EFFECTS OF TECHNOLOGICAL DEVELOPMENT ON FINANCIAL ACCESSIBILITY

A CASE STUDY OF EAST AFRICAN COMMUNITY

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DECLARATION

This research paper is my original work and to the best of my knowledge, has not been presented for a degree award in any other University.

Signed:.....Date:....

Anthony Njoroge Gathuru

This research project has been submitted for examination with my approval as the student supervisor.

Signed:.....Date.....

Dr. George Muniu Ruigu

DEDICATION

I dedicate this paper to my two adorable sons, Seth Gathuru Njoroge and Justin Muchiri Njoroge.

Let this paper inspire you to work hard and smart to achieve even higher academic goals.

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LIST OF ACRONYMS

AFI	-	Alliance for Financial Inclusion
ATM	-	Automated Teller Machine
CGAP	-	Consultative Group to Assist the Poor
СВК	-	Central Bank of Kenya
EAC	-	East African Community
EFInA	-	Enhancing Financial Innovation and Access
FI	-	Financial Institution
FSDP	-	Financial Sector Development Programme
GDP	-	Gross Domestic Product
GSMA	-	Groupe Speciale Mobile Association
ICT	-	Information and Communication Technology
IMF	-	International Monetary Fund
KNBS	-	Kenya National Bureau of Statistics
Kshs	-	Kenya Shillings
КҮС	-	Know Your Customer
NFIS	-	National Financial Inclusion Strategy
OLS	-	Ordinary Least Squares
SACCO	-	Savings and Credit Cooperative Organization
SME	-	Small & Medium Enterprises
Tshs	-	Tanzania Shillings
UNCTAD	-	United Nations Conference on Trade and Development
WDI	-	World Development Indicators

ABSTRACT

This paper examined the effects of technological development on financial accessibility for East African Community countries namely Burundi, Kenya, Rwanda, Uganda and Tanzania for the period 2004 to 2015 using secondary data obtained from World Bank's World Development Indicators (WDI). Using fixed effects estimation, the empirical findings of the study show that technological development, real GDP, school enrolment, primary (% Gross) and population density have a positive impact on financial accessibility. On the contrary we establish that higher levels of inflation and openness to trade are associated with lower levels of financial accessibility. We therefore conclude that financial inclusion is generally viewed as an important avenue towards economic development, and that banks and other financial institutions facilitate access to finance through technologically driven service delivery channels leading to increased financial inclusion.

CHAPTER ONE

INTRODUCTION

1.1 Background

Financial accessibility can be defined as the capacity of an individual or a business enterprise to obtain financial services which may include deposits, payments, credit facilities, insurance and other risk management services. According to Demirgüç-Kunt and Levine (2008), financial accessibility is the absence of either price or non-price barriers in the use of financial services. Claessens (2006) also defines it as the availability of supply of quality financial services at rational costs, where rational quality and costs have to be defined relative to an objective standard, with costs reflecting both financial and non-financial costs.

New technological advancements are now taking a significant role in enabling financial accessibility through innovative banking processes that create new customer demands, products, and procedures which improve efficiency, thus leading to broader shifts in products' demand, markets, and social equity. According to Al-Hakim, et al., (2016), technological development can be defined as the systematic use of economic, technical, scientific and commercial knowledge in order to meet specific business objectives.

Technological developments in the telecommunication sector and more specifically on the mobile telephony and internet are arguably the biggest and newest trending advancement in many economies, and the East African Community countries in focus are no exception. These have been useful not only to individuals but also to financial institutions. The latter have relied on technology as a platform to advance their own internal processes and operations as well as service delivery to their customers. This has continued to revolutionize payment systems especially in Kenya which is a leader in the mobile money revolution around the globe, with the provision of innovative and value-adding applications that enable diverse financial and non-financial transactions via the mobile platform. Various initiatives by the

banking sector utilize mobile telephony and by extension the internet in the provision of financial service solutions to the previously unbanked, thus increasing financial accessibility. These have provided unprecedented quality and convenient banking services besides creating employment for millions. Such services include but are not limited to remittances, bill payments, mobile airtime purchases, account opening and management, transfer between accounts either within the same bank or across different banks, etc. The services are commonly referred to as mobile banking, mobile transfers, or mobile payments. In fact, other countries around the globe are more than willing to send their technologically savvy representatives for bench marking missions to learn how these systems work and how they can be adopted in their financial systems. Internet banking is another newer development that utilizes the mobile telephony and which is also a bold step forward towards reaching the masses by the banking industry including the previously unbanked. In line with the technological advancements, there are several channels that the banking fraternity have adopted away from the face to face teller in order to easily reach the previously unbanked population. These include but are not limited to mobile banking, agency banking, ATMs, credit & debit cards, call centres and internet banking (also called online banking). These can collectively be referred to as electronic banking. Electronic banking can be defined as the provision of information and services by a bank to its customers through a computer (Elizabeth Daniel, 1999). Omariba et al. (2012) defines electronic banking as the use of a computer or related device to retrieve and process banking data and initiate transactions directly with a bank or other financial institution remotely through a telecommunications network. This study, however, has focused on mobile banking and internet banking.

Mobile banking is the availability and provision of banking, financial and insurance services by use of mobile telecommunication devices such as a tablet or the very popular mobile phone. It offers anytime and anywhere access to business transactions, thus offering customers a high flexibility of banking in terms of time and location. It enables users to store the monetary value in a virtual account which can be accessed through the mobile device, convert cash in and out of the stored value account and transfer stored value between several accounts.

Agency banking refers to an arrangement where a financial institution (bank) contracts a third party to process the bank clients' transactions on its behalf under specified conditions and regulations. The third party is the agent, who is a legal entity and has to be vetted and approved by the regulatory authority, mainly the central bank of the country's bank. The agent is usually an already existing retail outlet or a business establishment of any kind, for example, a supermarket, food kiosk, hardware shop, fuel station, etc. Financial institutions need to keep track of transactions done by retail outlets. This requires a number of technologies which include mobile phones, point-of-sale card readers, bar-code scanners and computers that connect to the financial institutions' servers. These technologies involve expertise and capital investment in acquiring and setting up the required technical equipment. This poses a challenge to some retail outlets due to limited capacity and associated costs.

ATM (Automated Teller Machine) is an electronic equipment that serves as a banking outlet and allows customers to perform various bank transactions without the direct interaction of a bank teller or representative. It involves both computer and telecommunication technologies. A customer uses a credit or debit card to access the ATM services which include cash deposits, balance enquiries, transfer of funds between accounts and the most popular cash withdrawal. ATMs are seen as a convenient channel for banks to expand their services and as a convenient solution for reducing congestion in bank branches. Several banks have incorporated their mobile banking into their ATM platforms, where a customer can perform mobile banking transactions at the ATM. Internet banking, also referred to as online banking, is an electronic banking system that enables bank customers to perform various financial transactions through the bank's website or through a web portal that connects to the bank's core banking system. Only virtual services are available in this channel, which means physical cash is absent. The services include but not limited to transfer of funds, account enquiries, loading of credit and debit cards and payment of bills.

Mobile banking requires a working mobile network provided by different operators in the three countries. A number of banks in these countries have integrated these mobile networks into their own core banking systems for their production and distribution processes. These processes have to be vetted, approved, controlled and regulated by the regulatory authorities. Cut throat competition and the thirst to increase their profitability have pushed more and more banks and other financial institutions into adopting and embracing mobile banking technologies as a matter of necessity rather than choice.

Mobile communication devices such as tablets and the most popular mobile phone are becoming a personal necessity every day which can be attributed to their increasing affordability and the convenience of owning one.

The more the population gets access to these mobile devices, the more beneficial it gets for banks and other financial institutions, because they are increasing their potential client base at minimal or no cost at all.

The East African population is a people in need of financial access, and this has been greatly facilitated by the successful uptake of both mobile banking and internet banking. This is for them to invest, improve their livelihoods and become self-reliant. This would go a long way in enhancing their economic stability which promotes the general economic growth of the

nations. Koivu (2002) argues that a suitable banking environment is a key pillar and an enabler of sustainable economic growth.

1.2 Overview of the East African Community Economies

1.2.1 Burundi

According to Deloitte's Burundi's Economic Outlook of 2016, mobile market grew by over 80% year on year in 2015 to reach 5.6 million subscribers. As a result, Burundi's mobile penetration rate increased to 49.9% at the end of 2015, up from 28.5% in 2014. By close of 2015, the country had 10 commercial banks, 26 Micro Finance Institutions and National Bank of Economic Development. These are regulated by The Bank of the Republic of Burundi.

The government of Burundi, through the National Financial Inclusion Strategy (NFIS), has been making efforts towards making financial services and products accessible to all categories of the population. One of the objectives of NFIS is to ensure increased and permanent access to and usage of financial services by the population. This can be achieved through, among others, developing financial services and products through mobile phones and expanding access to ATMs.

1.2.2 Kenya

The value of Information and Communication Technology (ICT) sector grew by 8.1% from 259 million in 2014 to 280 million in 2015. Mobile penetration stood at 87.7% in 2015 from 78.3% in 2014. The adoption and use of mobile money transactions has been increasing since its inception, and by the end of 2015, Kenya had the world's leading mobile money system, the Safaricom M-pesa. In 2015, mobile money subscriptions hit 26.8 million up from 26 million in 2014. The mobile money penetration, however, remained unchanged. Total cash

transfers made through mobile money agents hit 2.8 trillion shillings in 2015, up from 1.3 trillion shillings in 2014. (KNBS, 2016).

The mobile phone has continued to be a key platform for financial services thus reducing transactions costs. Money transactions through mobile phones were valued at an estimated average of 8.6 billion shillings daily in December 2015 compared to 7.3 billion shillings daily in December 2014. This growth is a manifestation that technology-led channels have a big potential in increasing access to financial services. (CBK Monetary Policy Statement, Dec 2015).

According to CBK, the mobile phone continued to be an important platform for financial services thereby reducing transaction costs. Money transactions through mobile phones were estimated at Kshs 8.6 billion daily in December 2015 compared with Kshs 6.5 billion in June 2015. This indicates that there is potential of technology-led delivery channels in increasing access to financial services. (CBK Monetary Policy statement, December 2015).

1.2.3 Rwanda

According to 2012 FinScope survey of Rwanda, 89% of adults are financially included through both formal and informal financial products and or services. About 26% of adult population is banked, and bank usage has steadily risen in recent years through bank loans, debit cards and mobile banking.

In 2006, the country launched the Rwandan Financial Sector Development Programme (FSDP) whose vision is to develop a sound and stable financial sector that is sufficiently broad and deep, capable of efficiently mobilising and allocating resources to address the development needs of its economy as well as to reduce poverty. FSDP is one of the main components in the implementation of Rwanda's vision 2020. One key objective of FSDP is to enhance access to and affordability of financial services through developing a strong,

competitive and efficient banking sector which offers a diversified array of financial services and products.

1.2.4 Tanzania

In Tanzania, the level of financial development and thus access has gradually improved in recent years. Access to financial services remains concentrated in urban areas at the expense of rural areas where the bulk of the population lives. This is attributed to lack of sufficient infrastructure and the high cost of establishing brick and mortar branches in the geographically expansive rural areas. Technologically driven platforms like mobile money and agency banking have however continually improved access to financial services while reducing the related costs. Tanzania has seen a rapid improvement in technological developments and thus enhancing financial accessibility to its citizens. In 2015, transactions through the mobile money amounted to almost 52 percent of the country's GDP, up from 0.2 percent in 2010. The mobile money transactions moved from Tshs 452 billion in July 2011 to Tshs 4.7 trillion in December 2015, an increment of 940 percent. Between 2004 and 2014, mobile subscriptions and internet users increased by 1,375 percent and 510 percent respectively.

1.2.5 Uganda

As stipulated in its Vision 2040, the Government of Uganda has taken deliberate steps to build a more inclusive financial system that is responsive to the needs of its citizens. In 2011, the Bank of Uganda adopted a new strategy for pushing forward the financial inclusion agenda based on four pillars namely financial consumer protection, financial literacy, financial innovations and financial services data and measurement. Of greater relevance to this study is the financial innovations pillar. The country has experienced an upward surge in financial services delivery through technological developments. These include electronic money, ATMs with deposit and withdrawal capabilities, SACCOs and mobile money service providers. There has been an upward trend on technological developments that are essential for enhancing financial accessibility. For instance between 2004 and 2014, mobile subscriptions and internet users increased by 1,101 percent and 2,570 percent respectively. (Bank of Uganda, 2014).

1.3 Trends in Mobile Phone Subscriptions and Internet Usage in the East African Economies

The mobile telephony has greatly increased over the last decade. By the end of 2015, the five countries had an average of 64.72% mobile phone subscriptions against an average of 3.89% in 2004. This represents a growth of 1,562%. Data on internet users per 100 people shows that the average between 2004 and 2015 was 1.08% and 18.61% respectively, a growth of 1,623%.

These growths are well demonstrated in the graphs below. The first and second graphs demonstrate growth in mobile phone subscriptions and internet users respectively for each country. The third graph shows the averages of the two indicators for the three countries.



Figure 1: Trends of Mobile Cellular Subscriptions per 100 People per Country; 2004-2015

Figure 2: Trends of Internet Users per 100 People; 2004-2015





Figure 3: Countries' Average Trends of Mobile Subscriptions and Internet Users; 2004-2015

This is a clear indication that there is a rising trend in both mobile cellular subscriptions and internet usage. They are convenient and allow not only easy communication but also ease of doing business. Moreover, because of factors like competition and development of low-cost devices, prices of mobile phones have continued to drop drastically, thus becoming affordable to a large part of the population.

The mobile phone has continued to be a key platform for financial services thereby reducing transactions costs. Taking Kenya as an example, money transactions through mobile phones were valued at an estimated average of 8.6 billion shillings daily in December 2015 compared to 7.3 billion shillings daily in December 2014. This growth is a manifestation that technology-led channels have a big potential in increasing access to financial services. (CBK Monetary Policy Statement, Dec 2015).

1.4 Statement of the Problem

Increasing financial accessibility has recently elicited substantial interest among researchers, policy makers, governments and other stakeholders. Prior to advancements in technological development, a good proportion of the population did not have financial access largely because of associated barriers. The aforementioned technological developments can, however, play a big role in breaking the barriers and thus enabling financial access. Financial accessibility is an important contributing factor to the economic development of a nation. Technological development and its application in the banking sector solutions is increasingly being seen as an important avenue of achieving the desired financial accessibility. Two such developments which are the focus of this study are mobile telephony and the internet revolution. These have been utilized by banks in coming up with mobile banking and internet banking respectively. Previous studies have concentrated on how financial accessibility and other factors have affected financial inclusion, but have somehow avoided to clearly demonstrate how technology has affected financial accessibility. Financial accessibility is the level of ease to access financial services by economic agents, while financial inclusion depicts the proportion of firms and individuals who use financial services. Increasing financial accessibility thus translates to increase in financial inclusion.

Access to finance has generally been hampered by barriers, both price and non-price. Of importance to this paper are price barriers which include but not limited to high banking transaction costs, high and prohibitive minimum balances of opening and maintaining accounts, high costs of setting up bank branches in remote areas, and high transport costs for both banks and individuals in delivering services and going for services respectively. Technological developments can help in eliminating these costs and thus enhance financial accessibility.

This study, therefore, endeavours to bridge that information gap and bring to light through concrete empirical evidence the relationship between mobile telephony and internet on one hand and financial accessibility on the other in the five EAC countries. This will provide room for further research into the subject matter. The study seeks to answer the question; does technological development affect financial accessibility?

1.5 Objectives of the Study

The main objective of this study is to establish the effect of technological development on financial accessibility in East African Community countries. Specifically, the study aims to:

- 1. Examine the effects of mobile telephony and the internet on financial accessibility.
- 2. Draw policy implications from the results.

1.6 Significance of the Study

Few studies in this field have been conducted in the East African countries under study. The available studies have concentrated on financial inclusion and have ignored to study the factors that influence financial accessibility. Financial inclusion cannot happen without financial accessibility. Furthermore, the studies have employed different techniques which have yielded different results. This study, therefore, employs fixed effects model of standard panel data estimation techniques to examine the effects of technological development and other variables on financial accessibility. The information will be important to scholars by not only providing new information but also by forming a basis for further research. It will also be of value to policy makers in the banking and communication sectors, as well as to the government in the quest of making valuable decisions for economic development.

1.7 Scope of the Study

The study focuses on a period of twelve years between 2004 and 2015. Data availability of our choice variables prior to 2004 is limited. We make use of panel annual data for five East African Community countries namely Burundi, Kenya, Rwanda, Tanzania and Uganda.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter will focus on literature which relate to how technological development has affected financial accessibility in several parts of the world. The chapter, therefore, presents review on theoretical literature, empirical literature and conceptual review, and summarises with the gaps that the study seeks to address.

2.2 Theoretical Literature

This section makes a review of theories that will guide the study.

Bank focused theory states that traditional banks use non-conventional low-cost delivery channels in providing banking services to their existing customer base. These channels may include ATMs, mobile banking, the internet (online) banking and agency banking to provide certain banking services to bank's customers. The model can be said to be additive in nature because it offers what the customers require at their doorstep. Through technology driven banking, banks and other FIs achieve economies of scale by serving many customers at low cost. The lower costs have an effect which is two-fold; on supply side and demand side. On the supply side, banks and other financial intermediaries are able to deliver services to a larger part of the population including the previously unbanked persons at lower costs. This in turn leads to savings by banks which they would use in further research and development of better and more efficient delivery channels. On the demand side, more consumers are able to afford the offered services and this will push their demand upwards. This inadvertently increases financial accessibility. A related theory is the bank led theory where a bank or financial institution offers financial services to its clients through a retail agent. According to Lyman et al. (2006), the bank or FI develops financial products and services, and distributes

them through contracted retail agents who handle most if not all of customers' interactions. This model offers a good alternative to conventional banking because it allows customers to conveniently perform a wide range of transactions through agents instead of going to bank branches. These models have the potential to significantly increase the accessibility of the financial services by using different technology-driven delivery channels which are substantially less costly than traditional bank alternatives.

Porteous, D. (2006) distinguishes two models of mobile banking; additive and transformative. Additive models are those in which the mobile phone is just another channel to an already existing bank account, while transformational models are those in which the financial product through the phone is targeted at the section of the population that is unbanked and which is largely compromised of low income people. He asserts that mobile banking can be transformational because it utilises the existing mobile phone networks which readily reaches the unbanked, and it may also be less costly than conventional banking.

In his theory of economic development, Schumpeter (1934) defines development as a spontaneous and discontinuous change in the channels of flow, disturbance of equilibrium which forever alters and displaces the equilibrium state previously existing. When an economy undergoes changes, circular flow is disturbed and the development process starts. The development process is based on disruptions of equilibrium by new combinations, which come in the form of innovations (Bazhal, 2016). Innovation is synonymous with technological development, and is introduced by a firm or entrepreneur with a view to reduce costs of production. This will in turn reduce the price of the entrepreneur's services to the consumer assuming there is competition in the market.

2.3 Empirical Studies

Empirical studies for EAC countries focusing on the relationship between technological development and financial accessibility are limited. Various studies have been done for other countries or regions in the recent past. This section will therefore endeavour to bring the few related studies into light.

In recent times, access to finance has attracted considerable attention and has become a significant problem on the development agenda among nations. Claessens (2005) postulates that due to dynamics in economies and economic production, financial exclusion may have taken a higher position in the ranking of barriers to growth.

Rabobank (2005) postulates that commercial banks and other formal financial intermediaries are sometimes reluctant in serving poor households and small & medium enterprises (SMEs) because of the high cost of small transactions, lack of minimum requirements and collateral for financing, as well as geographical isolation. Access to finance has the potential to stimulate self-reliance and development of poor households and SMEs. This will help to improve poor people's economic conditions as well as to offer ways to improve or maintain their quality of life when faced with uncertainties. According to Rabobank (2005), increasing financial access to the poor can help the financial sector play an important role in poverty alleviation in the developing countries.

Access to finance means an absence of both price and non-price barriers in using financial services. These services should be available at the time and location desired, and the related products should be designed according to specific requirements so as to meet demand and enable customers to access what they need most. In addition, the services should be convenient to the user in terms of indirect costs such as travelling long distances to an institution for them to access the services (Demirgüç-Kunt et al., 2008).

According to GSMA (2015), the use of cell phones in East Africa to access mobile payments and banking accounted for approximately half of all mobile connections in 2014.

Internet banking is progressively becoming a favourite financial delivery channel by many banks and financial institutions. It makes it easier for customers to compare banks' products and services, allows banks to expand their geographical reach by penetrating new markets and can also increase competition among banks. According to Nsouli and Schaechter (2002), banks are increasingly operating websites through which their customers do not only inquire about interest rates, exchange rates, and account balances, but are also able to perform a wide range of financial transactions.

Financial inclusion can be viewed as an intensification and extension of poverty alleviation efforts (Karmakar, 2011). According to Shukla and Singh (2015), financial inclusion is the process of ensuring access to financial services where and when needed at reasonable cost. World Bank data reveal that the higher the population, the lower the financial penetration (CGAP/The World Bank, 2009) and countries with a large proportion of the population having no access to financial services show higher poverty ratios measured by national and international poverty lines.

Zins, A., & Weill, L. (2016) examined the determinants of financial inclusion in Africa using World Bank's Global Findex database of 37 African countries. They performed probit estimations with financial inclusion as the dependent variable, against gender, age, education and income as the explanatory variables. The study found out that both secondary education and tertiary education have significantly positive association with financial inclusion.

World Bank data on percentage of population with financial access reveals that countries like China (42 percent), India (48 percent), the Philippines (26 percent) and Bangladesh (32 percent) with large proportion of population having no access to financial services show higher poverty ratios measured by both national and international poverty lines (World Bank, 2008).

Asongu and Nwachukwu (2017) examined the role of internet and mobile phone penetration in complementing financial sector development for financial access based on Generalised Method of Movements between 2004 and 2011 for 53 African countries. They concluded that internet-connected mobile phones have enabled instant access to bank accounts. This is through the mobile phone acting as a store of value because the subscriber's identity module is similar to a smart card, by playing the role of a point of sale terminal and by acting as an ATM.

In a study to examine the access and use of banking services in Nigeria, Efobi U., et al (2014) examined three dependent variables namely use of bank services, frequency of bank withdrawals and use of account to save. Four independent variables which comprised the base model included socio-demographic features, level of financial discipline, income characteristics and inclination to information and communication technology. To estimate the relationships, logistic regression based on the marginal effect was applied. The outcome was that inclination to ICT will foster withdrawals because it increases the likelihood to withdraw funds from banks through online banking, ATMs and mobile banking.

Kpodar and Andrianaivo (2011) studied the impact of technology on economic growth, and whether financial inclusion is one of the conduits through which mobile phone development stimulates economic growth. Data from a sample of African countries between 1988 and 2007 was used. Cost of local mobile calls and mobile penetration rate were used to represent mobile phone diffusion. The number of deposits and loans per head represented financial inclusion. These deposits and loans include those at commercial banks, microfinance institutions, co-operatives and specialized state financial institutions. The results indicated that mobile phone penetration can foster economic growth by facilitating financial inclusion. Higher mobile penetration eases access to deposits and loans.

In a study to assess the behaviour and determinants of financial inclusion in India, Nitin, K. (2013) employed fixed-effects model to analyse state-wise panel data between 1995 and 2008. Among the explanatory variables was population density, which is population per square kilometre, while the dependent variable was the number of deposit accounts per thousand of population, which measured deposit penetration. Contrary to the study's expectations, population density had a negative effect on deposit penetration.

Cámara and Tuesta (2014) did a study of measuring financial inclusion using a multidimensional index. They hypothesized that the scale of financial inclusion is determined by three dimensions namely barriers, usage and access to financial inclusion. They postulated that a good composite index should comprise important information from all the said indicators but not be strongly biased towards any of them. A two-stage Principal Component Analysis was thus employed to endogenously determine weights assigned to these three dimensions. The study considered four basic indicators to construct access dimension with supply-side data at country level namely ATMs per 100,000 adults, ATMs per 1,000km², commercial bank branches per 100,000 adults, and commercial bank branches per 1,000km². The study found out that access to financial services is the most important in explaining the extent of financial inclusion. GDP per capita was found to have a high positive correlation with financial inclusion index. The study also revealed a positive correlation between financial inclusion and engative correlation with illiteracy rate.

Abayomi and Olaronke (2016) studied the impact of trade openness on the development of financial system of Nigeria by considering both access to finance and financial depth indicators. They applied Simultaneous Openness Hypothesis as their theoretical framework

and Generalized Method of Moments as the estimation method. In the study, trade openness is measured by the ratio of imports plus exports to GDP. Financial indicators cover the depth and access of both financial markets and financial institutions. Access to finance for financial institutions was represented by commercial banks' branches per 100,000 adults. The study found out that trade openness has a significant negative relation with access to finance in Nigeria's financial institutions. Real GDP per capita was also an explanatory variable in the model. It was found that it has a positive and significant relationship with financial access.

2.4 Reducing Cost of Banking Services

According to a 2011 EFInA report commissioned by Oxford Policy Management Ltd, cost is one of the main obstacles to financial accessibility. This is cost incurred by banks while serving low-value accounts and by putting up brick and mortar branches in remote areas, and cost in time and money incurred by customers in remote areas to reach their bank branches.

Mobile and internet banking have the incentive of significantly reducing the cost of transactions to customers such as travel costs incurred by clients by delivering financial services efficiently to the geographically dispersed and hard to reach areas. Banks and other FIs often lack financial capacity or incentive to set up formal branches in these hard to reach areas because of the associated costs. These banking channels come in handy because their set ups are more flexible and less costly than conventional brick and mortar bank branches. This is because the need to invest in physical infrastructure and staffing is eliminated.

In a study to present a theoretical model to assist researchers better understand the acceptance and adoption of internet banking, Ezzi (2014) posits that the self-service nature of internet banking could translate to lower-average transactions costs and provide real-time accessibility when compared to normal teller supported banking services which are subject to fixed-hours. Internet banking has the ability to support banks' mission of increasing financial services and enhancing customer satisfaction through providing virtual time products and services, while realizing the potential of reduced operating and administrative costs.

According to Abu &Pearson (2009), internet banking offers customers the advantages of location and time convenience, ease and speed of completing transactions and lower costs. Banks also achieve lower costs as well as improved customer responsiveness and satisfaction.

2.5 Barriers to Financial Accessibility

It is noteworthy to look into the various impediments to financial accessibility which have forced a considerable part of the population to be unbanked or lack formal financial access. These barriers may be categorized into two broad categories, price barriers and non-price barriers. Price barriers are those that are directly related to costs of banking services and include high banking transaction costs, high and prohibitive minimum balances of opening and maintaining accounts, high costs of setting up bank branches in remote areas, and high transport costs for both banks and individuals in delivering services and going for services respectively. Non-price barriers are those that are not directly related to cost and may include prohibitive cultural or religious reasons, gender and age discrimination, prohibitive informational or contractual framework, geographical barriers or physical immobility, and banks viewing those who are low-income earners or have unpredictable and irregular incomes as a great risk. Also, some individuals do not perceive the need for the offered financial services and products from the formal financial service providers since they do not suit their needs.

According to UNCTAD (2014), access to financial services by individuals is inhibited by various factors that affect the demand for these financial services. While some of the unbanked population do not exhibit demand for bank accounts, most suffer from financial exclusion because of various barriers which include economic (cost), physical (distance that

one needs to travel), administrative (amount of documentation needed to open a bank account) and psychological (lack of trust in banks). Over 60% of adults indicate that lack of disposable income is the main reason of having no bank accounts. Fixed transaction costs pose a major constraint because the accounts are not affordable especially when transaction amounts are small. There is usually low branch penetration in rural areas and this could significantly increase the cost of financial accessibility. In addition, minimum documentation requirements for opening a bank account may exclude people living and working in rural areas as well as informal sector workers because of lack of official payslips or proof of residence which are necessary for KYC checks during account opening. Limited literacy and lack of financial knowledge could also hinder financial accessibility. Mistrust of financial institutions is another barrier, especially where the financial sector is underdeveloped. (UNCTAD, 2014).

2.6 Breaking the Barriers to Financial Accessibility

During the Alliance for Financial Inclusion Global Policy Report Forum of 2011, former CBK Governor, Prof.Njuguna Ndung'u, stated that financial inclusion is no longer something that is nice to do, but is now an essential part of the global economic development agenda. He pointed out that it is a public policy issue that bank regulators cannot shy away from.¹ But how are banks as agents of financial inclusion and accessibility ensure that this happens?

The introduction and improvement of mobile communication have gone a long way in enabling banks and other financial institutions in developing banking solutions to easily and readily reach their clients to offer their services through product and process innovations. These have eliminated some financial market imperfections such as transaction and information costs. Banks have developed various channels of banking which have made it

¹Professor Njuguna Ndung'u, Former CBK Governor and AFI Chair, September 2011

easy for them to reach their clients, even those who were previously unbanked. Mobile and internet banking are some of the innovative channels which have helped in mitigating some of the above mentioned barriers to financial accessibility. These enable bank clients to take advantage of technological development by easily and affordably accessing financial services at their conveniences of time and location. These services include but not limited to money transfers between accounts, remittances, airtime purchase, foreign currency exchanges (forex), cash deposits to their personal or others' accounts, cash withdrawals from agents, stopping of cheques, enquiries of account balances, issuance of bank statements, paying utility bills, borrowing loans, and collection of documents for account opening, loan and credit & debit card applications.

In addition, these channels have continued to demystify the notion that banking is only for the rich, the educated and those living in or close to towns. They have increased efficiency and motivated many people, including the very old in the village, to embrace the culture of saving and transferring money from one individual to another. These are catalysts of economic growth and societal development, and enable growth, stability, and equity among the population.

Mobile banking has greatly contributed in promoting financial accessibility to the previously unbanked and to the general population while yielding multiple effects on the number of banking solutions available to them as well as to the financial services providers. This is because a large number of the population has mobile phones, mobile banking has very affordable charges, and one needs not open a normal bank account, where a good number of the accounts have prohibitive opening and operating balances, and expensive monthly maintenance fees. The technologically driven banking channels have economic benefits to both society and individual. To the society, they aid in increasing domestic capital formation, enable banks to have access to more deposits thus enabling further lending, promote GDP growth and minimize population inequality through the triggering of job creation and entrepreneurship, and help the government in reducing costs that are associated with aid disbursement. Benefits to individuals include savings on costs of transactions, savings on time and on transport costs and using these savings for investing, increased financial inclusion, and increased entrepreneurship and creation of jobs through agency banking. (The Boston Consulting Group, 2011)

EFInA (2010) postulates that commercial banks and other FIs tend to set up brick and mortar branches in urban centers, leaving out areas that often do not have the capacity or incentive to establish formal branches. This excludes a considerable part of the population from the reach of banking services. Today banks and other FIs can expand their financial services to the previously unreachable and geographically scattered areas through mobile banking, internet banking, and other related channels. These technologically driven channels aid in indiscriminately getting more people in the active financial systems.

2.7 Overview of Literature Review

Financial accessibility is an area that has recently attracted the attention of researchers and its studies and outcomes thereof are important for policy makers and governments in identifying the necessary areas of improvement to enhance access to finance in order to further their development agenda. The above review of literature on the relationship between financial accessibility and technological development may not be conclusive. Most of it gives information on how several indicators determine financial inclusion. Studies to determine determinants of financial access are limited. The variables of consideration also differ across

the studies because there is no consensus on the indicators that should be used to measure financial accessibility as well as technological development.

Previous studies have produced inconsistent results depending on the countries or regions of study and the estimation methods used. Studies for the combined EAC countries to determine the relationship between financial accessibility and technological development have not been conducted. This study has endeavoured to fill that gap and also to generally contribute to the literature on the subject matter.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This section gives the conceptual framework of technological development on financial accessibility in the five East African Community countries, an econometric model that links technological development to financial accessibility, data to be used, variables definition and measurements, and lastly estimation technique to be used together with model diagnostic tests.

3.2 Conceptual Framework

Technological development is increasingly being considered as a crucial factor in explaining financial accessibility especially in developing economies (Kpodar and Andrianaivo, 2011). From a theoretical standpoint, technological development affects financial accessibility through a more direct transmission mechanism. Technological development enhances financial accessibility by reducing transaction costs in terms of distance and time of going to the formal banks hence ensuring low-cost transactions. It further influences financial accessibility by providing a platform for easy and consistent record keeping of transactions.

To conceptualize the link between technological development and financial accessibility, this paper follows the approach by Khayyat and Lee (2015) in defining technological development. Technological development can be described by total mobile phones subscriptions, internet users (per 100 people) and mobile cellular subscriptions (per 100 people) (Khayyat and Lee, 2015). Due to data limitations, however, this study uses fixed telephone subscriptions (per 100 people) in place of total mobile phones subscriptions, and internet users (% of population) in place of internet users (per 100 people). Further, in this paper, financial accessibility is represented by number of ATMs (per 100,000 adults), number

of bank branches (per 100,000 adults) and number of depositors with commercial banks (per 1,000 adults). The choice of these variables is partly guided by a study by Sophastienphong and Kulathunga (2008) on South Asian financial development. They considered six indicators of financial access from banks; demographic bank and ATM penetration, deposit and loan accounts per 1,000 people and number of bank branches. Additional indicators like the number of point of sale devices in rural areas, deposit and loan accounts with Micro Finance Institutions and number of bank agents could be good measures. However, they have not been considered in our study due to unavailability of data.

Dependent Variable

Figure 4: Conceptual Framework

Independent Variables



3.3 Econometric Model

The primary goal of this research paper is to shed more light on the role of technological development in financial accessibility in the five East African Community countries. The econometric model to be estimated can be written as;

$$FA_{it} = \alpha_0 + \alpha_1 T D_{it} + v_{it} + u_{it}.....(1)$$

Where FA_{it} denotes financial accessibility, TD_{it} is the technological development, v_{it} is the fixed effect parameter for country *i* at time *t*, u_{it} is the random error term for country *i* at time t and α 's are the coefficients of estimation.

Now to estimate equation (1), we include a set of control variables in our model, so as to present our estimable regression equation as;

$$FA_{it} = \alpha_0 + \alpha_1 T D_{it} + \alpha_2 X_{it} + v_{it} + u_{it}.....(2)$$

Where X_{it} denotes a vector of control variables that includes Gross Domestic Product (GDP), population, education, inflation and trade openness. We have transformed GDP, population density and trade openness into log form. This transformation compresses the scale in which the variables are measured thereby reducing a very big difference between two values into a very small difference. This can help in reducing the problem of heteroscedasticity. We expect, *a-priori*, technological development variables to have positive effects on financial accessibility.

3.4 Data Sources, Measurement, and Description of Variables

Table 1 presents the variable measurements and descriptions. In this study, we have used secondary level data for the period 2004 to 2015 for the five EAC countries namely Burundi,

Kenya, Rwanda, Tanzania and Uganda from World Bank's World Development Indicators

(WDI). We present the variable measurements and descriptions in Table 1 below.

Table 1:	Model	Variables
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Variable	Measure	Expected Sign					
Dependent Variable							
Financial Accessibility		+					
Number of ATMs	Per 100,000 adults						
Number of bank branches	Per 100,000 adults						
Depositors with commercial banks	Per 1,000 adults						
Independe	ent Variables						
Technological Development		+					
Fixed telephone subscriptions	Per 100 people						
Internet users	% of Population						
Mobile cellular subscriptions	Per 100 people						
Controls Variables							
Real GDP	Ksh Million	+					
Population density	Million	+					
Education	Primary school enrolment	+					
Inflation	Percentage	-					
Trade Openness (sum of exports and imports to real GDP)	Percentage	-					

3.5 Estimation Techniques

There are several estimation techniques that can be applied to estimate our regression model. This study has however adopted standard panel data estimation techniques; fixed effects and random effects models. This is because of the combination of a time-series (T) and crosssection dimension (N). In the fixed effects model, we assume that there's heterogeneity across individual countries. For random effects model, we assume there is no correlation between the decomposed country effects and the random error term. Random effects model, just like the pooled OLS, ignores the time-invariant component in the error term. To choose an appropriate model we will run a Hausman Test.

3.6 Diagnostic Tests

Since, as discussed, standard panel data analysis will be adopted in this study, we will perform the following diagnostic test.

3.6.1 Hausman Test

Hausman test allows us to test for the correlation between time-invariant fixed effects and the independent variables. In Hausman test, the null hypothesis is that there's no correlation between time-invariant fixed effects and the explanatory variables against the alternative hypothesis of the presence of correlation between time-invariant fixed effects and explanatory variables. In the event we reject the null hypothesis, we will use fixed effects model, otherwise we adopt random effects model.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

In this section we first present the summary statistics of the technological development, financial accessibility and the control variables in section 4.2, which is followed by a correlation of the variables in section 4.3. In section 4.4, regression estimates of the effects of technological developments on financial accessibility within the East African Community are presented.

4.2 Summary Statistics

Table 2 presents the summary statistics of all the variables adopted in the study. Examining the financial accessibility indicators aggregate statistics for the EAC region over time reveals that the traditional brick and mortar bank branch penetration remains very low at 2.894 per 100,000 adults while the depositors with commercial banks per 1,000 adults stood at 209.2. ATMs penetration is also still considerably low at 3.256 per 100,000 adults.

Considering the technological development indicators, we establish that fixed telephone subscriptions on average is 0.498 while mobile cellular subscriptions is considerably high at 211.0 and internet users is 5.932 for the region over the period considered in the analysis.

On the macroeconomic and social indicators, we find that the logarithm of real GDP for the region over the period 2004 to 2015 stood at 1.267 percent, while the gross school enrolment as a total of the population is 2.952 percent. On the other hand, trade openness for the region stood at 10.08 percent with the population density per square kilometre being 8.269 percent.

Indicators	Variable	Obs	Mean	Std. Dev	Min	Max
	Dank bronches	60	2 804	1 620	0.400	6 140
Financial Accessibility	Bank branches	00 50	2.894	1.030	0.400	0.140
	Depositors with banks	58	209.2	250.5	7.460	1310
	ATMs	60	3.256	2.926	0.040	10.16
Technological Developments	Fixed telephone subscriptions Mobile cellular subscriptions Internet Users	60 65 59	0.498 211.0 5.932	0.339 148.9 5.480	0.140 43.18 0.350	1.670 483.1 21
	Real GDP	55	1.267	1.806	0.020	8.910
	School enrolment	60	2.952	2.531	-6.800	8.170
Essentia Esstera	Inflation	56	116.7	17.99	74.72	145.8
Economic Factors	Trade openness	60	10.08	8.594	5.320	56.50
	Population density	60	8.269	6.572	1.550	30.81

Table 2: Descriptive Statistics

Source: Author's computation using Stata

4.3 Correlation Analysis

In Table 3, we look at the correlations between the variables adopted in the study where we establish that the correlation coefficients are generally moderate ranging from -0.622 to 0.694. We establish that the financial accessibility indicators, that is, ATMs penetration, branch network density and depositors with commercial banks have the highest positive correlation coefficients. Similarly, the correlation coefficients between the technological development indicators are lower compared to financial accessibility indicators but are all positive. The correlation coefficients between technological development indicators and financial accessibility are positive and therefore imply that they tend to move in the same direction though this does not imply causation in any way.

	1	2	3	4	5	6	7	8	9	10	11
Bank Branches (1)	1										
Depositors with commercial banks (2)	0.628	1									
ATMs (3)	0.694	0.842	1								
Fixed telephone subscriptions (4)	0.184	0.134	0.362	1							
Internet Users (5)	0.638	0.633	0.703	0.258	1						
Mobile cellular subscriptions (6)	0.203	0.083	0.129	0.018	0.151	1					
Real GDP (7)	0.169	0.512	0.545	0.562	0.196	-0.0565	1				
School enrollment (8)	0.281	-0.142	-0.223	-0.164	0.073	0.141	-0.371	1			
Inflation (9)	-0.150	-0.101	-0.086	0.302	-0.228	0.089	0.103	-0.087	1		
Trade Openness (10)	0.417	0.163	0.337	-0.184	0.44	0.144	-0.216	0.035	-0.622	1	
Population Density (11)	0.116	-0.362	-0.474	-0.341	-0.144	-0.054	-0.546	0.425	-0.19	0.19	1

Table 3: Correlation Matrix

Source: Author's computation using Stata

4.4 Empirical and Pre-Estimation Tests

In order to establish the appropriate model, under the panel data analysis framework we performed a Hausman Test² to determine whether to estimate a random effects of fixed effects model. This test seeks to establish whether there is significant correlation between the unobserved country specific random effects and the regressors. If no such correlation exists, then the random effects model may be more appropriate. In the presence of such a correlation, then random effects model would be inconsistently estimated and the fixed effects model would be more appropriate. From the test the fixed effects model is estimated as indicated by the insignificance of the Hausman test statistic in Table 4.

4.5 Effect of Technological Development on Financial Accessibility

As a preliminary estimation, we examine the role of technological development in influencing financial accessibility without controlling for macroeconomic and social factors

²This test is mainly based on the consistency and efficiency of the random and fixed effects estimators depending on the correlation between the individual effects and the regressors.

as captured by columns 1(a), 2(a) and 3(a) of Table 4 which represents the baseline regression estimates. The results presented without incorporating the control variables reveal that internet usage, a technological development indicator, is positively and significantly related with bank branches penetration, depositors with commercial banks and automated teller machines, which are financial accessibility indicators. This implies that more technological developments are likely to spur financial accessibility through increased access to information through the internet. Controlling for the macroeconomic and social factors the results are robust and still exhibit the positive relation. For instance, we still observe a significant positive relationship between technological development and financial accessibility indicators as presented in Columns 1(b), 2(b) and 3(b). This satisfies our main expectation of the study and is tandem with the findings from studies by Kpodar and Andrianaivo (2011) and Beck et al. (2010) that higher mobile phone penetration leads to easier access to financial services.

On the contrary, fixed telephone subscriptions and mobile cellular subscriptions, proxies for technology development is established to be insignificant though positive except for automated teller machines which is positive and significant. One likely reason for the significance observed in this case is that households with fixed telephone subscriptions are less likely to be income constrained and as a result are more likely to utilise banking products. This echoes the empirical conformance with theory that supports the argument that technological developments come in handy in enhancing financial access by ensuring flexibility and less cost in the banking model as compared to the conventional brick and mortar bank branches by reducing the need to invest in physical infrastructure and staffing while reaching out to the geographically dispersed and hard to reach populace. Similarly, this is in line with Abu and Pearson (2009) who also assert that internet banking offers customers

the advantages of location and time convenience, ease and speed of completing transactions and lower costs.

The macroeconomic and social indicators adopted as control variables also are consistent with our *a-priori* expectations. For instance, we establish that real GDP exerts a positive effect on all the three proxies of financial accessibility adopted which is in line with common intuition that access to finance is higher in countries with higher levels GDP. This therefore implies that higher levels of economic development ensure a deep financial system which also feeds into enhancing development and conforms with the findings of Kpodar and Andrianaivo (2011) that economic growth bolsters financial inclusion and that of Park and Mercado (2015) that per capita income significantly influences the level of financial inclusion in Asia, and those of IMF (2015) that a positive correlation exists between the use of commercial bank services and increase in per capita GDP.

Secondly, we also find that School Enrolment, Primary (% Gross) has a positive effect on bank branches per 100,000 adults and is in line with widely held view that higher levels of education lead to increased financial accessibility as a result of people being educated. This is attributed to the fact that education increases the chances of an individual to have a source of income and therefore own a bank account in which to receive a salary or deposit or save their earnings. This finding therefore is in conformity with the empirical evidence presented by Arora (2012), Demirgüç-Kunt and Klapper (2012), Kumar (2005) and Mzobe (2015) who also documented a positive relationship between education and financial inclusion.

In line with the theoretical expectations, we establish that higher levels of inflation lead to lower levels of financial accessibility as indicated by its negative coefficient on all the financial accessibility indicators and this is likely the case as inflation increases the cost of financial products therefore lowering its demand. This is in line with the observation by Boyd et al. (2001) that economies with higher inflation rates are likely to have smaller, less efficient and less active banks.

Similar evidence is also documented in the case of trade openness, implying therefore that more openness to trade adversely affects financial accessibility although not being significant. Given that the EAC is a net importer, it is not surprising to find that openness to trade has a negative effect as there are more financial outflows from the region. Finally, in line with theoretical arguments, population density exerts a positive significant effect on bank branches per 100,000 adults. This is the case since branch network density is influenced by the population within an area and thus banks are more likely to put up branches in areas that are densely populated relative to areas that are sparsely populated. Our findings are thus consistent with the general view that economies with large population sizes are likely to have greater access to financial services and aligns well with the findings of Park and Mercado (2015) that population density significantly increased financial access.

Table 4: Effects of Technological Development on Financial Accessibility Estimates

	Panel (1a)	Panel (1b)	Panel (2a)	Panel (2b)	Panel (3a)	Panel (3b)
	Bank branches	Bank branches per	Depositors with	Depositors with	Automated teller	Automated teller
	per 100,000	100,000 adults	commercial banks	commercial banks	machines per	machines per
	adults		per 1,000 adults	per 1,000 adults	100,000 adults	100,000 adults)
Fixed Telephone Subscriptions (Per 100 People)	0.019	0.071	-0.091	-0.228	0.270^{**}	0.047
	(0.615)	(0.737)	(1.032)	(1.050)	(0.991)	(0.867)
Internet Users (% of Population)	0.486^{***}	0.356**	0.736***	0.427**	0.439***	0.301**
-	(0.052)	(0.054)	(0.086)	(0.077)	(0.083)	(0.064)
Mobile Cellular Subscriptions (Per 100 People)	0.078	0.085	-0.022	0.004	-0.048	0.000
	(0.011)	(0.009)	(0.018)	(0.013)	(0.017)	(0.011)
Real GDP		0.344**		0.423***		0.421***
		(0.000)		(0.000)		(0.000)
School Enrolment, Primary (% Gross)		0.238**		-0.005		-0.040
		(0.011)		(0.016)		(0.012)
Inflation, Consumer Prices (Annual %)		-0.097		-0.164		-0.081
		(0.063)		(0.091)		(0.075)
Trade Openness		-0.006		-0.792**		-0.023
		(0.078)		(0.111)		(0.092)
Population Density		0.304**		-0.033		-0.192**
1 2		(0.001)		(0.002)		(0.001)
Adjusted R^2	0.056	0.258	0.058	0.467	0.177	0.656
Hausman Test (x2)	2.36	9.86	0.43	9.30	3.24	5.53
	(0.50)	(0.20)	(0.93)	(0.23)	(0.36)	(0.60)
Wooldridge's Test for Serial Correlation	42.55	27.21	44.52	2.855	16.07	4.363
	(0.00)	(0.00)	(0.00)	(0.122)	(0.00)	(0.06)
Observations	59	55	57	53	59	55

Notes: Standardized beta coefficients; *t* statistics in parentheses. ${}^{+}p < 0.1$, ${}^{**}p < 0.05$, ${}^{***}p < 0.01$

Source: Author's computation using Stata

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND POLICY RECOMMENDATIONS

5.1 Introduction

This chapter provides a summary of the key findings of the study. It begins by highlighting the key results of the study, and then gives a conclusion and recommendations based on the study findings. The chapter also points out limitations of the study and suggests areas for further research.

5.2 Summary of the Findings

The study empirically examined the effects of technological development on financial accessibility in the five East African Community countries. The motivation of the study originated from the fact that there is emergent interest in enhancing financial inclusion around the world especially in the developing economies. Financial inclusion has the potential of benefiting economies and their respective populations. It cannot take place without proper access to finance. With the increasing developments in technology and their uptake by banks while abandoning traditional methods of banking, it was therefore necessary to establish through empirical evidence how this uptake can affect financial accessibility. The study covered a period of 12 years between 2004 and 2015 and panel data modelling was used.

Using the fixed effects estimation, the empirical findings of the study show that technological development has a high and positive impact on financial accessibility. We also find that fixed telephone subscriptions and mobile cellular subscriptions though positive is insignificant, except for automated teller machines which is positive and significant. Secondly, we establish that real GDP exerts a positive effect on all the three proxies of financial accessibility adopted which is in line with common intuition that access to finance is higher in countries with higher levels GDP.

Thirdly, school enrolment, primary (% Gross) has a positive effect on bank branches per 100,000 adults and is in line with widely held view that higher education levels lead to increased financial accessibility as a result of people being educated. Fourthly, we establish higher levels of inflation lead to lower levels of financial accessibility as indicated by its negative coefficient on all the financial accessibility indicators. Similar observation is established with regard to openness to trade. Finally, in line with theoretical arguments, population density exerts a positive significant effect on bank branches.

5.3 Conclusions

Financial inclusion is generally viewed as an important avenue towards economic development throughout the world. Banks and other financial institutions facilitate access to finance leading to increased financial inclusion. Through statistical evidence, the study has established that technological development has a positive and significant effect on financial accessibility. This is in conformity with our expectation of a positive relationship. Generally, the study has made a contribution to economic literature by identifying determinants of financial accessibility in the five East African Community countries.

5.4 Policy Recommendations

Based on our study findings, the following set of policy recommendations to improve on access to finance can be drawn. The study findings indicate that technological development plays a major role in aiding financial accessibility. Banks and other financial institutions should put in place research and development efforts towards increasing their technologically driven banking channels. There is need for continued product developments and business model innovations that will enable more people access a wider range of financial products at lower costs. Banks and other

financial institutions should increase their uptake of channels which have the capacity to lower transactional costs and which are easily and readily accessible to their customers. In recent times, banks have made use of channels like mobile banking, internet banking, agency banking and card based transactions. In addition, a new financial services sector called Fintech, or financial technology, is emerging and is taking the place of traditional financial services. This is fully technologically driven. As banks are agents of financial accessibility, this study recommends that they adopt these technologies driven channels as a means to increasing financial access among the population. Governments through their regulatory authorities should push banks and other financial institutions to enhance the implementation of these channels while cutting down on the traditional ones. Real GDP has a positive impact on access to finance and therefore Governments and policy makers should therefore aim at developing policies that not only contribute to GDP growth but also ensure income equality. With wide income gaps, only a few people among the population will access financial services leading to undesired low levels of access.

5.5 Areas for Further Research

Financial accessibility is an important aspect for economic growth of any nation. It leads to financial inclusion which is a common economic blueprint goal of many economies. Technological developments, which can increase financial accessibility, are very dynamic and differ across countries. This study has considered only mobile telephony and internet revolution. Other forms of technological developments are available and their application by the banking industry could positively influence financial accessibility. There is therefore need to empirically explore them. In addition, further research needs to be done on how the effects of technological developments on financial accessibility differ across the five countries.

The study variables were limited to their availability. The series of data used in the study was too short to clearly ascertain the short run and long run dynamics of our choice variables. In addition, a number of country specific data were missing in some years resulting into different number of observations among variables. Future studies therefore need to investigate the relationships using longer time series while making use of data which is complete.

REFERENCES

- Abayomi T. and Olaronke T. (2016). Do Financial and Trade Openness Lead to Financial Sector Development in Nigeria? *Zagreb International Review of Economics & Business*, 19(2) 57-68.
- Abu-Shanab, E., & Pearson, J. M. (2009). Internet Banking in Jordan: An Arabic Instrument Validation Process. *Int. Arab J. Inf. Technol.*, 6(3), 235-244.
- Al-Hakim, L., Wu, X., Koronios, A., & Shou, Y. (2016). Handbook of Research on Driving Competitive Advantage through Sustainable, Lean, and Disruptive Innovation. *IGI Global*. Pp 183.
- Arora, R. U. (2010). Measuring Financial Access. *Griffith University*, Discussion Paper in Economics, (7), 1-21.
- Arora, R. U. (2012). Financial Inclusion and Human Capital in Developing Asia: The Australian Connection. *Third World Quarterly*, 33(1), 177-197.
- Asongu, S. A., & Nwachukwu, J. C. (2017). ICT, Financial Sector Development and Financial Access. *Journal of the Knowledge Economy*. 1-26.
- Bagli, S., & Dutta, P. (2012). A Study of Financial Inclusion in India. Radix International Journal of Economics & Business Management, 1(8), 1-18.
- Bank of Uganda (2014). Status of Financial Inclusion in Uganda.
- Bazhal, I. (2016). The Theory of Economic Development of JA Schumpeter: Key Features (No. 69883). *University Library of Munich, Germany*. Pp 4-8.

- Beck, T., Cull, R., Fuchs, M. J., Getenga, J., Gatere, P. K., Randa, J., & Trandafir, M. (2010).
 Banking Sector Stability, Efficiency, and Outreach in Kenya. *Policy Research Working Paper; No. WPS 5442.* Washington, DC: World Bank.
- Beck, T., Demirgüç-Kunt, A., & Honohan, P. (2009). Access to Financial Services: Measurement, Impact, and Policies. *The World Bank Research Observer*, *24*(1), 119-145.
- Beck, T., Demirguc-Kunt, A., & Peria, M. S. M. (2007). Reaching out: Access to and Use of Banking Services across Countries. *Journal of Financial Economics*, 85(1), 234-266.
- Boyd, J.H., Levine, R., Smith, B.D., 2001. The Impact of Inflation on Financial Sector Performance. J. Monet. Econ. 47 (2), 221-248.
- Burundi Economic Outlook (2016). The Story behind the Numbers. Deloitte & Touche.
- Camara, N., & Tuesta, D. (2014). Measuring Financial Inclusion: A Multidimensional Index. *BBVA Bank, Economic Research Department*. Working Paper, (No. 14/26).
- Central Bank of Kenya (2010). Guidelines on Agent Banking CBK/PG/15. Nairobi: Government Printer.
- Central Bank of Kenya (Various Issues), *Bank Supervision Annual Reports*. Nairobi: Government Printer.
- Central Bank of Kenya (Various Issues), *Monetary Policy Statements*. Nairobi: Government Printer.
- Claessens, S. (2006). Access to Financial Services: A Review of the Issues and Public Policy Objectives. *The World Bank Research Observer*, vol. 21, no. 2. Pp 210.

Cull, R., Ehrbeck, T., and Holle, N., (2014). Financial Inclusion and Development: Recent Impact Evidence. *CGAP Focus Note*, No. 92.

Deloitte & Touche (2016). Burundi Economic Outlook 2016: The Story behind the Numbers.

- Demirgüç-Kunt, A., & Klapper, L. F. (2012). Measuring Financial Inclusion: *The Global Findex Database*. *The World Bank*. (No. 6025).
- Demirgüç-Kunt, A., Beck, T. H. L., & Honohan, P. (2008). Finance for all? Policies and Pitfalls in Expanding Access. *A World Bank policy research report*. Pp 22.
- Demirgüç-Kunt, A., & Levine, R. (2008). Finance and Economic Opportunity. *Policy Research Working Paper 4468*. Pp 17.
- EFInA, (2011). Evaluation of Agent Banking Models in Different Countries. Oxford Policy Management Ltd.
- Efobi, U., Beecroft, I., & Osabuohien, E. (2014). Access to and use of Bank Services in Nigeria: Micro-econometric Evidence. *Review of Development Finance*, 4(2), 104-114.
- Elizabeth Daniel, (1999) "Provision of Electronic Banking in the UK and the Republic of Ireland", *International Journal of Bank Marketing*, Vol. 17 Issue: 2. Pp.72-83.
- Ezzi, Shaza W. (2014). A theoretical Model for Internet Banking: Beyond Perceived Usefulness and Ease of Use. *Archives of Business Research* 2.2: 31-46.
- Fernando, N. A. (2007). Low-Income Households' Access to Financial Services: International Experience, Measures for Improvement, and the Future. *Manila, Philippines, Asian Development Bank*: Pp 1-36.

- Groupe Speciale Mobile Association (GSMA). 2015. "The Mobile Economy: Sub-Saharan Africa 2015." *GSMA, London*.
- Hanafizadeh, P., Keating, B. W., & Khedmatgozar, H. R. (2014). A Systematic Review of Internet Banking Adoption. *Telematics and Informatics*, 31(3), 492-510.
- Karmakar, K. G., Banerjee, G. D., & Mohapatra, N. P. (2011). Towards Financial Inclusion in India. SAGE Publications India.
- Kapoor, S. (2010). Succeeding in UK with the Bank-Focused Model of Mobile Banking. *Finacle Whiteboard*.
- Khayyat, N. T., & Lee, J. D. (2015). A Measure of Technological Capabilities for Developing Countries. *Technological Forecasting and Social Change*, 92, 210-223.
- Koivu, T. (2002). Do Efficient Banking Sectors Accelerate Economic Growth in Transition Countries? *Bank of Finland Institute for Economies in Transition*. Pp 18.
- Kpodar, K., & Andrianaivo, M. (2011). ICT, Financial Inclusion, and Growth Evidence from African Countries. *IMF Working paper* 11/73 13-20.
- Kumar, A., Beck, T., Campos, C., & Chattopadhyay, S. (2005). Assessing Financial Access in Brazil. World Bank Publications.
- Lyman, T., Ivatury, G., and Staschen, S. (2006). Use of Agents in Branchless Banking for the Poor: Rewards, Risks, and Regulation. *Focus Note 38. Washington, D.C.: CGAP.* Pp 4.
- McKay, C. (2011). Ghana: Aiming For Interoperability in Branchless Banking. Consultative Group to Assist the Poor. *Journal of Economic Literature*, 35, 34-44.

- Michael Chibba. (2009). Financial Inclusion, Poverty Reduction and the Millennium Development Goals. *European Journal of Development Research* Vol. 21.
- Ministry of Finance and Economic Development Planning, (2014). National Financial Inclusion Strategy (NFIS) 2015-2020. *Republic of Burundi*.
- Mzobe, N. (2015). The Role of Education and Financial Inclusion in Africa: The Case of Selected African Countries (Doctoral Dissertation, Stellenbosch: Stellenbosch University).
- Nitin, K. (2013). Financial Inclusion and Its Determinants: Evidence from State Level Empirical Analysis in India. *Reserve Bank of India*. Pp 1-23.
- Nsouli, S. M., & Schaechter, A. (2002). Challenges of the 'e-banking Revolution'. *Finance & Development, IMF* 39(3), 48-48.
- Omariba, Z. B., Masese, N. B., & Wanyembi, G. (2012). Security and Privacy of Electronic Banking. *International Journal of Computer Science Issues*, 9(3), 432-446.
- Owens, J. (2006). RBAP Text-a-Payment and G-Cash Cash-in/Cash-out Services: Innovative Banking Services at Your Fingertips. *Journal of Finance*, 12-15.
- Park, C. Y., & Mercado Jr, R. V. (2015). Financial Inclusion, Poverty, and Income Inequality in Developing Asia. Working Paper Series No. 426. Asian Development Bank Economics.
- Porteous, D. (2006). The Enabling Environment for Mobile Banking in Africa. *Department for International Development*, 3(1), 3-4.
- Rabobank Nederland, (2005) Access to Financial Services in Developing Countries. *Economic Research Department*.Pp 2-3.

- Raman et al., (2016). United Republic Of Tanzania: Selected Issues- Macrofinancial Issues. *IMF Country Report* No. 16/255.
- Ramji, M. (2009). Financial Inclusion in Gulbarga: Finding Usage in Access. Institute for Financial Management and Research. Centre for Micro Finance, Working Paper Series No. 26.

Republic of Kenya. Economic Surveys 2007-2016. Nairobi: Government Printer.

- Seven, Ü. & Yetkiner, H. (2016). Financial Intermediation and Economic Growth: Does Income Matter? *Economic Systems*, 40(1), 39-58.
- Shukla, T., & Singh, A. (2015). Financial Inclusion: An Empirical Study of Banking Products. International Conference on Management and Information Systems 18 (20). Pp 17.
- Sophastienphong, K., & Kulathunga, A. (2010). Getting finance in South Asia 2010: Indicators and Analysis of the Commercial Banking Sector. *World Bank Publications*.
- The Boston Consulting Group (2011). The Socio-Economic Impact of Mobile Financial Services: Analysis of Pakistan, Bangladesh, India, Serbia and Malaysia
- Thornton, J., & White, L. (2001). Customer Orientations and Usage of Financial Distribution Channels. *Journal of Services Marketing*, 15(3), 168-185.
- UNCTAD (2014). Impact of Access to Financial Services, Including by Highlighting Remittances on Development: *Economic Empowerment of Women and Youth*. Pp 6.

United Nations (2015): World Economic Situation and Prospects 2015. New York

- World Bank: (2006). Policy Research Report (PRR) on Access to Finance: Measurement, Impact and Policy Concept Note.
- Zins, A., & Weill, L. (2016). The Determinants of Financial Inclusion in Africa. *Review of Development Finance*, 6(1), 46-57.