



## **FINANCIAL INCLUSION IN RURAL KENYA: AN INVESTIGATION OF THE ROLE OF FINANCIAL TECHNOLOGY AS AN INSTRUMENT**

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**Abstract :** Despite Kenya being the pioneer of financial technology including mobile banking and agency banking, financial exclusion among adults is still high among people living in the rural Kenya. The purpose of this study was to investigate the role of financial technology as an instrument in financial inclusion in the rural Kenya. In addition, the study sought to examine the influence of mobile banking, agency banking and automated teller machines on financial inclusion in the rural Kenya. This study used explanatory research design. The study focused on the rural Kenya and covered a period between January 2011 to December 2016. Secondary data on all the independent variables was obtained from CBK payment system statistics. The secondary data was quantitative in nature. The collected quantitative data was analyzed using descriptive as well as inferential statistics. In descriptive statistics included frequency distributions and percentages. In relation to inferential statistics, the study made use of analysis of variance, correlation analysis, univariate regression analysis and multivariate regression analysis. The study found that mobile banking has a positive and significant influence on financial inclusion in the rural Kenya. The adoption and utilization of mobile banking in Kenya has been increasing for the last six years, with commercial banks adopting the technology and the number of Fintech companies in Kenya increasing. This study also found that agency banking has a positive and significant influence on financial inclusion in the rural Kenya. However, unlike mobile banking, which takes advantage of the high mobile phones penetration in the rural areas, agency banking requires customers to visit agents, normally located in shopping centers. The introduction of mobile banking and agency banking led to a significant decrease in the utilization of automated teller machines. The study recommends that policy makers consider mobile banking in their formulation of policies because of the technological developments and the expected switch from physical branch networks to technologically supported banking services. In addition, all commercial banks in Kenya should adopt agency banking as a way of reducing cost of service provision and improving their financial performance and hence enhance financial inclusion. Also, commercial banks should design and develop protective measures to secure their customers money.

**Key Words:** Financial inclusion, Mobile banking, Agency banking, Automated teller machines

### **Introduction**

The principle of financial inclusion has assumed a greater level of importance in recent times due to its perceived importance as a driver of economic growth (Nyandika, 2015). Giving access to the hundreds of millions of men and women (all over the world) who are presently excluded from financial services would provide the possibilities for the creation of a large depository of savings, investable funds, investment and therefore global wealth generation (Santiago *et al.*, 2014). In other words, access to financial services, that are well suited for low-income earners promote enormous capital accumulation, credit creation and investment boom. Usually, the low-income earners constitute the largest proportion of the population and so control an enormous chunk of the economies idle fund albeit held in small amounts in the hands of each of the several million members of this group (Nyandika, 2015).

Harnessing and accumulating these resources provides a huge source of cheap long-term investable capital.

The government's global policy of financial inclusion includes the design of a regulatory framework, support for market development, and direct assistance to financial institutions with subsidies in low-profit areas. Major efforts have been made in this respect by increasing channels and product development (Mago & Chitokwindo, 2014). Despite the adoption of these strategies, financial inclusion in developing countries still remains low. Currently, there are more than 300 million people categorized as financially excluded in Sub-Saharan Africa. They are primarily rural-based but not exclusively so. However, according to Santiago *et al.* (2014), financial technology offers opportunities to increase financial inclusion as it reduces operating and transaction expenses (such as time in which people would travel to carry out the transactions), as most mobile transactions, agency transactions and automated teller machines transactions do not currently have any cost for use.

In various African countries, mobile banking has been successful in enhancing financial inclusion. In Zimbabwe, Mago and Chitokwindo (2014) found that with mobile banking, the poor people can now enjoy the same basket of financial services to rich people. The mobile banking system in Zimbabwe is ideal for the remote areas given that it is an easily accessible, cheaper, more convenient and faster means of sending and receiving money. In Madagascar, Riquet (2013) found that in the year 2010 only 5.2% of the adult population had an account at a formal financial institution. About 70% of Madagascar's population lives and farms in rural and remote areas, so reaching this group was essential. Two and a half years after launching the initial mobile money operations mid-2010, mobile money companies registered 1.7 million mobile money subscribers, exceeding the number of bank and MFI customers (1.4 million) by a quarter of a million people. In Tanzania, Ishengoma (2011) found that mobile banking had played a major role in improving financial inclusion. As a result of mobile banking adoption, 79% of the population was using the Mobile banking system technology in accessing financial services in an easy way. In Kenya, Ngugi (2015) argues that mobile money contributes to financial inclusion process by providing range of markets instruments and enabling access to financial services. Mutsune (2015) indicates that MPesa allows ordinary Kenyans to send money across the country cheaply and reliably using a mobile device and it creates an environment conducive to the vibrant economic activity via aiding time-sensitive farming activities.

In regard to agency banking, Waihenya (2012) found that agency banking is continuously improving and growing and as it grows, the level of financial inclusion in the rural and urban areas is also growing proportionately. In addition, Munoru (2013) indicated that agency banking had a positive and insignificant relationship with the financial inclusion. For a long time, the expansion strategy of many commercial banks in world over was through building premises for new branches or leasing space. Regardless of the achieved expansion of branches network which mostly was challenged by high overheads and inefficiencies, the challenge of access to formal financial services remained a big impediment to financial inclusion. People (especially in remote areas) were forced to travel long distances and spend huge amounts of money on transport in order to access a branch. In addition to the cost of transport, time spent commuting to and fro could have been spent more productively.

Automated Teller Machine (ATM) has become a major indicator of ICT investment by banks. Globally, Automatic Teller Machines (ATMs) have been adopted and are still being adopted by banks. They offer considerable benefits to both banks and their depositors. The machines can enable depositors to withdraw cash at more convenient times and places than during banking hours at branches. These potential benefits are multiplied when banks share their ATMs, allowing depositors of

other banks to access their accounts through a bank's ATM. Banks have become the principal users of ATMs because the cost of a single transaction performed at an ATM is potentially less than the cost of a transaction conducted from a teller, as ATMs are capable of handling more transactions per unit of time than Tellers. Nyambariga (2013) found that automated teller machines had a significant influence on financial inclusion. Despite Kenya being the pioneer of financial technology including mobile banking and agency banking, and the increased growth of mobile money and agency banking business, about 17.4% of the adult population in Kenya is still financially excluded. However, this percentage is higher in the rural areas.

### **Statement of the Problem**

Globally, financial inclusion is a major policy concern for governments across the world. The lack of access to the formal financial sector by a large percentage of working age adults is a genuine global policy concern (Santiago *et al.*, 2014). In addition, other than the aspect of providing access, financial inclusion includes issues such as helping people manage their resources in a better way and building financial capabilities through savings. The emergence of mobile banking was expected to improve financial inclusion as it offers financial services like deposits, withdraws, money transfer and payment for goods and services easily with mobile devices. In other countries like Pakistan (Boston Consulting Group, 2011), Bangladesh (Siddik *et al.*, 2014), India (Motwani, 2017) mobile banking plays a major role in improving financial inclusion. World Bank (2014) notes that technology can lower cost and conveniences of accessing formal financial services. They note that the sharp growth in technologies like mobile payment, mobile banking, internet banking and biometric identification which are proving to reduce transaction cost, leading to greater financial inclusion.

Mobile banking was developed from the concept of M-Pesa, which is a mobile phone-based money transfer, financing and microfinancing service, launched in 2007 by Vodafone for Safaricom in Kenya. It has since expanded to Afghanistan, South Africa, India and Romania, Albania and other parts of the world. Despite Kenya being the pioneer of mobile banking, financial exclusion among adults is still high among farmers (Rosengard, 2016), including horticultural farmers (Tonui & Kimani 2016). According to the World Bank (2015), 75% of the adult population in Kenya had accounts, 30% had formal savings and 15% had access to formal borrowing. This implies that 70% of the adult population in Kenya does not utilize formal methods of saving and 85% have not access to formal borrowing. In addition, M'Amanja (2015) found that the average formal financial access in Kenya is 35%, which is lower than that of Botswana (41%), Namibia (45%) and South Africa (63%).

Various studies have been conducted in Kenya on financial technology/innovation and financial inclusion. For instance, Agufa (2016) conducted a study on the effect of digital finance on financial inclusion in the banking industry in Kenya and Thairu and Wahome (2015) carried out a study on the effect of technological innovations on financial inclusion initiatives by banks in Nakuru Town. However, studies conducted in financial technology/innovation and financial inclusion in Kenya focus on Kenya as a whole including both urban and rural areas. In addition, Thairu and Wahome (2015) study was limited to Nakuru town and hence the findings cannot be generalized to the whole country. In addition, people living in the rural areas, have a lower financial services access as compared to people living in the urban areas. There is therefore little empirical evidence on the effect of financial technology on financial inclusion in the rural Kenya. To fill this research gap, this study sought to investigate the role of financial technology as an instrument in financial inclusion in the rural Kenya.

## Study Hypotheses

The study was guided by the following hypotheses;

$H_{01}$ : Mobile banking does not have statistically significant effect on financial inclusion in the rural Kenya

$H_{02}$ : Agency banking does not have statistically significant effect on financial inclusion in the rural Kenya

$H_{03}$ : Automated teller machines do not have statistically significant effect on financial inclusion in the rural Kenya

## Theoretical Review

A theory is a systematic explanation of the relationship among phenomena. Theories offer a generalized description to an occurrence. The theories reviewed and which inform this study include; Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT) theory and Financial Intermediation Theory (FIT).

### Technology acceptance model (TAM)

Technology Acceptance Model (TAM) was developed by Davies in 1986. Two key beliefs were used to develop TAM: perceived usefulness and perceived ease of use and users' attitudes, intentions and actual computer usage behavior. Behavioural intention is jointly determined by attitude and perceived usefulness. Attitude is determined by perceived usefulness (PU) and perceived ease of use (PEOU). TAM replaces determinants of the attitude of the theory of Reasoned Action (TRA) by perceived ease of use and perceived usefulness. Generally, TAM specifies general determinants of individual technology adoption and therefore can be and has been applied to explain or predict individual behaviors across a broad range of end-user computing technologies and user groups (Agufa, 2016).

The goal of TAM is to provide an explanation for the determinants of technology acceptance that are in general capable of explaining user behaviour across a broad range of end-user computing technologies and user populations, while at the same time being both parsimonious and theoretically justified. However, since it incorporates findings accumulated from over a decade of Information System research, it may be especially well suited for modelling computer Information Systems (Munoru, 2013).

In this study, technology acceptance model is used to explain the adoption of financial technology by people in the rural areas. In the rural areas, the adoption and utilization of financial technology are highly influenced by perceived ease of use and usefulness of the technology. The ease of use of agency banking, automated teller machines and mobile banking platforms (MPESA, Mswari, Equitel, Airtel money, Orange money, Mobikash, Tangaza) may influence the adoption and utilization of technology. This is because of even the illiterate people in the rural areas can use them. In addition, financial technology is perceived to be useful as it brings financial services (access to cash, money transfer and savings) closer to the farmers.

### Unified Theory of Acceptance and Use of Technology (UTAUT)

The unified theory of acceptance and use of technology (UTAUT) is a technology acceptance model formulated by Venkatesh and others in "User acceptance of information technology: Toward a unified view". The UTAUT aims to explain user intentions to use an information system and subsequent usage behavior (Venkatesh, et al., 2003). The UTAUT was introduced with four core determinants of

intention and usage and up to four moderators of key relationships. The UTAUT formulated four constructs to play an important role as direct determinants of user acceptance and usage behavior: Performance expectancy, Effort expectancy, Social influence and Facilitating conditions. The key moderators in the model are gender, age, voluntariness, and experience. UTAUT provides a refined view of how the determinants of intention and behavior evolve over time (Venkatesh, et al., 2003). In addition, it is important to emphasize that most of the key relationships in the model are moderated.

Behavioral intention is an individual's intention to perform a given act which can predict corresponding behaviors when individual acts voluntarily. Besides that, behavioural intention is the subjective probability of carrying out behavior and also the cause of certain usage behavior. Thus, intentions show the motivational factors that influence behavior and are indicators of how hard people are willing to try and the effort they put in to engage in a behavior. Performance expectancy is the degree to which users gain benefits in using a technology while carrying out activities (Venkatesh et al. 2012). Effort expectancy is the degree to which a technology is easy to use. Social influence is an individual's perception that significant others believe the individual should adopt the technology. The UTAUT2 added four more constructs: facilitating conditions, hedonic motivation, price value and habit (Tan & Leby, 2016).

Facilitating Conditions is the perception that organizational and technical infrastructure exists to support the use of technology (Venkatesh et al. 2003). Hedonic Motivation is the fun or pleasure derived from using a technology. Price Value is the trade-off between the cost paid for using the technology and the perceived benefits received. Habit is the extent that individuals tend to execute behaviors automatically. Venkatesh et al. (2012) discovered that habit, directly and indirectly, effects on BI to use technology. It was found that increased experience in usage leads to habitual technology use.

This theory is used to explain the adoption and utilization of financial technology. Effort Expectancy is an individual's perception that using financial technology will be free of effort (Rosengard, 2016). This is measured in terms of ease of use, clarity of data, an ability to identify relevant data, smoothness of interacting with the system, and system's overall presentation and outline. Social Influence is an individual's perception of the degree to which important other people approve or disapprove of the target behavior. This is measured in terms of usage and adoption by other farmers. Facilitating Conditions include the availability of infrastructure and other related equipment. In relation to price value, the adoption of agency banking, automated teller machines or mobile banking is cheap as customers do not need to buy any other phone as the mobile money application is compatible with any type of phone.

### **Financial Intermediation Theory (FIT)**

Financial intermediation is a process which involves surplus units depositing funds with financial institutions who then lend to deficit units. Brandie and Abbott (2014) identified that financial intermediaries can be distinguished by four criteria. First, their main categories of liabilities or deposits are specified for a fixed sum which is not related to the performance of a portfolio. Second, the deposits are typically short-term and of a much shorter term than their assets. Third, a high proportion of their liabilities are chequable which can be withdrawn on demand and fourthly, their liabilities and assets are largely not transferable. The most important contribution of intermediaries is a steady flow of funds from surplus to deficit units.

According to Tan and Leby (2016), the role of the financial intermediary is essentially seen as that of creating specialized financial commodities. These are created whenever an intermediary finds that it

can sell them for prices which are expected to cover all costs of their production, both direct costs and opportunity costs. Financial intermediaries exist due to market imperfections. As such, in a 'perfect' market situation, with no transaction or information costs, financial intermediaries would not exist. Numerous markets are characterized by informational differences between buyers and sellers. In financial markets, information asymmetries are particularly pronounced. Borrowers typically know their collateral, industriousness, and moral integrity better than do lenders. On the other hand, entrepreneurs possess inside information about their own projects for which they seek financing. Moral hazard hampers the transfer of information between market participants, which is an important factor for projects of good quality to be financed.

Over the years, farmers and people living in the rural areas have been sidelined in financial inclusion due to lack of consistent income and poor saving structures. However, with the advent of mobile banking, farmers can make savings through their phones which increase their chances to access credit. In addition, farmers can borrow money without any security or guarantors through mobile phones.

## **Empirical Review**

### **Effect of Mobile Banking on Financial Inclusion**

Various studies show the relationship between mobile banking and financial inclusion in different countries. In India, Singh et al. (2014) conducted a study in the role of mobile banking in financial inclusion. The study found that although over the years a large section of the society has been deprived of financial services like credit, loan, insurance, financial education, remittances and pension, mobile banking has been seen as a feasible solution. However, it has also led to an increase in instances of money laundering.

In Zimbabwe, Mago and Chitokwindo (2014) conducted a study on the impact of mobile banking on financial inclusion in Masvingo Province. The paper adopted a qualitative research methodology and a survey design. The results revealed that the low-income people are willing to adopt mobile banking and the reasons are that it is easily accessible, convenient, cheaper, easy to use and secure. In addition, the poor people have been traditionally located in the informal sector where they hardly enjoy banking services. With mobile banking, they can now enjoy the same basket of financial services through mobile banking. The mobile banking system is definitely ideal for the remote areas given that it is an easily accessible, cheaper, more convenient and faster means of sending and receiving money. Financial activity is increased in the rural areas and therefore economic growth is boosted.

In Tanzania, Ishengoma (2011) conducted an analysis of mobile banking for financial inclusion in Kibaha District Council. The objectives of the study were to analyze coverage of M-Banking for financial inclusion, the usage behavior of mobile subscribers to M-Banking services, understand the extent in which mobile banking systems had impeded financial development and the assessment of service effectiveness and service cost charges. The results indicated that 79% of the population were using the M-banking system technology of which almost 100% has helped in accessing financial services in an easy way. It further shows that, the illiterate populations are facing the difficulty in using technology compared to literate one. Also, the service cost charges are still not clear. However, those who were not registered with any of M-Banking facility showed interest to use it in future due to the perceived importance of technology in financial accessibility. In addition, those who were not registered with the facility showed awareness that the service is believed to be convenient in obtaining services in an easy way.

### **Effect of Agency Banking on Financial Inclusion**

Agency banking is described to as the process by which a principal in this case financial institution contracts a party to handle some of its transactions for the principals' clients. In this case the agent conducts the contracted business on behalf of the principal and they are rewarded on an agreed basis. According to Agufa (2016), the financial institution agents conducts various transactions on behalf of the principal such as receiving of deposits, funds transfers, clients withdrawal, payments of bills, balance inquiry, receiving of government benefits and receiving direct deposits from the employers. Around the globe the banking agents may include, supermarkets, lottery outlets, convenience stores and even post offices. Agency banking is evident all over the world, it is well adopted in counties such as Australia, where the post offices are used as banking agents. In Brazil, the many lottery outlets are used to offer agency banking. Also, in the Philippines, the agency banking has been adopted especially to reach out to the people in remote places and to encourage their saving behavior. In Africa, agency banking has also been adopted majorly in countries such as South Africa, Nigeria, Tanzania and also Kenya.

A study was conducted by Aduda, Kiragu and Ndwiga (2013) on the relationship between agency banking and financial performance found that financial institutions have invested in the development of strategies and as a result they have made it to setting up of multiple branches. Their study found out that the financial institutions studied, in this case being Kenya commercial bank, Equity Bank and Co-operative bank showed a significance performance index. In a study conducted by Munoru (2015) on the effect of agency banking on financial inclusion in Kenya, agency banking incurs higher variable costs. This is as a result of paying commissions to the agents. They also incur communication cost also the fixed cost according to each transaction especially for the branches that are quite higher. However, cost reduction to the customers has resulted to people having an urge to transact using banks more so to the less banked people in the society.

### **Effect of Automated Teller Machines on Financial Inclusion**

Automated Teller Machine (ATM) is described as a machine that acts as a bank teller as it receives and issue money to and from its account holders (Gilbert, 2006). The growth of ATMs have not been at bay, but on contrary it have been as a result of the global wave in the technological revolution (Kathleen, 2005). This has come into place because of the urge to respond to problem of multiple bulk of daily complex information that comes up from among others, this entails a rise in competition and rise in customers demand for services. The application of the ATMs system of banking has brought efficiency in the banking industry. The system has brought efficiency especially in terms of speed, data storage and data processing. Also the system has aided in reduction of long queues in the banking halls for services that used to be offered by the teller that are now executed by the machines.

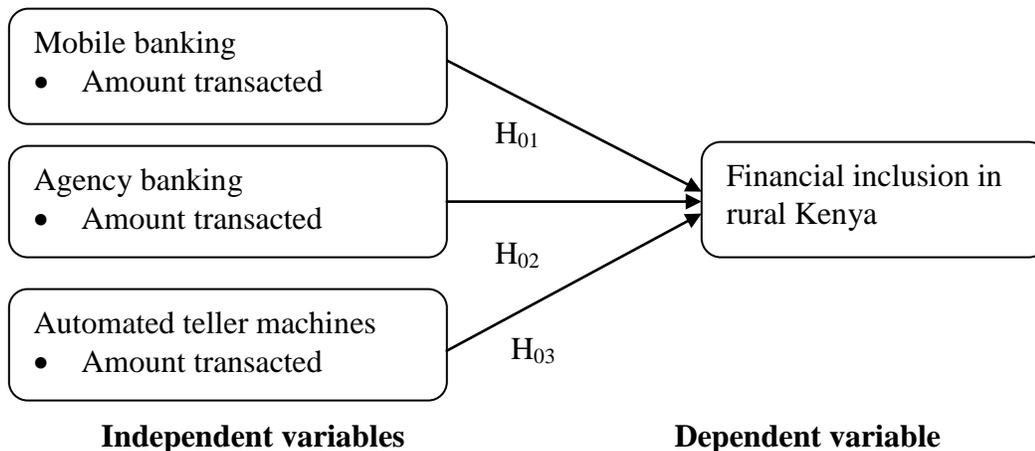
The ATMs have become one of the major indicator of ICT investment by the banks. Worldwide the machines have adopted and even now the process to adopt them continues in the banks (Ram, Kagan & Lingam, 2008). The machines offer a wide range of benefits to the banks and also to the depositors. This is due to the services that they can be able to deliver on behalf of the bank, this comes in hand with the benefits each party is able to receive. The machines runs on twenty four hour basis thus it is able to allow the depositors to withdraw or deposit cash at their own convenient times and places as compared to the opening and closing hours of the bank's branches (Okiro & Ndungu, 2013). The banks also allows users to rip benefits when the banks share their ATMs to allow depositors of other banks to have access to their account via a bank's ATM. Today the banks have become principal users of ATMs this is due to the cost of a single transaction as executed by the machine is relatively less than the cost

of transaction that is performed by the teller. This is due that the ATMs are capable of handling more transactions in a given time than the tellers.

Also the Automated teller machines have their shortcoming despite their advantages. The short comes that are associated with ATMs are; long queues at ATM centres and also break downs of ATMs but not limited to this two. Jegede (2014) did a study on the effects of ATM on the performance of Nigerian banks using 125 employees of five selected banks in Lagos State with inter-switch network. The study found that the deployment of ATMs terminals have averagely improved the performance of Nigerian banks because of the alarming rate of ATM fraud. However, these findings are contrary to Adewoye (2013) findings that the intensity of ATMs deployment made positive contribution to the cost efficiency of Nigerian banks.

### Conceptual Framework

The study sought to investigate the role of financial technology as an instrument in financial inclusion in the rural Kenya. The independent variables were mobile banking, agency banking and automated teller machines. The dependent variable will be financial inclusion in the rural Kenya. The hypothesized relationship between the independent variables and the dependent variable is presented in figure 1.



**Figure 1: Conceptual Framework**

### Research Methodology

This study used explanatory research design. The term explanatory research implies that the research in question is intended to explain, rather than simply to describe, the phenomena studied. Explanatory studies are designed to test whether one event causes another. This study focused on the rural Kenya. Sampling in this study was done along the years. This study selected data between 2011 January to 2016 December. Mobile banking was introduced in Kenya in the year 2007 while agency banking was introduced in Kenya in May 2010 and hence data was available from January 2011.

This study used secondary data. Secondary data on all the independent variables was obtained from CBK payment system statistics. The Central Bank of Kenya operates and owns the Kenya Electronic Payment and Settlement System (KEPSS) which is used to facilitate real time transactions. The database comprises of statistics on amount of money transacted via electronic means on the monthly bases since the year 2005. The data is considered reliable as it is collected by the Central Bank of Kenya, the banking sector regulator, for all commercial banks in Kenya. Data on the dependent

variable (financial inclusion) was obtained from the Central Bank of Kenya IMF's database called International Financial Statistics (IFS).

The secondary data was quantitative in nature. The collected quantitative data was analyzed using descriptive as well as inferential statistics. In descriptive statistics analysis, the study used frequency distributions, mean, standard deviation and percentages. In relation to inferential statistics, the study made use of analysis of variance, correlation analysis, univariate regression analysis and multivariate regression analysis. The inferential statistics were used to evaluate the relationship between the dependent and the independent variables. The correlation analysis was used to establish whether there is an association between the dependent and the independent variables.

The regression model will be expressed as follows;

$$FI_t = \beta_0 + \beta_1 MB_t + \beta_2 AB_t + \beta_3 ATM_t + \varepsilon_t \dots\dots\dots(1)$$

$FI_t$  is the dependent variable (financial inclusion),  $B_0$  is the y intercept (Constant),  $MB_t$  is mobile banking,  $AB_t$  agency banking;  $ATM_t$  is automated teller machines; t represents time and  $\varepsilon_t$  is an error term.

The diagnostic tests that were performed on the model include multicollinearity test, normality test, Heteroscedasticity Test, Autocorrelation and Stationarity and Unit Root Test. In testing for multicollinearity, Spearman's rank coefficients were used to show the relationship between various pairs of variables (Creswell, 2006). The significance of the relationships were further investigated to show whether the pairs of relationships are significant.

To fulfill the requirements of OLS, Shapiro Wilk test and Kolmogorov-Smirnov Test were used to investigate whether the variables are normally distributed or not (Cooper & Schindler, 2006). In heteroscedasticity test, the study used the residual plot method to investigate whether there is variation of the residuals across all the observations under the study (Greener, 2008). Considering the residual plot method is too subjective, the study further employed Breusch-Pagan/Cook-Weisberg test for heteroscedasticity.

Autocorrelation leads to bias and thus spurious estimates. To test for this, the study used Breusch-Godfrey Langrage Multiplier test for autocorrelation. Serial correlation usually implies that there is correlation between stochastic random error terms of the subsequent time periods. Autocorrelation can be remedied through the use of robust standard errors. In order to check for stationarity of the data, the study employed Augmented Dickey Fuller unit root test (ADF); this was chosen because it is not affected by autocorrelation as opposed to other tests (Kothari, 2004).

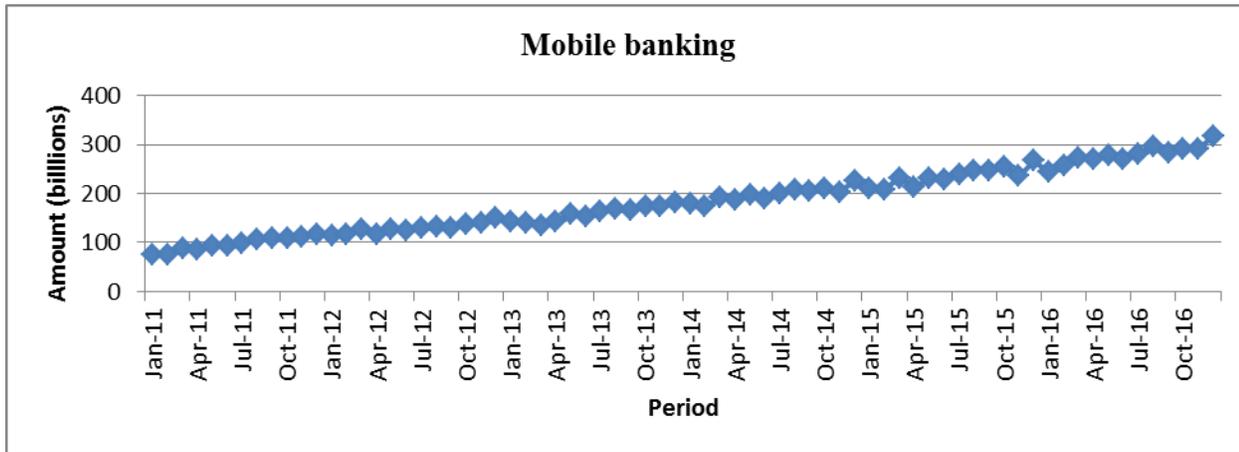
## Results and Discussions

The study covered a period of 6 years starting from January 2011 to December 2016. The total number of observations was 72 and analysis was done for the influence of mobile banking, automated teller machines and agency banking.

### Trend Analysis

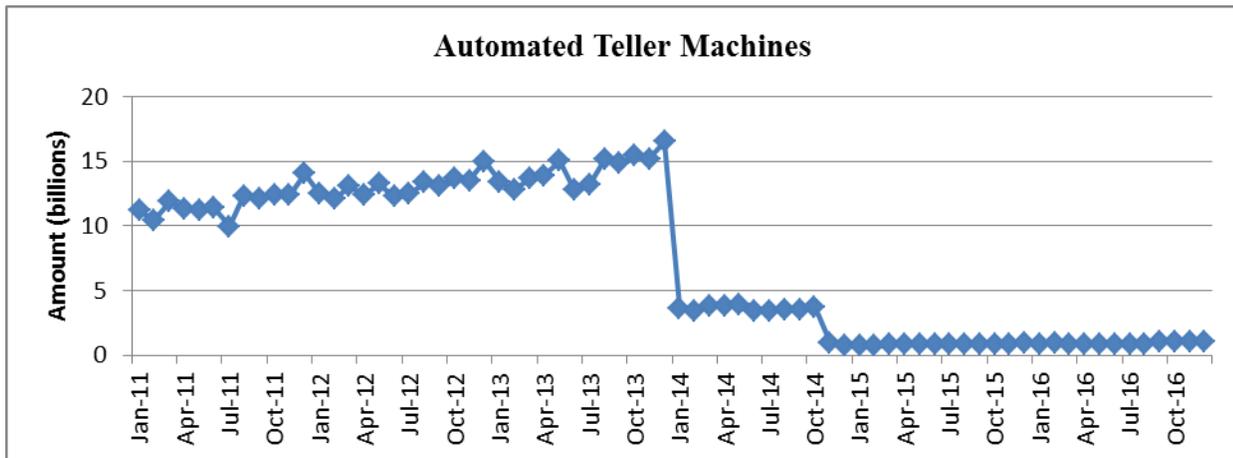
This section presents the trend analysis for the dependent variable (financial inclusion) and the independent variables (mobile banking, agency banking and automated teller machines). Figure 2 shows the trend of amount of money transacted through mobile banking for the period ranging from January 2011 to December 2016. From the findings, the amount of money transacted through mobile

banking in Kenya has generally been increasing over the study period (January 2011-December 2016). The minimum figure, Ksh. 75.433 billion was in February 2011 while the highest figure, Ksh. 316.733 billion was in December 2016.



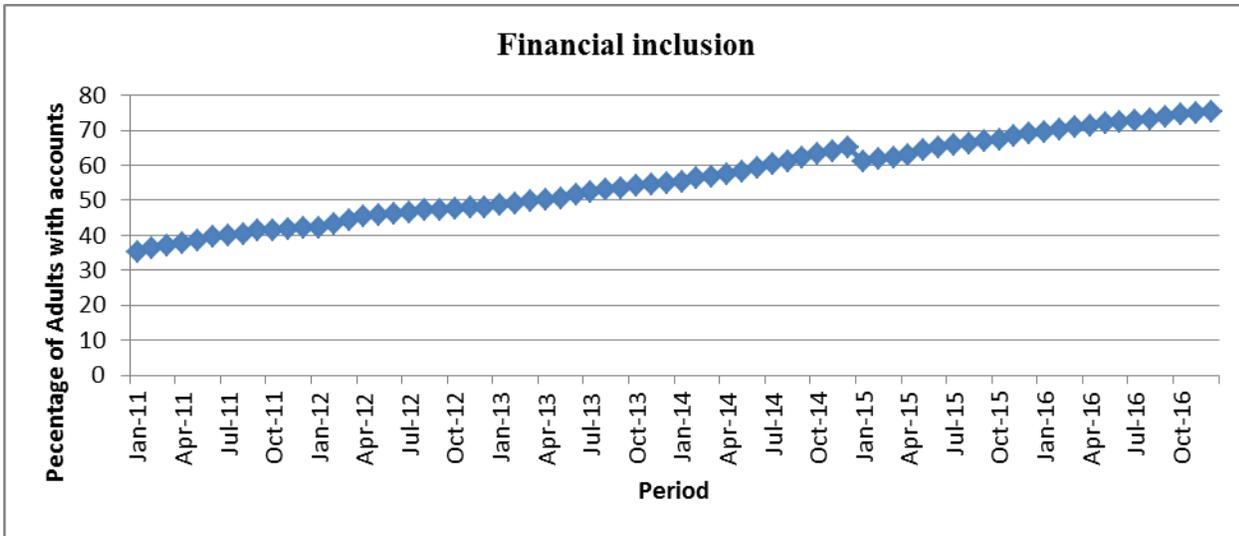
**Figure 2: Trend of the amount transacted through Mobile Banking**

Figure 3 shows the trend of the amount transacted through automated teller machines for the period starting from January 2011 to December 2016. Although the amount transacted through automated teller machines was fluctuating between January 2011 and October 2014, it decreased drastically to Ksh. 3.646 billion from Ksh. 16.513 billion.



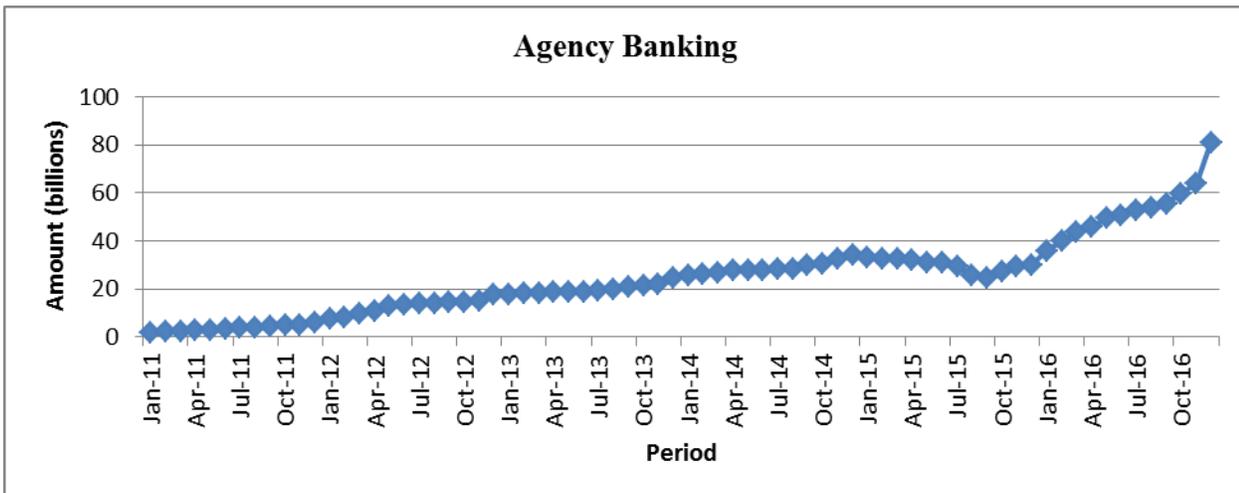
**Figure 3: Trend of Automated Teller Machines**

From the findings, financial inclusion has been having an upward trend during the study period. The lowest percent of adults with formal bank accounts was in January 2011 at 35.3 per cent and the highest percent of adults with formal bank accounts was in December 2016 at 75.3 per cent. However, in January 2015, there was a decline in the percentage of adults with formal bank accounts from 65 per cent December 2015 to 61.2 per cent.



**Figure 4: Trend of Financial Inclusion**

From January 2011 to December 2014 the amount of money transacted through agency banking increased from Ksh. 1.56 billion to Ksh. 34.02 billion. The figure then attained a declining trend to Ksh. 24.56 billion in September 2015. In addition, the figure attained an increasing trend to Ksh. 80.98 billion December 2016.



**Figure 5: Trend of the amount transacted through Agency Banking**

**Diagnostic Tests**

The diagnostic tests include normality test (Shapiro-Wilk test), Multicollinearity test (VIF), Breusch-Pagan/Cook-Weisberg test for heteroscedasticity, Breusch-Godfrey LM Test for autocorrelation and unit root test (Augmented Dickey Fuller unit root test).

**Normality Test**

Shapiro-Wilk W test was used to test the normality of the data. The null-hypothesis of this test is that the population is normally distributed. The results indicated that mobile banking (p-value=0.118), automated teller machines (p-value=0.091), financial inclusion (p-value=0.093) and agency banking

(p-value=0.090) were normally distributed. This is because the p-values were more than the significance level (0.05).

**Table 1: Shapiro-Wilk W test**

	Shapiro-Wilk		
	Statistic	df	Sig.
Mobile Banking	.662	72	.118
Automated teller machines	.642	72	.091
Financial Inclusion	.648	72	.093
Agency Banking	.630	72	.090

### Multicollinearity Test

The variance inflation factor (VIF) quantifies the severity of multicollinearity in an ordinary least squares regression analysis. A variable whose VIF value is greater than 10 may merit further investigation. From the findings, the VIFs for the variables, mobile banking (12.68) was more than 10. However, the VIF for agency banking (8.84) and automated teller machines (3.26) was less than 10. This implies that the multicollinearity for mobile banking was severe, but the multicollinearity for agency banking and automated teller machines was not severe.

**Table 2: Variance Inflation Factor**

Variable	VIF	1/VIF
MB	12.68	0.078885
AB	8.84	0.113115
ATMs	3.26	0.306850
Mean VIF	8.26	

### Breusch-Pagan/Cook-Weisberg test for heteroscedasticity

The study used Breusch-Pagan/Cook-Weisberg test for heteroscedasticity. From the findings, as shown in table 3, it was revealed that the p-value of 0.0778 was more than the significance level (0.05) implying that the study accepts the null hypothesis of homoscedasticity.

**Table 3: Breusch-Pagan/Cook-Weisberg test for heteroskedasticity**

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity  
 Ho: Constant variance  
 Variables: fitted values of FI

chi2(1) = 3.11  
 Prob > chi2 = 0.0778

**Breusch-Godfrey LM Test for Autocorrelation**

The study used Breusch-Godfrey Lagrange Multiplier test to test for autocorrelation between variables. The results indicated that the p-value (0.7124) is greater than the significance level (0.05) and hence we accept the null hypothesis. This implies that there is no serial correlation in the variables.

**Table 4: Breusch-Godfrey LM Test for Autocorrelation**

Breusch-Godfrey LM test for autocorrelation

lags(p)	chi2	df	Prob > chi2
1	0.136	1	0.7124

H0: no serial correlation

**Unit root test**

In order to check for stationarity of the data, the study employed Augmented Dickey Fuller unit root test (ADF); this was chosen because it is not affected by autocorrelation as opposed to other tests. The null hypothesis is that the variables are not stationary or they got unit root. In relation to mobile banking the null hypothesis was that ‘mobile banking has got unit root or it is not stationary’. Since the p-value (0.9493) was more than the significance level (0.05), we can accept the null hypothesis. This implies that mobile banking has got unit root.

With regard to automated teller machines the null hypothesis was that ‘automated teller machines’ has got unit root or it is not stationary’. Since the p-value (0.7989) was more than the significance level (0.05), we can accept the null hypothesis. This implies that automated teller machines’ has got unit root or it is not stationary’.

Regarding financial inclusion (percentage of adults with formal bank accounts) the null hypothesis was that ‘financial inclusion has got unit root or it is not stationary’. Since the p-value (0.8805) was more than the significance level (0.05), we can accept the null hypothesis. This implies that financial inclusion (percentage of adults with formal bank accounts) has got unit root.

With regard to agency banking (amount transacted through agency banking) the null hypothesis was that ‘agency banking has got unit root or it is not stationary’. Since the p-value (1.000) was more than the significance level (0.05), we can accept the null hypothesis. This implies that agency banking (amount transacted through agency banking) has got unit root.

**Table 5: Augmented Dickey Fuller unit root test**

	Test Statistics	1% critical value	5% critical value	10% critical value	p-value for z(t)
Mobile Banking	Z(t) -0.101	-3.551	-2.913	-2.592	0.9493
Automated teller machines	Z(t) -1.090	-3.551	-2.913	-2.592	0.7189
Financial inclusion	Z(t) -0.556	-3.551	-2.913	-2.952	0.8805
Agency banking	Z(t) 4.168	-3.551	-2.913	-2.952	1.0000

**Correlations Analysis**

This study made use of Pearson product-moment correlation analysis to determine whether there is a relationship between the independent variables and the dependent variable. According to the findings, there is a positive association between mobile banking and financial inclusion in rural Kenya ( $r=0.9914$ ,  $p\text{-value}=0.000$ ). These findings agree with Ngugi (2015) argument that mobile money contributes to financial inclusion process by providing range of markets instruments and enabling access to financial services. The results also show that there exists a positive association between agency banking and financial inclusion in the rural Kenya ( $r=0.9313$ ,  $p\text{-value}=0.000$ ). These findings are in line with Munoru (2013) indicated that agency banking had a positive and significant relationship with the financial inclusion. However, automated teller machines was found to have an inverse influence on the financial inclusion in the rural Kenya ( $r=-0.8353$ ,  $p\text{-value}=0.000$ ). These findings are contrary to Nyambariga (2013) findings that automated teller machines had a significant influence on financial inclusion.

**Table 6: Correlation Coefficients**

	FI	MB	AB	ATMs
FI	1.0000			
MB	0.9914* 0.0000	1.0000		
AB	0.9313* 0.0000	0.9393* 0.0000	1.0000	
ATMs	-0.8353* 0.0000	-0.8249* 0.0000	-0.7360* 0.0000	1.0000

**Univariate Regression Analysis**

A univariate analysis was conducted to investigate the effect of mobile banking on financial inclusion in the rural Kenya. The null hypothesis was;

$H_{01}$ : *Mobile banking does not have statistically significant effect on financial inclusion in the rural Kenya*

The r-squared for the relationship between mobile banking and financial inclusion was 0.9829, which shows that mobile banking can explain 98.29% of financial inclusion in the rural Kenya. The F-

calculated (4028.64) was greater than the F-critical (4.00) and the p-value (0.000) was less than the significance level (0.05), which implies that the linear regression model is a good fit for the data and hence can be used to predict the influence of mobile banking on financial inclusion in the rural Kenya. The Beta coefficient was 0.1795255 for the relationship between mobile banking and financial inclusion. This shows that a unit improvement in mobile banking would lead to a 0.1795255 improvement in financial inclusion in the rural Kenya. The relationship is significant as the P-value (0.000) was less than the significance level (0.05). Therefore we can accept the alternative hypothesis that “Mobile banking has a statistically significant effect on financial inclusion in the rural Kenya”. These findings agree with Mago and Chitokwindo (2014) findings that mobile banking significant influences financial inclusion.

**Table 7: Mobile Banking and Financial Inclusion**

Source	SS	df	MS			
Model	9448.8806	1	9448.8806	Number of obs =	72	
Residual	164.179866	70	2.34542665	F( 1, 70) =	4028.64	
Total	9613.06046	71	135.395218	Prob > F	= 0.0000	
				R-squared	= 0.9829	
				Adj R-squared	= 0.9827	
				Root MSE	= 1.5315	

FI	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
MB	.1795255	.0028284	63.47	0.000	.1738844	.1851667
_cons	22.97286	.5475384	41.96	0.000	21.88083	24.06489

A univariate analysis was also conducted to investigate the effect of agency banking on financial inclusion in the rural Kenya. The null hypothesis was;

*H<sub>02</sub>: Agency banking does not have statistically significant effect on financial inclusion in the rural Kenya*

The r-squared for the relationship between agency banking and financial inclusion was 0.8672, which shows that agency banking can explain 86.72% of financial inclusion in the rural Kenya. The F-calculated (457.30) was greater than the F-critical (4.00) and the p-value (0.000) was less than the significance level (0.05), which implies that the linear regression model is a good fit for the data and hence can be used to predict the influence of agency banking on financial inclusion in the rural Kenya. The Beta coefficient was 0.6595675 for the relationship between agency banking and financial inclusion. This shows that a unit improvement in agency banking would lead to a 0.6595675 improvement in financial inclusion in the rural Kenya. The relationship is significant as the P-value (0.000) was less than the significance level (0.05). Therefore we can accept the alternative hypothesis that “Agency banking has a statistically significant effect on financial inclusion in the rural Kenya”. these findings are in line with Aduda et al. (2013) findings that agency banking plays a major role in the rural financial inclusion in Kenya.

**Table 8: Agency Banking and Financial Inclusion**

Source	SS	df	MS			
Model	8336.90058	1	8336.90058	Number of obs =	72	
Residual	1276.15988	70	18.2308554	F( 1, 70) =	457.30	
Total	9613.06046	71	135.395218	Prob > F =	0.0000	
				R-squared =	0.8672	
				Adj R-squared =	0.8654	
				Root MSE =	4.2698	

FI	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
AB	.6595675	.0308433	21.38	0.000	.5980525	.7210825
_cons	39.55688	.9104928	43.45	0.000	37.74096	41.3728

The study also used a univariate analysis to investigate the effect of automated teller machines on financial inclusion in the rural Kenya. The null hypothesis was;

$H_{03}$ : Automated teller machines do not have statistically significant effect on financial inclusion in the rural Kenya

The r-squared for the relationship between automated teller machines and financial inclusion was 0.6977, which shows that agency banking can explain 69.77% of financial inclusion in the rural Kenya. The F-calculated (161.59) was greater than the F-critical (4.00) and the p-value (0.000) was less than the significance level (0.05), which implies that the linear regression model is a good fit for the data and hence can be used to predict the influence of automated teller machines on financial inclusion in the rural Kenya. The Beta coefficient was -0.001651 for the relationship between automated teller machines and financial inclusion in the rural Kenya. This shows that a unit improvement in automated teller machines would lead to a 0.001651 decrease in financial inclusion in the rural Kenya. The relationship is significant as the P-value (0.000) was less than the significance level (0.05). Therefore we can accept the alternative hypothesis that “Automated teller machines has a statistically significant effect on financial inclusion in the rural Kenya”. these findings are in line with Jegede (2014) argument that utilization of automated teller machines improves financial inclusion.

**Table 9: Automated Teller Machines and Financial Inclusion**

Source	SS	df	MS			
Model	6707.46699	1	6707.46699	Number of obs =	72	
Residual	2905.59348	70	41.5084782	F( 1, 70) =	161.59	
Total	9613.06046	71	135.395218	Prob > F =	0.0000	
				R-squared =	0.6977	
				Adj R-squared =	0.6934	
				Root MSE =	6.4427	

FI	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
ATMs	-.001651	.0001299	-12.71	0.000	-.0019101	-.001392
_cons	67.92734	1.220291	55.66	0.000	65.49354	70.36113

### Multivariate Regression analysis

The study used multiple regression analysis to examine the weight of the relationship between the independent variables (mobile banking, agency banking and automated teller machines) and the dependent variable (financial inclusion). In regression analysis, The R-squared shows the variation in the dependent variable that can be explained by the independent variables being studied. The R-squared in this study was 0.9839. This implies that the three independent variables (mobile banking, agency banking and automated teller machines) can explain 98.39% of the dependent variable (financial inclusion). The F-calculated (1387.22) is greater than the F-critical (2.76), which shows that the model can be used in predicting the influence of the independent variables on the dependent variable. In addition, the p-value (0.000) is less than the significance level (0.05), which shows that the model is a good fit for the data.

The results show that mobile banking has a positive and significant influence on financial inclusion in the rural Kenya ( $\beta_1=0.1677033$ , p-value=0.000). This implies that a unit increase in mobile banking adoption, leads to a 0.1677033 increase in financial inclusion in the rural Kenya. In addition, the results indicate that agency banking has a positive but insignificant influence on financial inclusion in the rural Kenya ( $\beta_2=0.0137016$ , p-value=0.674). This may be because agency banking is still in the process of adoption, with only 15 commercial banks having adopted this financial technology. In addition, correlation analysis shows that there is a strong correlation between agency banking and mobile banking. This explains why agency banking significant influences financial inclusion in the univariate regression, but in the multivariate regression analysis it has no significant influence.

Further, the results show that automated teller machines have an inverse and negative influence on financial inclusion in Kenya ( $\beta_3=-0.0001129$ , p-value=0.043). However, as noted the trend analysis, utilization of automated teller machines decreased sharply. This decreased can be associated to the increased use of agency banking and mobile banking in the rural Kenya.

**Table 10: Regression Coefficients**

Source	SS	df	MS	Number of obs = 72		
Model	9458.51212	3	3152.83737	F( 3, 68) = 1387.22		
Residual	154.548344	68	2.27276976	Prob > F = 0.0000		
Total	9613.06046	71	135.395218	R-squared = 0.9839		
				Adj R-squared = 0.9832		
				Root MSE = 1.5076		

FI	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
MB	.1677003	.0099132	16.92	0.000	.1479188	.1874819
AB	.0137016	.0323798	0.42	0.674	-.0509113	.0783145
ATMs	-.0001129	.0000549	-2.06	0.043	-.0002224	-3.46e-06
_cons	25.6277	1.522699	16.83	0.000	22.5892	28.6662

### Conclusions

The study concludes that mobile banking has a positive and significant influence on financial inclusion in the rural Kenya. Therefore an increase in mobile banking in Kenya leads to an increase in financial inclusion in the rural Kenya. The adoption and utilization of mobile banking in Kenya has been increasing for the last six years, with commercial banks adopting the technology. In addition, the

increase in utilization of mobile banking in Kenya can be shown by the increasing number of Fintech companies, which currently stands at 38 in Kenya.

This study concludes that agency banking has a positive and significant influence on financial inclusion in the rural Kenya. Agency banking enables commercial banks to partner with other businesses to make financial services easily accessible to the Kenyan population at a fair cost. However, unlike mobile banking, which takes advantage of the high mobile phones penetration in the rural areas, agency banking requires customers to visit agents, normally located in shopping centers.

The introduction of mobile banking and agency banking led to a significant decrease in the utilization of automated teller machines. Unlike mobile banking, where the customers uses his/her phone at her convenience, and agency banking where customers visit agents, which are most of the times near their homes, automated teller machines require customers to visit ATMs mostly installed in towns.

### **Recommendations**

1. From the above conclusion, the study recommends that policy makers consider mobile banking in their formulation of policies because of the technological developments and the expected switch from physical branch networks to technologically supported banking services.
2. In Kenya, only 15 out of 43 commercial banks in Kenya had adopted the use of agency banking. The study therefore recommends that all commercial banks in Kenya should adopt agency banking as a way of reducing cost of service provision and improving their financial performance and hence enhance financial inclusion.
3. The adoption of financial technology exposes financial institutions and customers to fraud. The study further recommends that commercial banks should design and develop protective measures to secure their customers money.
4. The study further recommends that commercial banks keep adopting and using mobile banking in their operations because the number of people with access to a mobile hand set is increasing every day. In addition, the convergence of mobile phones and commercial banks has revolutionized the banking operations. For example, Safaricom Limited in conjunction with Commercial Bank of Africa launched M-Shwari services which provide registered members an opportunity to borrow money from the bank and repay conveniently. This has introduced another perspective that is likely to revolutionize the banking operations for increased profitability.

### **Areas for Further Research**

The data used in this study did not cover transactions made by microfinance institutions (MFIs) and Savings and Credit Cooperatives (SACCOs). The study recommends further studies to focus on the adoption of financial technology in MFIs and SACCOs in Kenya. The study also suggests further studies to focus on the challenges facing the adoption of financial technology among financial institutions in Kenya.

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