of mobile money providers. The empirical results suggest that the availability of electricity is an important factor for mobile phone functionality and ongoing use of mobile money in the long run. There is also a correlation between regulations that are perceived to be enabling and the intentions of individuals to continue using mobile money. However, there is a negative correlation between rural dwellings and the intentions of individuals to adopt the use of mobile money which finds its basis in the inadequate mobile networks and national grid systems in rural areas.

Keywords: Mobile money, technology acceptance model, ubiquity, perceived rural

Data Availability: Data analysed in the study are collected from public sources.

1 Introduction

Mobile money is considered by many (De Koker and Jentzsch, 2013; Gosavi, 2018; Ngugi et al., 2010; Porteous, 2009) 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 uptake of mobile

phones in Africa offers opportunities for financial access to previously unbanked segments of the population. However, the very trend of increased penetration of mobile money among the poor of Africa has concerned policymakers and development experts (Aker and Mbiti 2010).

For mobile money providers (mobile network operators, MNOs), acquiring new customers and promoting their usage is only the initial step. They also need to retain existing users and facilitate their ongoing custom, which represents better security for the long-term existence of providers. Reichheld and Scheffer (2000) have contended that the cost of acquiring a new user is five times that of retaining an existing user. According to GSMA (2019), there are 395.7 million registered mobile money accounts in the Sub-Saharan African region as of December 2018, representing 45.6% of the global figures. Further, out of the 395.7 million registered mobile money accounts, 145.8 million are active users. What accounts for this fall in active usage? Although competition among providers is intense (Okeleke, Rogers, and Pedros, 2017; GSMA, 2016), and service provisions are almost homogenous, mobile money providers need to retain users in order to achieve a competitive advantage. The costs of switching from one provider to another are also relatively low for customers which means that active, ongoing usage levels should also remain high. However, factors such as the limited availability of power, constraining regulations, poor infrastructure within rural dwellings, and low incomes still remain, and these cut across all provider networks. For providers to be able to maintain and retain active customers in the mobile money industry, it is important that they overcome these structural barriers.

To date, no research has investigated the relationship between mobile money adoption/retention and the exigencies of power supply and government regulations. Despite the fact that consumers' initial adoption of mobile money is an important first step towards successful financial inclusion (the inception of the Kenyan M-PESA in 2007 provides assurance that consumers are willing to engage), many scholars note that the long-term viability of the use of information technology for financial inclusion and its eventual success depends on its continued use rather than its initial adoption (Zheng, Zhao, & Stylianou, 2013, Bhattacharjee, 2001). This is especially critical with regard to the success of mobile money (San-Martin and López-Catalán, 2013, Hung, Yang, and Hsieh, 2012). However, the ongoing use of mobile money has garnered little research attention to date. The question that emerges is this: *"Are consumers in Africa able to continue using mobile money beyond the initial stage of adoption or do current structural bottlenecks preclude their ongoing usage?"*¹

This study contributes to the literature by providing empirical evidence on critical context-based factors (modelled using TAM) that leads to long-term ongoing usage of mobile money in rural Africa. 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 mobile money services. Service pricing, the supply of electricity for mobile phone functionality, mobile network infrastructure development, government regulations, and income disparities are all key determinants of ongoing usage by consumers. Presumably, if ongoing use of mobile money proves to be less costly for consumers

¹ Empirical evidence of poor uptake and minimal levels of continuous use of bank accounts in randomised control trials (RCTs) highlight the problems that arise if context-based factors are not addressed before interventions and innovations are rolled out. More details can be found in Dupas et al., (2012) and Karlan, Ratan, and Zinman (2014).

than traditional alternatives -- for example, money transfer through banks and informal mechanisms using bus drivers as middlemen -- there will be greater consumer acceptance of this innovative technology in the long run (Schierz et al, 2010).

Our empirical results show that the availability of electricity is a significant factor for consumers initially adopting and intending to continue using mobile money in Africa. . Our study finds that a second significant factor in facilitating the adoption and ongoing use of mobile money in Africa is government regulations that are enabling. Conversely, income disparities appear to be an insignificant factor in this regard.²

The rest of this paper is as follows: Section 2 reviews the relevant literature and addresses the theoretical perspectives; Section 3 develops the research hypotheses; Section 4 describes the data, measurement of the variables and the research method; Section 5 presents the empirical results; Section 6 provides a discussion and addresses policy implications; and finally, the conclusions of this study and future research directions are summarized in Section 7.

2 Theoretical perspectives

Davis (1985) argues that a person's motivation to adopt a technological system can predict how that person makes use of the system, which is also directly influenced by external stimuli such as the system's features and capabilities. He proposed the technology acceptance model (TAM) which has been 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 that help to predict the acceptance of a system by an individual: perceived usefulness, perceived ease of use, attitudes toward use, intention to use, and actual use. Davis (1989) defined perceived usefulness as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis, 1989 p. 320). Perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of efforts" (Davis, 1989 p. 323). Fishbein and Ajzen (1975) argue that attitudes toward the use of an information system is "the individual's positive or negative feelings or value about performing the target behaviour" (Fishbein and Ajzen, 1975 p.216). The intention to use is described as "the strength of one's intention to perform a specified behaviour" (Fishbein and Ajzen, 1975 p.288).

According to Bagozzi (2007), the TAM model is too parsimonious and should be expanded by factors relevant to the specific technology under investigation. Integrating variables from related theoretical perspectives can also provide a better understanding of consumer acceptance (Nysveen, Pedersen, and Thorbjørnsen, 2005). Thus, consistent with other studies (Luarn and Lin, 2005; Schierz, Schilke et al., 2010), we use the main constructs of TAM as the foundational point of our research and extend it with additional constructs important to mobile money acceptance in the African context (Schierz, Schilke et al., 2010).

² This is true when we reflect on the number of mobile phones in Africa that appear to belie the poverty of African people. See Aker and Mbiti (2010) for more information on this.

3 Development of research hypotheses

3.1 Attitudes to adopt and intentions to keep using mobile money

Attitude is defined as the degree to which using technology is positively or negatively valued by an individual. Attitude in turn positively affects consumers' adoption of technology and their usage intentions (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989). Personal experience plays a strong role in forming an individual's attitude and social influence is another important determinant of consumer intentions and behaviour (Venkatesh et al., 2003). In our model, we represent attitude by the percentage of subscribers per 100 inhabitants of mobile money users. 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. It represents individual willingness to choose and use mobile money as opposed to other alternatives (if any) by actively using it on an ongoing basis. GSMA (2019) reports that most African countries' mobile subscriptions are in the range of 120% to 189%, which is higher than in some developed countries. In line with this, we propose the following hypothesis:

H1 : There is a positive relationship between an individual's attitude towards adoption of mobile money and their ongoing use of it.

3.2 Perceived usefulness, ease of use, and adoption of mobile money

Davis (1989) refined the TAM by suggesting that a user's motivation can be explained by three factors: perceived usefulness, perceived ease of use, and attitude towards using the system. The relationship between perceived ease of use and perceived usefulness and their effects on a user's behaviour to adopt and continue using the technology have been examined in IT/IS literature (Venkatesh & Davis, 1996; Horton & Lipsitz, 2001; Davis 1989). While the above studies used TAM wholly as the theoretical model, others have extended the TAM by including additional constructs. For instance, Lu et al., (2003) extended the TAM by studying mobile wireless internet acceptance. They argue that individual differences, technological complexities, facilitating conditions, social influences, and trust in the wireless environment have a positive effect on long-term and short-term perceived usefulness and on perceived ease of use. Mao et al., (2005) developed a research model to test the adoption of advanced mobile phone services (e.g. mobile internet access, e-mail, and payments) using TAM. In addition to perceived usefulness and perceived ease of use, they found support for variables measuring efficacy and personal innovativeness. Finally, Kwon and Chidambaram (2000) suggested that the adoption and acceptance of cellular phones was influenced directly and indirectly by individual characteristics, perceived ease of use, perceived usefulness, enjoyment, social pressure, and apprehensiveness. Based on these studies, we propose our generic TAM hypotheses as follows:

H2 : There is a positive relationship between perceived usefulness and attitudes to adopt mobile money.

H3 : There is a positive relationship between perceived ease of use and attitudes to adopt mobile money.

3.3 Effects of ubiquity/power supply and rural dwelling on perceived ease of use and perceived usefulness of mobile money

This study suggests that ubiquity of mobile phones, the availability of power, and rural dwellings have an influence on consumer perceptions of the usefulness and convenience of

mobile money. This is in accordance with previous literature which highlights the importance of identifying antecedents of TAM (Agarwal & Prasad, 1999; Benbasat and Barki, 2007) based on particular IS and geographical contexts. Perceived usefulness and perceived ease of use are hypothesised as antecedents of individual attitudes towards adoption which, in turn, affects intentions to use mobile money on an ongoing basis.

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 mobile money technology compared to one who leads a sedentary lifestyle. The effectiveness of mobile money rests on its ubiquity, which enable transactions to place anytime, anywhere (Kleinrock 1996), particularly the extent to which mobile money is perceived to provide personalised and uninterrupted banking and payments needs between the individual and other individuals, businesses, and governments, (P2P, P2B, P2G, B2B, and B2G). However, this can only happen if the functionality of the mobile phone -- such as having a reliable source of electricity to charge it -- is supported. As electricity generation is well below full capacity in most parts of Africa (Rubin, 2017), individuals, especially rural dwellers, may struggle to find a reliable power source to charge their mobile devices. There are multiple documentations of the extreme lengths to which rural people resort in order to access a power source to charge their mobile phones and to access mobile phone network services (Eriksson, 2008; Gyimah-Brempong & Karikari, 2007; Jacobson, 2007). Rural dwellers who have no electricity will find it more difficult to adopt and use mobile money compared to those in urban areas with a reliable source of electricity. Therefore, if the national grid is unavailable, the mobility-related needs that serve as the driver for adopting and using mobile money (Kakihara and Sorensen, 2002) in the first place may affect perceptions of its usefulness and convenience. We therefore propose our third and fourth hypothesis:

H4 : There is a positive relationship between ubiquity of mobile phones/reliable power supply and perceived ease of use of mobile money.

H5 : There is a negative relationship between rural dwelling and perceived usefulness of mobile money.

3.4 Effects of regulation and costs on perceived usefulness and perceived ease of use of mobile money

Enabling regulations and the associated costs with using mobile money can also affect consumer perceptions of the usefulness and convenience of mobile money. Those who adopt the use of mobile money may adapt their behaviour to the new technology if they perceive it is useful to their everyday life (Agarwal and Prasad, 1999). Liu, Kauffman, and Ma (2015) argue that market competition, cooperation, and regulations act as key accelerators of industry changes, while innovations in mobile payments have 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 (Liu et al., 2015). Enabling regulations facilitate acceptance and uptake of new systems (Zacharis, 2012) in providing assurance that sanctions will follow should there be any breach of contracts. Inter-operability is another reason why regulation is important. Because of competition and financial sector harmonisation, inter-operability that does not have the necessary regulation could be as any form of informal system, which can have a negative impact on the financial system of African countries.

In looking at how the costs of mobile money services can affect consumer perceptions of its usefulness, we take inspiration from the work of Swanson (1982), who provided evidence that perceptions of technology as both useful and easy to use were important behavioural determinants. Swanson demonstrated that potential users will select and use information reports based on a trade-off between perceived information quality (perceived usefulness) and the associated cost of access. Mathieson, Peacock, and Chin (2001) and Luarn and Lin (2005) also find that perceived costs influence one's intentions to use an information service and mobile banking, respectively. Similarly, Venkatesh, Thong, and Xu (2012) argue that the cost and pricing structure of IT/IS have a significant impact on technology use by consumers. For mobile money to be perceived as useful, potential users must see that the benefits of the system outweigh the costs. Consequently, we propose the next hypotheses as follows:

H6 : There is a positive relationship between regulation and perceptions of mobile money as easy to use

H7 : There is a positive relationship between costs and perceptions of mobile money as useful

3.5 Effects of education and gender on perceptions of mobile money as easy to use

Venkatesh et al. (2003) argue that social influence and individual characteristics are important determinants of user intention and behaviour. Arguably then, social influence and individual characteristics will influence one's perceptions of how easy it is to use mobile money. Venkatesh et al. (2012) contend that mobile device consumers are highly diverse and factors such as age, gender, and experience (education) (Agarwal and Prasad, 1999; Porter and Donthu, 2006; Yang, 2005) will have a direct impact on user perceptions of mobile money, particularly in terms of perceived ease of use. Females may face greater difficulties in processing information or using technology and thus may require more support, compared to their male counterparts (Venkatesh et al., 2012). However, greater experience (education) can moderate perceptions as the user becomes more familiar with using the technology and will be less inclined to rely on external support (Venkatesh et al., 2012). In line with these views, we hypothesise the following:

H8 : There is a positive relationship between education level (experience) and perceptions of mobile money as easy to use.

H9 : There is a negative relationship between female users and perceptions of mobile money as easy to use.

3.6 Control variables

To fully account for the differences among individuals and the organisations that provide mobile money, we include four control variables that characterise our unit of analysis (Liang et al., 2007). These control variables are referred to as facilitating conditions (absorptive capacity), and comprise age, income, provider size, and marketing advertisement. Facilitating conditions involve the individual's ability to use IS when conditions are conducive to their adoption. It is similar to the capacity of organisations to assimilate new IT/IS systems into their existing processes. For the purposes of this paper, we suggest that facilitating conditions also involves the link between the MNO's capacity to make their mobile money system user-friendly and the ability of the user to use it with minimum effort. Our study controls for age and income differences between individual users and provider size and marketing strategies between mobile money providers as each of these factors may impact on user adoption and

ongoing use of mobile money systems. Older consumers may struggle more to use new systems, such as mobile money while regulations may also restrict very young individuals from using it (Venkatesh et al., 2012). Meanwhile, the purchasing power of affluent consumers may increase their likelihood of adopting new technologies compared to poorer consumers as they have the ability to select those which are most suitable to their needs. Large provider organisations may have a greater capacity to market product and services which, again, may influence levels of uptake and ongoing usage. Figure 1 provides the hypothesised research model, indicating the direction of mediation.

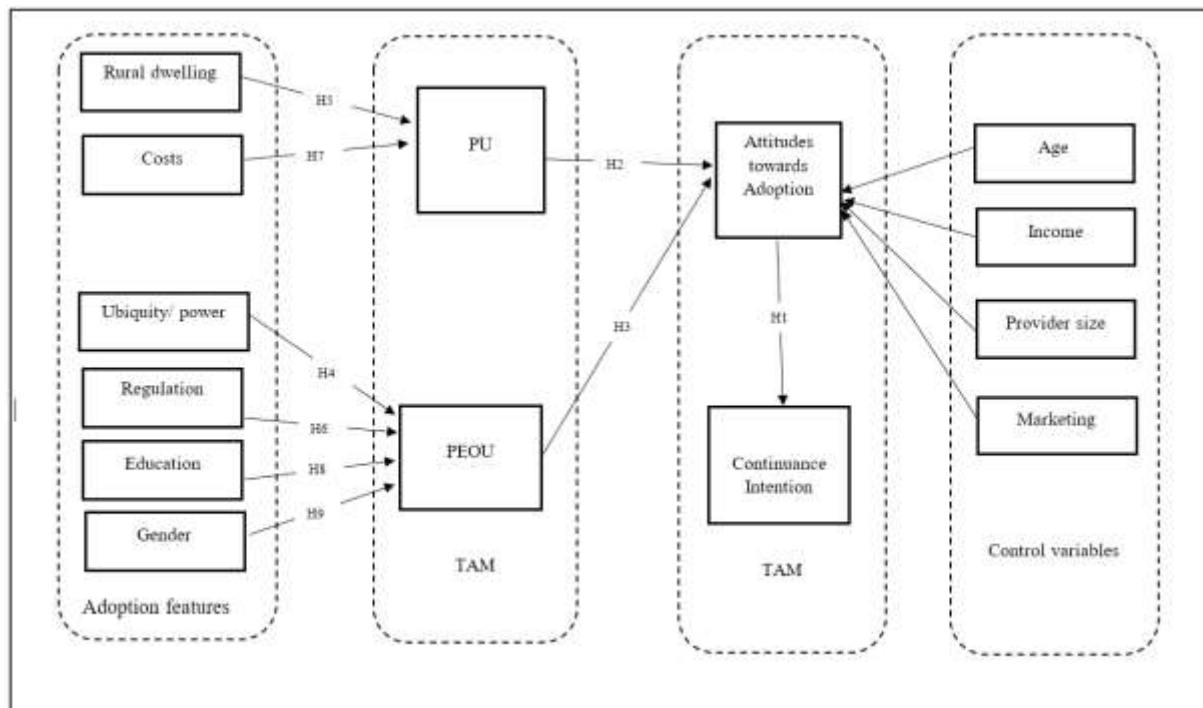


Figure 1 Research Model

4 Data, measurement of variables and research method

4.1 Data

The data for the study is obtained from GSMA. The GSMA is a subsidiary of Groupe Speciale Mobile (GSM), which was formed in 1982 by the Confederation of European Posts and Telecommunications (CEPT) to design a pan-European mobile technology. The GSMA Mobile for Development Foundation, Incorporation was created in 2007 to demonstrate the positive social impact of mobile technology, bringing together mobile operators, donors and the international development community. They also collect data known as The Global Mobile Money Dataset. This is a comprehensive set of global metrics for the mobile money industry, measured on a quarterly or monthly basis depending on the metric. Among the dataset is the Mobile Money Regulatory Index, the Mobile Money Deployment Tracker that comprises live services, registered agents, registered accounts, and the volume and value of transactions.

These datasets represent one of the most current sources of information about the mobile money industry. Our study used these datasets to understand the drivers of mobile money adoption and ongoing usage. For the regulation variable, we used the Mobile Money

Regulatory Index, which scores countries based on the extent to which their regulatory framework enables widespread mobile money adoption. Scores range between 0-100, with a higher score associated with more enabling regulations. Each mobile money deployment (live service) is associated with a regulatory index, so account owners are able to discern if enabling regulations have had an impact on their attitudes and intentions to adopt and use mobile money.

The GSMA defines a mobile money service as a service that includes transferring money and making payments using the mobile phone. For a mobile money service to be included in the Mobile Money Deployment Tracker, it must meet the following criteria: available to the unbanked; offers a network of physical transactional points which can include agents; separate from bank branches and ATMs, making the service widely accessible to everyone; and separate from payment services such as Apple Pay and Google Wallet.

The Global Mobile Money Dataset also has data on mobile cellular subscribers and the percentage of rural dwellers with ICT infrastructure. The percentage of mobile cellular subscribers for every 100 inhabitants and the percentage of population covered by the mobile cellular network were taken from the International Telecommunications Unit (ITU). These data were cross-checked with data from the World Bank, and the differences are negligible. Data on the percentage of the total population with electricity consists of the percentage of the country's population that is connected to the national grid, also taken from ITU and the World Bank.

The data for the cost of mobile money was taken from the Research ICT Africa (RIA) Network, a non-profit organisation based in South Africa. RIA researches ICT policy and regulations and facilitates evidence-based policies that aim to improve access, use, and applications of ICT for social development and economic growth. The quarterly data on prices are gathered from mobile network operators across Africa and standardised using the OECD mobile pricing measurement (cheapest prepaid mobile voice product by country (in USD)).

Data on the individual characteristics for mobile money customers (a proxy for facilitating conditions) are taken from the Global Findex database. These comprise age, gender (female), income and education. To control for the variations in size of mobile money provider organisations, we use sales revenue and marketing budgets as two measures of organisational size, obtained from the financial statements and websites of these MNOs. Overall, 40 countries that offer mobile money operations are included in this study, giving us a monthly dataset of 480 data points.

4.2 Measurement of variables

The measurement items were formulated based on theory, review of the literature and modified to reflect the assumptions, propositions and hypotheses of context-based themes. The items used to measure attitudes towards adoption and ongoing intentions to use mobile money were taken from Davis (1989), Davis, Bagozzi, and Warshaw (1989), and Luarn and Lin (2005) and proxied in order to understand mobile money in the African context.

Construct name	Description	Measurement	Coded as	Data source	Related studies
Intention to use mobile money	Given the opportunity, the respondent will use mobile payment services.	Percentage of the population with a mobile network in a country	1= 50% and above 0= 49% and below	ITU (2018), GSMA (2018), World Bank (2018)	Venkatesh et al. (2003), Davis (1989)
Attitude towards adopting mobile money	The degree to which using technology is positively or negatively valued by an individual.	Percentage of mobile subscribers per 100 inhabitants	1= 50% and above 0= 49% and below	ITU (2018), GSMA (2018), World Bank (2018)	Venkatesh et al. (2003), Davis (1989)
Perceived usefulness	The degree to which a person believes that using a particular system would enhance his or her job performance.	Percentage of people who used the internet to pay bills or to buy something online in the past year, primary education or less (% age 15+)	1 = 50% and above 0 = 49% and below	Global Findex (2018)	Venkatesh et al. (2003), Davis (1989)
Perceived ease of use	The degree to which a person believes that using a particular system would be free of efforts.	Mobile money account ownership, primary education or less (% age 15+)	1 = yes 0 = otherwise	Global Findex (2018)	Venkatesh et al. (2003), Davis (1989)
Antecedents of Perceived Usefulness (PU)					
Rural dwelling	Lack of mobile network infrastructure and electricity.	Rural population as the percentage of the total population	1 = 50% and above 0 = 49% and below	GSMA (2018)	Venkatesh, Thong, and Xu (2012)
Cost	The extent to which a person believes that using mobile money will cost money.	Price of prepaid mobile voice and SMS.	1 = 10 cent and above 0 = 9 cent and below	RIA (2018)	Luarn and Lin (2005)
Antecedents of Perceived Ease of Use (PEOU)					
Ubiquity/power	How well consumers believe mobile money can be integrated into their daily mobile activities (ability to use mobile	Percentage of the population with electrification (national grid)	1= 50% and above 0= 49% and below	ITU (2018), World Bank (2018)	Kakihara and Sorensen (2002), Rubin (2017)

Regulation	phone and mobile money at anytime and anywhere). Mobile Money Regulatory Index which scores countries based on the extent to which their regulatory framework enables widespread mobile money adoption. Scores range between 0-100, with a higher score associated with more enabling regulation.	Mobile Money Regulatory Index which scores countries based on the extent to which their regulatory framework enables widespread mobile money adoption. Scores range between 0-100, with a higher score associated with more enabling regulation.	1 = 50% and above 0 = 49% and below	GSMA (2018)	Liu, Kauffman, and Ma (2015)
Education	Better knowledge structures to facilitate user learning of mobile money.	Primary school completion rate as a percentage of the total population	1 = primary 2 = others	Global Findex (2018)	Venkatesh, Thong, and Xu (2012),
Gender	The likelihood that females may require more support to adapt to technology use than men.	Percentage of women with mobile money accounts	1= 50% and above 0= 49% and below	Global Findex (2018)	Venkatesh, Thong, and Xu (2012),
Control variables					
Age	The likelihood that older consumers may turn to face difficulty in processing information or using technology (mobile money).	Percentage of population aged 65 and above as the percentage of total population	1 = age 65 and above 0 = age 64 and below	Global Findex (2018)	Venkatesh, Thong, and Xu (2012)
Income	Willingness to pay (WTP) for mobile money due to price value.	Percentage of mobile account ownership	1 = ownership 0 = otherwise	Global Findex (2018)	Venkatesh, Thong, and Xu (2012)
Provider size	Total assets or total market share controlled by an MNO	Total assets or total market share controlled by an MNO	1 = 20% and above 0 = 19% and below	MNOs websites and annual financial statements (2018)	
Marketing budget	Total advertising budget committed for marketing mobile money in a year	Total advertising budget committed for marketing mobile money in a year	1 = US\$ 1 million and above 0 = below US\$ 1 million	MNOs websites and annual financial statements (2018)	

Table 1: Variable description, measurement and data source

As discussed earlier, perceived ease of use is the proxy for the percentage of people with primary education or lower who have mobile money accounts in a country (Demirguc-Kunt et al., 2018). Perceived ease of use is a latent variable with a number of items (ubiquity/power, regulation, education and gender) as its antecedents and which are taken from previously validated studies and modified to fit the specific technology under study (Rubin, 2017; Luarn and Lin, 2005; Venkatesh and Davis, 1996; Liu, Kauffman and Ma, 2015; Venkatesh et al., 2012). Facilitating conditions include individual covariates such as age, gender (female), income disparities and experience (education), all of which affect the main TAM construct, perceived ease of use and the control variables. For the other controls, provider size and marketing strategies, we obtained data from financial statements and other information on the websites of various MNOs.

Perceived usefulness, also a latent variable (proxied as the percentage of people who used the internet to pay bills or to buy something online in the past year), (Demirguc-Kunt et al. 2018), is determined by the adoption features comprising the constructs of rural dwelling and cost (Fishbein and Ajzen, 1975; Venkatesh et al., 2012; Swanson, 1982). The hypothesised model (Figure 1) comprised 12 observed variables and two latent constructs (perceived usefulness, perceived ease of use) are used to determine intentions to adopt and to continue using mobile money in Africa. The full list of items used in this study and their modifications are listed in Table 1.

4.3 Assumptions for secondary data as an alternative to traditional TAM

Traditionally, TAM is grounded in primary data since constructs are built based on predetermined survey questions that enquire about user intentions to adopt and use a particular IS. The limitations of the context in which this study was conducted compelled the use of secondary data as proxies for the traditional TAM constructs. The following assumptions guide the use of secondary data:

1. The choice of the secondary data approach is governed by both the research questions and data availability. The research question approach is used because the authors have a priori hypotheses that needed verification through suitable datasets. The datasets used in this study were deemed to be the most appropriate proxies because of the unique nature of the phenomenon under investigation.
2. The authors generated operational definitions of the proxies used, and the independent, control, and outcome variables. This helped us to identify the best analytical approach to use.
3. The data is recorded from the original variables. This is done in order to transform them to meet the assumptions of the statistical model of analysis, structural equation modelling (SEM).

Using secondary data as an alternative to TAM, simulation analysis has some advantages, including its cost-effective nature. Secondary datasets may be regarded as 'clean data', already scrutinised by primary data collectors who normally document the data collection and filtration process. The hypotheses for this study would otherwise require primary datasets are potentially costly to acquire. Using datasets that are already available saves money, time, and serves as a preliminary study for future undertakings. Secondary data also provides us with the ability to cross-link information from different data sources that are key to studying ongoing usage of mobile money systems for which the original TAM model lacks. This is

necessary as some researchers agree that TAM is more parsimonious (Bagozzi, 2007) and therefore requires additional constructs to help understand the adoption of mobile money in Africa. The use of the proxies has, therefore, opened up another window from which TAM researchers can approach with confidence. Finally, the use of secondary data in this study allows us to study real-life cases in conjunction with existing theories like TAM. Our approach enables us to identify potential new interventions to current problems that can subsequently be tested in prospective studies. A particular case in point is the ownership of mobile money in Africa, a phenomenon that defies logic in light of the region's widespread poverty (Aker and Mbiti, 2010).

4.4 Advantages of SEM over regression analysis

The 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 inclusion of variables in multiple regression analysis rests on the assumptions that variables should be normally distributed, given the explanatory variables, and that measurement errors and multicollinearity are 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 by the type of data used for this study. 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 the explanatory indicators are free of multicollinearity.

For the above reasons, we use SEM for the empirical estimation. SEM analysis is arguably the most effective way to test mediated effects when data requirements are met. As multiple indicators are used, SEM is ideal in constructing measurement models for the theoretical concepts hypothesised (Li, 2011) and allows for multiple indicators of latent variables which are a more realistic representation of the variables under study (Schierz et al., 2010). When measurement error is a concern, as is the case with our data, SEM uses multiple indicators to overcome it. In contrast to OLS regression, which is based on the assumption that variables are measured perfectly (Bollen 1987), SEM operates on a rationale that each explanatory and dependent variable may be associated with measurement errors.

4.5 Assumptions for using SEM in TAM analysis

Following Bailey and Pearson (1983), we postulate that the adoption of mobile money is a desire to be satisfied. Legris et al. (2003) argue that satisfaction is considered as the sum of one's feelings or attitudes toward a variety of factors affecting the situation. They defined it as the sum of m user's weighted reactions to a set of n factors.

$$\text{Satisfaction} = \sum W_{ij} R_{ij} \quad (j = 1, \dots, n, \quad i = 1, \dots, m) \quad (1)$$

where R_{ij} is the reaction to factor j by individual i and W_{ij} is the importance of factor j to individual i . attitudes toward adoption and intentions to use mobile money on an ongoing basis are directly related to the reactions of individuals i , who see the usefulness of mobile money in their everyday life. To understand these reactions and to measure their importance as factors that satisfy the desire of individuals' attitudes and continuance intentions to adopt and use mobile money, certain variables must trigger them. These variables are the exogenous variables that play crucial roles for people in their decisions about whether to adopt mobile

money. This can be illustrated as paths of structural coefficients (Dawn, 2009) in SEM as in equation (2) below:

$$y_{ij} = \Phi y_{ij} + \Pi X_{ij} + \delta \quad (2)$$

Where y_{ij} is a vector of endogenous dependent variables, Φ is a matrix of coefficients of the y_{ij} 's on other y_{ij} 's (part of the structural relationships), Π is a matrix of coefficients of X_{ij} 's on the y_{ij} 's (also part of the structural relationship). X_{ij} is a vector of the independent latent variables, exogenous constructs (the predictor variables), and δ is the error disturbance. y_{ij} 's and X_{ij} 's depict the one-on-one mapping between the variables and constructs, and the matrix of measurement error δ , (Dawn, 2009). This path model for user intentions to adopt and use mobile money is represented in Figure 1. For this study, all the constructs were estimated using SEM with maximum likelihood.

5 Empirical results

To begin with, we conducted an 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) = 0.89, Root mean square error of approximation (RMSEA) = 0.060, the Bentler-Bonett normed fit index (NFI) = 0.91, the Tucker-Lewis index (TLI) = 0.88, the comparative fit index (CFI) = 0.85, the incremental fit index (IFI) = 0.90, and the coefficient of determination (CD) = 0.91, which are within accepted values (Bollen, 1987).

Following Goodhue, Lewis, and Thompson (2011), (as cited in Henseler, Ringle, and Sarstedt, 2015), we examine the VIF values between the constructs. This is to avoid high collinearity between constructs that may lead to an exaggerated estimation of path coefficients. Any construct that exhibits a VIF number above 5.00 shows collinearity. The VIF values (see Table 2) for the study fell between 1 and 4, all below the recommended values of below 5, indicating that multicollinearity is not an issue in our study.

Satisfied that the model is fit, we now show the results of the context-based factors that determine the initial uptake and ongoing usage of mobile money in Africa. Following Bollen's (1987) approach regarding 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. We show the standardised coefficients in Figure 2 and Table 3 for easy comparison of magnitudes, as the measurement of the variables was done on different scales. The standardised 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).

To ensure the stability of the results, we test the correlation of the exogenous variables (see Table 2) to deduce the presence of multicollinearity. Berry et al. (1985) argue that for any specific empirical analysis, multicollinearity, which is a correlation among explanatory variables, can affect the stability of the empirical results. To avoid this, they suggested that, as a rule of thumb, the correlation among the explanatory variables should be below 0.8. As shown in Table 4, all the correlations are within the cut-off value of 0.8, reconfirming that the multicollinearity is not an issue in our study.

Item	Intention	Attitude	PU rural	PU cost	PU ubiquity	PU regulation	PEOU education	PEOU gender	Age	Income	Provider size	Marketing	VIF
Intention	1.00												.21
Attitude	.68	1.00											.30
PU rural	-.41	-.23	1.00										.17
PU cost	-.35	-.74	-.57	1.00									.39
PEOU ubiquity	.74	.51	-.25	-.58	1.00								.27
PEOU regulation	.72	.57	-.24	-.19	.72	1.00							.32
PEOU education	.58	.49	-.70	-.44	.67	.54	1.00						.41
PEOU gender	-.34	-.31	-.36	.23	-.16	.61	.14	1.00					.09
Age	.46	-.01	-.42	.52	-.63	.31	-.31	.08	1.00				.28
Income	.61	.21	-.29	.27	-.65	.16	-.52	-.21	.25	1.00			.22
Provider size	.06	.21	-.34	-.49	.38	.54	.63	.05	.06	.12	1.00		.33
marketing	.10	.13	.09	.72	.64	.42	.41	.07	.23	.30	.65	1.00	.29

Notes:

1. This table lists the correlations matrix of all the tested variables in the study. First, the positive and significant correlation between PEOU Ubiquity/power and continuous intention to adopt mobile money indicates that the supply of electricity is important to the adoption of mobile money. Second, the correlation between PEOU Ubiquity/power and attitudes towards adoption of mobile money is also positive and significant, which supports a similar argument as above. Surprisingly, the values of PU rural and continuous intention to adopt mobile money is negative and significant, which indicate the challenges of rural dwellers on the adoption of mobile money in Africa. The correlation matrix largely supports the estimation results in Table 4 and figure 2.
2. The correlation estimates shown in this table suggest that multicollinearity is not a problem among the constructs. All constructs are below the cut-off figure of .80, and .50 for correlation and VIF respectively.
3. PU is perceived usefulness and PEOU is perceived ease of use.

Table 2 Correlation matrix and VIF among the exogenous variables

Since measurement scales can affect the results of the estimation of the sample if items are found to be highly correlated with each other, we test 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 12 items used. As shown in Table 3, the item-test correlation and the item-rest correlation all produce figures that are within limits of 0.8. The overall α of 0.8 is an indication that items in the model are reliable and consistent with providing stable results.

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
Antecedents of perceived usefulness						
Rural	40	-	.52	.56	.28	.74
Cost	40	-	.58	.46	.26	.78
Antecedents of perceived ease of use						
Ubiquity/Power	40	+	.71	.75	.23	.75
Regulation	40	+	.64	.54	.25	.77
Education	40	+	.78	.73	.23	.75
Gender	40	-	.24	.08	.31	.82
Control variables						
Age	40	-	.30	.14	.30	.81
Income	40	-	.32	.17	.30	.81
Provider size	40	+	.68	.58	.25	.77
Marketing	40	+	.72	.68	.24	.74
Test scale					.26	.80

Notes:

This table presents the estimation results of the scale reliability test. The standardised Cronbach's alpha for the scale reliability is found through the equation

$\alpha_{standardised} = \frac{K\theta}{(1+(K-1)\theta)}$, where K is the number of items, θ is the average inter-item correlation, that is the mean of K (K-1)/2 coefficients in the upper triangular correlation matrix. The table measures the internal consistency of the 12 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 suggests that the items have high internal consistency. The standardised values are important as it helps in supporting the hypotheses tested.

Table 3. Scale reliability test of standardised items

As shown in Table 4, all our hypotheses are supported in the model. For the control variables, age and income are not significant, but the size and marketing strategies of mobile money providers show significant values. The R^2 values are substantial for perceived usefulness ($R^2 = 0.677$), attitudes towards adoption ($R^2 = 0.691$), perceived ease of use ($R^2 = 0.785$), and intentions to continue using mobile money ($R^2 = 0.683$). The results show that, together, rural dwelling and costs explained 67.7% of the total variance in perceived usefulness, while ubiquity/ power supply, regulation, education and gender explained 78.5% of the variance in perceptions of mobile money as easy to use. Moreover, 69.1% of the variance in attitudes towards adoption is explained. 68.3% of the variance in intentions to adopt and to keep using mobile money is explained. The results of these R^2 statistics indicate that the structural model developed in this study has an acceptable level of predictive accuracy as seen in Figure 2.

Examined variable	SEM coeff	Chi-statistics	Remark
H_1 : Attitude towards Adoption	.51*** (4.21)	$\chi^2 = .72$ $df = 1, p = .000$	Accepted
H_2 : PU	.42*** (6.73)	$\chi^2 = .72$ $df = 1, p = .000$	Accepted
H_3 : PEOU	.54*** (3.45)	$\chi^2 = .72$ $df = 1, p = .000$	Accepted
H_4 : PEOU ubiquity/power	.54*** (6.13)	$\chi^2 = .79$ $df = 1, p = .000$	Accepted
H_5 : PU rural dwelling	-.39*** (-5.08)	$\chi^2 = .49$ $df = 1, p = .000$	Accepted
H_6 : PEOU enabling regulation	.33*** (7.20)	$\chi^2 = .59$ $df = 1, p = .000$	Accepted
H_7 : PU cost	.17** (4.09)	$\chi^2 = .68$ $df = 1, p = .005$	Accepted
H_8 : PEOU education	.24*** (3.55)	$\chi^2 = .61$ $df = 1, p = .000$	Accepted
H_9 : PEOU gender (female)	-.02* (-0.57)	$\chi^2 = .37$ $df = 1, p = .641$	Accepted
<i>Control variables</i>			
Age	-.01ns		Not accepted
Income	-.03ns		Not accepted
Provider size	.09***		Accepted
Marketing	.08***		Accepted
Overall R^2	.64		

Table 4 Mediation effects on individual attitudes towards the adoption of Mobile Money in Africa.

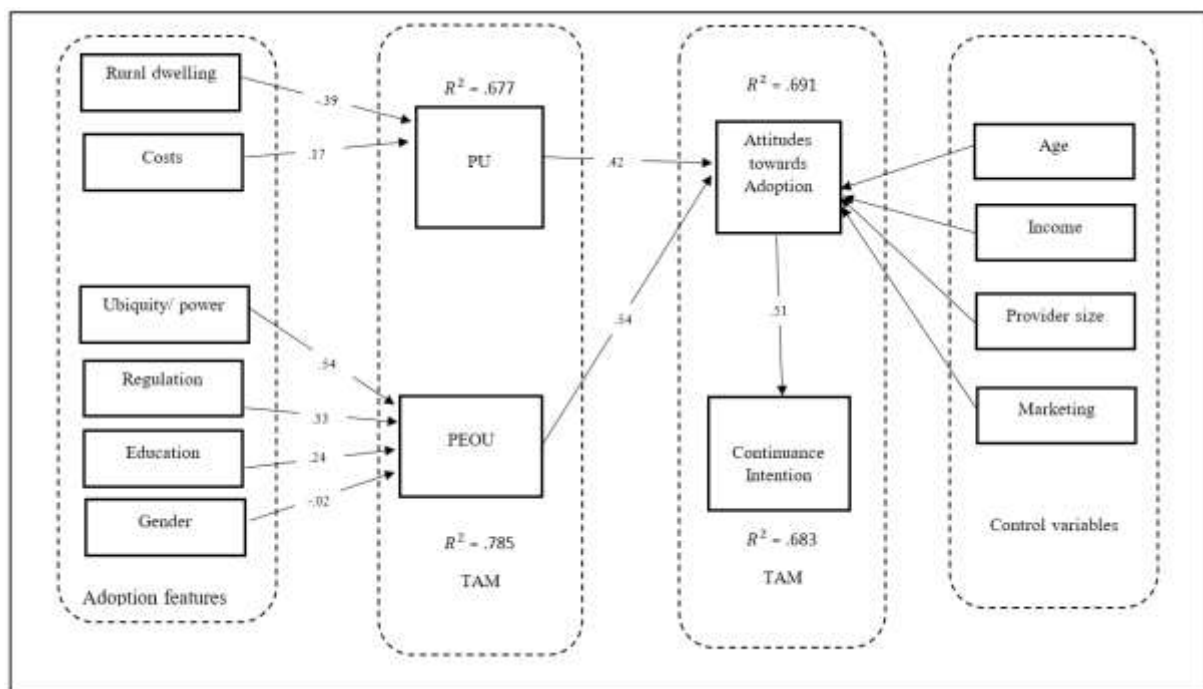


Figure 2 Results of the path relations in the research mode

6 Discussion and implications

6.1 Theoretical implications

This study examines the factors that influence the initial adoption of, and ongoing intentions to use, mobile money by employing TAM that includes perceived usefulness and perceived ease of use as moderators to attitudes towards adoption. The existing literature provides limited guidance on how TAM is perceived within the context of African IS adoption. The importance of context cannot be overstated (Agawal and Prasad, 1997); in another context, there may be differences in the variables identified to understand IS use and acceptance. Equally, the meaning of variables such as perceived usefulness and perceived ease of use may be drastically influenced by the type of IS being studied. The use of proxies to study adoption of mobile money in Africa is, therefore, a justifiable enterprise. The most important determinant of mobile money usage in Africa is perceived ease of use. Context-based variables such as ubiquity/power supply, enabling regulations, education and gender are positively associated with individual attitudes towards the adoption of mobile money. Perceived usefulness is another significant determinant of the uptake of mobile money in Africa. These findings support prior studies on mobile payment adoption and acceptance (Bailey et al, 2017; He, Chen, and Kitkuakul, 2018; Polites and Karahanna, 2018). The findings also open a new window on the use secondary data in TAM that is parsimonious.

6.2 Methodological implications

From a methodological point of view, our study offers a new perspective on how TAM can be analysed, incorporating secondary data. Our novel approach is applied to a new IS (mobile money) that has, until now, received minimal examination in relation to TAM. Our use of proxies highlights how available datasets can be leveraged to study TAM. The outcomes of using these proxies warrant some discussion here.

Ubiquity and power supply are shown to be particularly important; simply put, if people lack a reliable supply of power to charge their phones, they cannot use mobile money systems. African people are known to be mobile (Kakihara and Sorensen 2002; Kleinrock, 1996), in search of economic opportunities, and mobile money supports this mobility. Limited access to electricity affects the number of people who can adopt and sustain their use of mobile money (Rubin, 2017). In Africa, the costs involved in securing access to electricity are high, especially for inhabitants of towns and villages that are not connected to the national grid. Such mobile phone users are compelled to travel long distances in order to access electricity just to keep their phones functional. Although the availability of mobile money systems in Africa should, in theory, allow people to increase the quality of their lifestyles, the lack of basic infrastructure, such as limited access to electricity³, prevents a great number of people from reaping these benefits.

Regulations are another significant factor in consumer intentions to adopt and to keep using mobile money. When mobile money systems were first introduced in Africa (M-PESA), regulations were not considered to be of high importance (Jack and Suri, 2011). However, consumer reports of abuse by agents and operators, and most recently fraud, have made

³ The countries with the lowest levels of public access to electricity are as follows: Burundi (6.5% of the population), Malawi (9.8% of the population), Liberia (9.8% of the population), Central African Republic (10.8% of the population), Burkina Faso (13.1% of the population) (World Bank, 2014).

regulations an important factor in perceptions of mobile money as easy to use since consumers are assured of some means of recourse if contracts are breached. Furthermore, as with other traditional financial systems (GSMA, 2016), mobile money requires proper regulations to be in place as it is a form of financial provision. MNOs also require regulations to ensure that their investments are secured and to enable them to conduct legitimate and competitive business. Regulations also ensure that government revenue generation, in terms of taxes, is adequately secured. They are also a mechanism for effective competition between mobile money providers, ensuring that prices are kept low for everybody.

Previous user experience of mobile money platforms and brand reputations will also influence one's intentions to adopt and to keep using mobile money. Prior experience with the technology reduces one's dependence on external support to use mobile money (Venkatesh et al., 2012). The intuitive interface of mobile money platforms (McGrath and Lonie 2013) can lead to positive attitudes towards adoption. According to Wu and Wang (2005), the extent to which a new system is consistent with those previously used by the user strongly influences perceptions of that new system's ease of use.

The use of mobile money by women is found to be negative and moderately significant. This confirms the hypothesis that females tend to depend on men for engaging with new information systems, which is in line with the findings of Venkatesh et al. (2012).

Our findings with regard to rural dwelling and the perceived usefulness of mobile money supports our hypothesis and existing literature in that mobile money adoption and usage is concentrated in cities and urban centres (Aker et al., 2016; Aker and Mbiti, 2010; Asongu, 2015; Donovan, 2012). Although adoption of mobile money is starting to grow in rural areas, there remains a great disparity between rural uptake and adoption levels in urban centres, which reflects the underdevelopment of infrastructures in rural areas of Africa (Mas and Kumar, 2008, Rubin, 2017).

A comparison between the transaction costs associated with mobile money services and those of traditional money transfer systems in Africa indicates that mobile money has advantages (Aker and Mbiti, 2010; Jack and Suri, 2014). The fast and secure nature of mobile money services also contribute to the reduction in costs, further reinforcing its perceived usefulness (Aker et al., 2016; GSMA, 2016; Jack and Suri, 2011; Mas and Kumar, 2008).

Individual attitudes towards mobile money are an important factor for its adoption and use in Africa. We defined this factor with a proxy -- the percentage of mobile subscribers per 100 inhabitants -- and found a positive and significant correlation. The data also provides evidence to this effect. For instance, the data for attitude towards mobile money for South Africa, Mauritius and Ghana are 147.13%, 143.73% and 135.8% respectively. The positive attitudes of African people towards mobile money reflects its convenient, secure and fast nature, but it also exposes the inadequate and underdeveloped nature of other payment systems in Africa.

For the controls, we find negative and insignificant coefficients for age and income but positive and significant values for provider size and ability to market mobile money products and services. The result is consistent with the literature that adults aged 65 years and over are less likely to adopt mobile money because of the technical knowledge associated with it (Zimmerman and Arnold, 2013). Also, most African countries restrict people below the age of 18 from purchasing SIM cards which may hinder this group from using mobile money even if they may have access to mobile phones (Zimmerman and Arnold, 2013). The use of income to

gauge uptake of mobile money needs further analysis as the number of mobile phones per head belies the widespread poverty in Africa. Provider size and marketing is important, and each MNO's strategy is to capture the greatest market share in order to enjoy economies of scale.

6.3 Managerial implications

This study reveals that organisational support is required to promote consumer adoption and ongoing usage of mobile money. This can be done through the provision of incentives and through strengthening end-user support so as instil confidence among users. It also revealed that MNOs use marketing communications like advertisements to encourage consumers to adopt and to continue using mobile money. Managers of mobile money services can leverage the positive impact of mobile money in Africa to expand their services to enhance financial inclusion, which is a necessary component for the region's growth and development. It is further envisaged that MNOs will, in the long run, remain competitive in terms of service pricing as ongoing increases in price will dissuade consumers from continuing their use of mobile money.

6.4 Policy implications

Our study has important policy implications for mobile money services in Africa. It demonstrates that the availability of electricity is absolutely crucial for the uptake of mobile money. People need a reliable source of power in order to charge their mobile phones so that these phones can be used anytime and anywhere. Basic infrastructure is a necessary component for the expansion of mobile money services into areas that are yet to be adequately connected. If power or energy is available, this cuts the cost of travel for rural dwellers who may intend to use mobile money but who do not have the means to maintain the functionality of their phones in their homes. Rubin (2017) emphasises that policy frameworks are gathering momentum internationally around the build-once approach to infrastructure development. An example of the build-once approach for Africa through the Public Private partnerships (PPPs) would be electricity and MNOs sharing towers for their wires. Another example involves the coordination of MNOs to lay wires under new roads for electricity. This policy framework will direct future ICT and energy transformations that can further lower the costs of electricity. In turn, this may allow MNOs to increase their customer base if consumers have access to basic infrastructure that enables them to keep using mobile money.

Enabling regulations are important for the growth of mobile money services. Since the introduction of M-PESA in 2007, mobile money services in Africa have undergone major transformations in terms of service provision, competition, consumer protection protocols, monetary policy frameworks by the government and central banks, and tax payments. Enabling regulations also imply that MNOs are regulated which gives consumers the assurance that their rights are protected. Central banks have an obligation to ensure that regulations are sufficiently enabling in order to sustain the evolution and expansion of mobile money. The interoperability of mobile money remains a challenge for several African countries (particularly within the eight countries of the West African Economic Monetary Union (WAEMU) as existing regulations are often inadequate to address the changes and complexities that arise as technology keeps evolving. Policymakers and regulators need to undertake broader consultation involving a wide range of stakeholders in order to progress forward.

7 Conclusion and future research

This study seeks to understand the context-based factors that influence the adoption and continuous use of mobile money in Africa. Using data from different sources, we presented the preliminary results for 40 African countries in relation to consumer intentions to use mobile money.

Our study used TAM with modifications made for local context factors. We use the model to determine how these factors affect the initial adoption and ongoing use of mobile money. Using SEM, our results show that access to electricity is crucial to consumers' ability to use mobile money. Partnerships between MNOs and the government are critical to improving the provision of electricity to rural inhabitants which, in turn, enables MNOs to grow and sustain their customer base.

MNOs can influence the attitudes of consumers through their marketing and agent networks. Our preliminary empirical results for the attitude construct (proxied by the percentage of mobile network subscribers per 100 inhabitants) indicate that peoples' attitudes play a major role in the uptake and ongoing use of mobile money in Africa. MNOs should identify reference groups who can play an important role in the diffusion of mobile money. In particular, if users are identified in the early stages of their adoption of mobile money, and they continue to enjoy the benefits of it, they may influence their social networks to also adopt mobile money.

Our results highlight the importance of enabling regulations as a mechanism for increasing the uptake of mobile money. As people become increasingly aware of regulations that guide MNOs in their mobile money operations, people are more inclined to trust the system of mobile money. Conversely, a lack of proper regulations will hinder the inroads made by mobile money in Africa thus far.

Finally, the current lack of infrastructure (mobile networks and electricity) continues to hinder the diffusion of mobile money in rural areas of Africa. Given that the majority of Africans continue to live in rural areas, it is only prudent that MNOs collaborate with governments to improve these infrastructures for shared prosperity.

There are several directions for future research that this research facilitates. First, the data used is secondary, with its attended measurement issues. Future studies could 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 adoption and ongoing use of mobile money by African consumers. A fruitful direction for additional research would be to examine the earlier stages of the adoption process and to capture the responses of individuals who eventually stop using mobile money. Finally, the results of this study are valid only for the African context, which is characterised by a very high penetration rate of mobile phones in spite of widespread poverty and limited infrastructure. More empirical studies should be carried out in other cultural settings with similar characteristics of widespread poverty, limited infrastructure and minimal regulations, to widen our knowledge.

References

- Agarwal, Ritu, and Jayesh Prasad. 1999. "Are individual differences germane to the acceptance of new information technologies?" *Decision Sciences* 30 (2):361-391.
- Agarwal, R Prasad, J. 1997. The role of innovation characteristics and perceived voluntariness in the acceptance of information technologies. *Decision Science*, 28,(3), 557-582.
- 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.
- 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.
- Bailey, A.A.; Pentina, I.; Mishra, A.S.; Mimoun, M.S.B. (2017). Mobile payments adoption by US consumers: An extended TAM. *Int. Journal of Retail Distribution Management*, 45, 626–640.
- 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.
- Benbasat, Izak, and Henri Barki. 2007. "Quo Vadis TAM?" *Journal of the Association for Information Systems* 8 (4):7.
- Berry, William D, William D Berry, Stanley Feldman, and Dr Stanley Feldman. 1985. *Multiple regression in practice*: Sage.
- Bhattacharjee, Anol, 2001. "Understanding information systems continuance: an expectation-confirmation model." *MIS quarterly*, 351-370.
- 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>.
- 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.
- Dawn Iacobucci,. (2009). Everything you always wanted to know about SEM (structural equations modeling) but were afraid to ask. *Journal of Consumer Psychology* (19) 673–680.
- De Koker, L., & Jentzsch, N. (2013). Financial inclusion and financial integrity: Aligned incentives?. *World development*, 44, 267-280.

- Demirgüç-Kunt, Asli, Leora F Klapper, Dorothe Singer, and Peter Van Oudheusden. 2015. "The Global Findex Database 2014: Measuring financial inclusion around the world." The World Bank.
- Demirguc-Kunt, Asli, Leora Klapper, Dorothe Singer, Saniya Ansar, and Jake Hess. 2018. *The Global Findex Database 2017: Measuring Financial Inclusion and the Fintech Revolution*: The World Bank.
- 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.
- Eriksson, Evanjeline. 2008. *A case study about cell phone use by people in rural Kenya*. diva-portal.org.
- Fishbein, Martin, and Icek Ajzen. 1975. *Belief, attitude, intention and behaviour: An introduction to theory and research*.
- Goodhue, Dale L, William Lewis, and Ronald L Thompson. 2011. "A Dangerous Blind Spot in IS Research: False Positives Due to Multicollinearity Combined With Measurement Error." AMCIS.
- Gosavi, A. (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*.
- GSMA. 2019. "Mobile Money Metrics,." *GSMA Intelligence, London. UK*.
- Gyimah-Brempong, Kwabena, and John Agyei Karikari. 2007. "Telephone demand and economic growth in Africa." *OECD Economic Studies*, 38 (1).
- Hair, Joseph F, Rolph E Anderson, Ronald L Tatham, and William C Black. 1995. "Multivariate data analyses with readings." *Englewood Cliffs, New Jersey*.
- He, Y.; Chen, Q.; Kitkuakul, S. (2018). Regulatory focus and technology acceptance: Perceived ease of use and usefulness as efficacy. *Cogent Business Management*, 5, 1–22.
- Henseler, Jörg, Christian M Ringle, and Marko Sarstedt. 2015. "A new criterion for assessing discriminant validity in variance-based structural equation modelling." *Journal of the academy of marketing science* 43 (1):115-135.
- Horton, Nicholas J, and Stuart R Lipsitz. 2001. "Multiple imputations in practice: comparison of software packages for regression models with missing variables." *The American Statistician* 55 (3):244-254.
- Hung, Ming-Chien, Shih-Ting Yang, and Ting-Chu Hsieh. 2012. "An examination of the determinants of mobile shopping continuance." *International Journal of Electronic Business Management* 10 (1):29.
- J.E. Bailey, S.W. Pearson. (1983). Development of a tool for measuring and analysing computer user satisfaction, *Management Sciences* 29 (5), pp. 530–545.

- 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.
- Jacobson, Arne, 2007. "Connective power: solar electrification and social change in Kenya." *World Development*, 35 (1):144-162.
- Kakihara, Masao, and Carsten Sorensen. 2002. "Mobility: An extended perspective.", *Proceedings of the 35th Annual Hawaii International Conference on System Sciences*.
- 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.
- Kwon, Hyosun Stella, and Laku Chidambaram. 2000. "A test of the technology acceptance model: The case of cellular telephone adoption." *Proceedings of the 33rd Annual Hawaii International Conference on System Sciences*.
- Li, Spencer D. 2011. "Testing mediation using multiple regression and structural equation modelling analyses in secondary data." *Evaluation Review* 35 (3):240-268.
- Liang, Huigang, Nilesh Saraf, Qing Hu, and Yajiong Xue. 2007. "Assimilation of enterprise systems: the effect of institutional pressures and the mediating role of top management." *MIS quarterly*:59-87.
- Lim, W. M. (2018). Dialectic Antidotes to Critics of the Technology Acceptance Model. *Australasian Journal of Information Systems*, Vol 22, Research Note
- Lim, W, A, Lim and C, Phang. 2019. Toward a conceptual framework for social media adoption by non-urban communities for non-profit activities: Insights from an integration of grand theories of technology acceptance. *Australasian Journal of Information Systems*, Vol 23
- 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.
- Lu, June, Chang Lu, Chun-Sheng Yu, and James E Yao. 2003. "Exploring factors associated with wireless internet via mobile technology acceptance in Mainland China." *Communications of the IIMA*, 3 (1):9.
- Luarn, Pin, and Hsin-Hui Lin. 2005. "Toward an understanding of the behavioural intention to use mobile banking." *Computers in human behaviour* 21 (6):873-891.
- Mao, En, Mark Srite, Jason Bennett Thatcher, and Onur Yaprak. 2005. "A research model for mobile phone service behaviours: empirical validation in the US and Turkey." *Journal of Global Information Technology Management* 8 (4):7-28.
- Mas, Ignacio, and Kabir Kumar. 2008. "Banking on mobiles: why, how, for whom?" *papers.ssrn.com*.

- 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.
- McGrath, Fionán, and Susie Lonie. 2013. "Platforms for successful mobile money services." *GSMA Mobile Money for the Unbanked*, June 27.
- Ngugi, B., Pelowski, M., & Ogembo, J. G. (2010). M-pesa: A case study of the critical early adopters' role in the rapid adoption of mobile money banking in Kenya. *The Electronic Journal of Information Systems in Developing Countries*, 43(1), 1-16.
- 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.
- Okeleke, Kenechi, M Rogers, and X Pedros. 2017. "The mobile economy 2017." *GSMA Intelligence, London. The UK*.
- Paul Legris, John Ingham, and Pierre Collerette. 2003. Why do people use information technology? A critical review of the technology acceptance model. *Information & Management* 40, 191–204.
- Polites, G.; Karahanna, E. (2018). Shackled to the Status Quo: The Inhibiting Effects of Incumbent System Habit, Switching Costs, and Inertia on New System Acceptance. *MIS Quarterly*, 36, 21–42
- Porteous, D. (2009). Mobilizing money through enabling regulation. *Innovations: Technology, Governance, Globalization*, 4(1), 75-90.
- Porter, Constance Elise, and Naveen Donthu. 2006. "Using the technology acceptance model to explain how attitudes determine Internet usage: The role of perceived access barriers and demographics." *Journal of Business Research* 59 (9):999-1007.
- Reichheld, Frederick F, and Phil Scheffer. 2000. "E-loyalty: your secret weapon on the web." *Harvard business review* 78 (4):105-113.
- 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.
- San-Martin, Sonia, and Blanca López-Catalán. 2013. "How can a mobile vendor get satisfied customers?" *Industrial Management Data Systems*, 113 (2):156-170.
- 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.
- Syed, M., & Nelson, S. C. (2015). Guidelines for establishing reliability when coding narrative data. *Emerging Adulthood*, 3(6), 375-387
- Venkatesh, Viswanath, and Fred D Davis. 1996. "A model of the antecedents of perceived ease of use: Development and test." *Decision Sciences* 27 (3):451-481.

- Venkatesh, Viswanath, Michael G Morris, Gordon B Davis, and Fred D Davis. 2003. "User acceptance of information technology: Toward a unified view." *MIS quarterly*:425-478.
- 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.
- World Bank, IEA. 2014. "Electric power consumption (kWh per capita) in Africa."
- Wu, Jen-Her, and Shu-Ching Wang. 2005. "What drives mobile commerce?: An empirical evaluation of the revised technology acceptance model." *Journal of Information management*, 42 (5):719-729.
- Yang, Kenneth CC, 2005. "Exploring factors affecting the adoption of mobile commerce in Singapore." *Telematics informatics*, 22 (3):257-277.
- Zacharis, Nick Z, 2012. "Predicting college students' acceptance of podcasting as a learning tool." *Interactive Technology Smart Education*, 9 (3):171-183.
- Zheng, Yiming, Kexin Zhao, and Antonis Stylianou. 2013. "The impacts of information quality and system quality on users' continuance intention in information-exchange virtual communities: An empirical investigation." *Decision Support Systems* 56:513-524.
- 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.

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