UNIVERSITY OF GHANA

THE EFFECTS OF MOBILE PHONE TECHNOLOGY ON FINANCIAL INCLUSION IN GHANA

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THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF MPHIL FINANCE DEGREE

JULY, 2017

DECLARATION

I do hereby declare that this work is the result of my own research and has not been presented by anyone for any academic award in this or any other university. All references used in the work have been fully acknowledged.

I bear sole responsibility for any shortcomings.

…… ……

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CERTIFICATION

I hereby certify that this thesis was supervised in accordance with the procedures laid down by the University.

…… ……..

Prof. J. Y. ABOR DATE
(SUPERVISOR)

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Prof. K. A. OSEI DATE
(SUPERVISOR)

DEDICATION

Dedicated to my beautiful daughters, Chelsea Naa Ardua, Miranda Naa Odey and Cheryl-Matilda Arday.

I would like to express my heart-felt gratitude to my loving wife, Nuna Arday for coping with the difficult times during my study. She was a pillar of strength that stood by me and believed in me every step of the way.

I also thank my brothers, Edmund, David, Samuel and Daniel Arday for supporting and encouraging me throughout my study. Last but not the least; I salute my maternal cousin, Nathan Tetteh for his immense support and mentorship.

ACKNOWLEDGEMENT

I acknowledge with immense gratitude the role of my supervisor, Prof. J. Y Abor in my dissertation. He without doubt provided excellent guidance and direction without which completion of my thesis would have been a nightmare. He selflessly pointed me to the right paths and places to source the necessary data as well as providing a conducive environment for the research.

I would also like to express my sincere gratitude to my second supervisor, Prof. K. A. Osei, who patiently counseled, advised and guided on this work.

I also take this opportunity to render sincere gratitude to Prof. Bill Puplampu for encouraging me to take this path.

Great appreciation to Haruna Issahaku of the University of Development Studies for his guidance and taking time to help enhance my understanding of the econometric model used for this research. Special thanks to George Amponsah (my senior) and Mohammed Musah Amin (of UDS) for their immense contribution on probit regression and the general lay out of the study.

I would like to thank my friends, Sylvester Sadekla, David Korsah, Prince Takyi and Norman Adu Bamfo; who were always willing to help and give great inputs.

Many thanks to Robert Nketiah for accepting to proof-read this document.

ABSTRACT

The importance of financial inclusion especially in the developing world cannot be over-emphasized. Several researches have pointed to the positive impact of financial inclusion on poverty reduction and financial integration. Provision of suitable financial services by traditional banks is hampered by poor road infrastructure, high cost of fees, amongst others. Financial exclusion mostly plagues the poor and vulnerable including women and households in rural and semi-rural areas. With estimated mobile phone ownership of 38.8 million in Ghana (NCA, 2017), innovative mobile telephony technology solutions such as mobile money and mobile banking stand to offer potential channels to further financial inclusion.

This study explores the ownership and usage of mobile telephony technology of households in Ghana to ascertain their impact on financial inclusion. The objectives therefore were to assess the determinants of mobile telephony adoption in Ghana and to determine whether mobile telephony technology can be leveraged to achieve financial inclusion in Ghana. It also looks at whether access to financial services enhances the capacity of households to own and use mobile phones. The study is quantitative in nature with data sourced from the Ghana Statistical Services Department; specifically, the Ghana Living Standards Survey (GLSS) R6 Report (2014), an authentic and rich data source on households in Ghana. Overall, 15 households from 1,200 enumeration areas were selected using a stratified sampling process for the GLSS R6 Report. Latent Simultaneous Variable Model was employed using seemingly unrelated bivariate probit to analyze the data. The results of the study show that mobile penetration; that is mobile phone ownership and usage can be leveraged on to achieve financial inclusion in Ghana. Again, the results further show that financial inclusion of households significantly increases the probability

of mobile phone ownership and usage. The results further indicate that males are more likely to own mobile phones than females. Community infrastructure characteristics are also found to impact both financial inclusion as well ownership and usage of mobile phones. These findings provide useful guide for government and the National Communication Authority for policy prescription in enhancing the regulation of the sector. The provision of necessary policy framework for the Mobile Network Operators (MNOs/Telcos), will help to bring about unleashing of relevant products and services for the consumption of households with the object of enhancing financial inclusion.

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ICT	Information and communication technology
WOCCU	World Council of Credit Unions
IMF	International Monetary Fund
GFDR	Global Financial Development Report
MNO	Mobile Network Operator
UNCTAD	United Nations Conference on Trade and Development
PDA	Personal Digital Assistant
PIN	Personal Identification Number
OTP	One-Time Password
PPI	Payment Protection Insurance
GDP	Gross Domestic Product
USAID	United States Agency for International Development
GLSS	Ghana Living Standards Survey
MFI	Micro-Finance Institutions
SSA	Sub-Saharan Africa
AFI	Alliance for Financial Inclusion
EBT	Electronic Benefits Transfer
FII	Foreign Institutional Investor
CGAP	Consultative Group to Assist the Poor
GSMA	Global System for Mobile Communications Associations

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The Information and Communication Technology (ICT) renaissance has changed the face of mobile telephony. The technology of mobile telephony has seen a tremendous rise in its ownership in developing economies not excluding Sub Saharan Africa in recent times. Mobile phones have metamorphosed from a simple gadget, hitherto used for receiving and making simple calls to a complex device used to conduct banking transactions, receive remittances and make bill payments amongst others. Ghana being the context of this study has been no exception in this development. Today, mobile phones are owned and used in every nuke and cranny of the country. In the not too distant past, mobile phones were predominantly used in urban areas of the country and often seen as a status symbol. The story is no longer the same, as the lowliest paid people, including head porters (*kaya yei)* are known to own mobile phones currently.

This study views the proliferation of mobile telephony technology as a positive development that can be leveraged for economic development in a developing economy. Of interest to the proliferation of the mobile telephony technology is financial inclusion; that is, how the technology can be leveraged to offer financial products and services in a transparent manner and at affordable prices to the underserved and unbanked population in Ghana.

Financial inclusion highlights the extent to which individual(s) own, maintain and operate accounts with banks and financial institutions for the purposes of domestic or commercial activities. Embedded in the ownership and maintenance of accounts at banks/financial institutions is the inducement for personal savings which stimulates demand and enhances economic growth in the long run. Maintenance of accounts with banks/financial institutions by

individual(s) remains a critical requirement for accessing of credits to enhance trade and commerce within an economy (World Council of Credit Unions (WOCCU), n.d.). Hence, the act of financial inclusion is at the heart of personal financial independence and a stimulant for economic growth for any economy, especially for a growing economy such as Ghana. The provision of credit and for that matter access to financial services has positive impact on the growth of people and enterprises and benefits the economy through accelerated economic growth (Subbarao, 2009). Furthermore, the role of financial inclusion to achieve economic and social development remains a truism that is asserted by IMF, GFDR (2014). The IMF held the view that, there exists a positive correlation between access to financial services and poverty reduction as well as sustainable development (ibid). Empirical studies also show that, the poor benefit significantly when they have access to basic financial services, including savings, payments and insurance services (Ackah & Asiamah, 2014).

In its basic understanding, according to Cult (2015), financial inclusion relates to 'financial identity' among the citizenry. This implies the extent of access to at least a basic minimum financial service among the citizenry (Bill and Melinda Gates Foundation, 2015). According to Beck, Demirguc-Kunt and Martinez (2008), incomes of those at the lower income ladder typically increases, through effective financial inclusion activities, leading to a reduction in inequality and poverty. Exclusion from the formal financial system, for that matter its services, has increasingly been identified as one of the barriers to a world without poverty (Bello & Adenuga, 2013). The level of financial inclusion of any country therefore is a key pointer to the country's developmental status (Subbarao, 2009). Key players in the financial sector had traditionally linked directly the activities of formal orthodox (traditional) banks and financial institutions with degree of inclusion. Largely, these orthodox/ traditional banks were deemed to

be responsible for ensuring availability of affordable and accessible financial products and services to the people. This is because the traditional banks had generally been playing a key role in the socio-economic development of countries through financial intermediation amongst others. Yet, globally over half of the adult population does not have formal bank accounts, according to the Financial Access Initiative Report (2010). This indicates an enormous threat to an accelerated financial inclusion, globally.

Again, globalization, financial liberalization and ICT (Information and Communication Technology) combined, have revolutionized the banking industry drastically; leading to a fierce competition among players in the sector (Al-Smadi & Al-Wabel, 2011). In that direction, banks have reacted to these changes by increasing the choice of products and services offered to their customers through increased reliance on technology (ibid). That notwithstanding, revolutionizing the banking environment further to cast the net so wide to achieve accelerated financial inclusion, especially among the poor was eminent and has been in motion globally for some time now (Cult, 2015, Mahindra, n.d.). Mobile telephony technology, in the form of mobile money applications on phones provides a channel to expand and revolutionize the traditional financial services and extend access to multiple segments including under-served or unserved groups whilst addressing the very different banking needs for both the banked population in developed markets and the unbanked population in developing economies such as Asia, Africa and Latin America (Bello & Adenuga, 2013, WOCCU, n.d.).

The gap in access and use of financial services remains a challenge in Sub-Saharan Africa (SSA), the most financially excluded region in the world according to AfDB (2013). In Sub-Sahara Africa (SSA), traditional banking is severely hampered by inefficient transportation system and other infrastructure (Cult, 2015), thereby increasing the level of the 'unbanked'

population. Invariably, such a situation becomes a disincentive to effective financial inclusion, especially among the poor and the women, (Smith, 2015; Acquah, 2015). Therefore, there is the need to create a more inclusive financial system capable of breaking the barrier to economic growth and by extension socio-economic development, as noted in Beck *et al.* (2008). In that regard, without a revolutionary intervention in the banking environment (i.e. financial system), the traditional banks alone cannot facilitate financial inclusion that is capable of effectively integrating the poor among the financial service users (Bill and Melinda Gates, 2015).

Whilst mobile telephony technology, in a form of mobile banking, emerged as the foremost tool in this revolution, the developing world leads the way, geographically (Subbarao, 2009; Bill and Melinda Gates Foundation, 2015). Mobile banking is one of the many channels of digital banking which is a low-cost, safe and convenient method of banking that enable customers to manage their money digitally (i.e. basic financial service) via basic mobile phones; that is, mobile telephony technology (ibid). Again, mobile phone users have been observed to have out-numbered bank account holders in not only African countries, but that of far East-Asia as well, which India and Pakistan feature the most prominent (Arun, 2012; AfDB, 2013). In that regard, the gap between banking penetration and mobile telephony penetration in the developing economies means that while many people do not have access to financial services, they do have a mobile phone (Bello & Adenuga, 2013). As a result, both East-Asian and African governments have regarded mobile technology as one of the most promising tools for expanding access to finance and achieving financial inclusion due to the ubiquity of mobile phones and good mobile network coverage, even in rural areas, hence rigorously promoting the use of mobile phones in diverse ways among the citizenry (Arun, 2012). The ubiquity of cell phone services offers the possibility of financial services in remote areas of a country where it would be otherwise

economically unsustainable to provide traditional banking services. These services could enhance financial inclusion especially when appropriate model(s) is/are well implemented and adopted (Bello & Adenuga, 2013).

Capitalizing on the phenomenal growth of mobile telephony penetration as well as inability of traditional banks to serve majority of the lower income population groups in Africa and Asia, many mobile service providers (i.e. Mobile Network Operators-MNOs) are already active in deploying mobile banking services to tap the demand from the large unbanked population in the said regions. For instance, in November 2012, the United Nations Conference on Trade and Development (UNCTAD) revealed that 40 million mobile money users existed in Africa and projected to rise to 1.2 billion by the close of 2015 (Bello & Adenuga, 2013). Mobile payments technology, via basic mobile phones, has increasingly become significant, especially in the context of developing economies where many low-income households and micro-enterprises do not have ready access to financial services (AfDB, 2013).

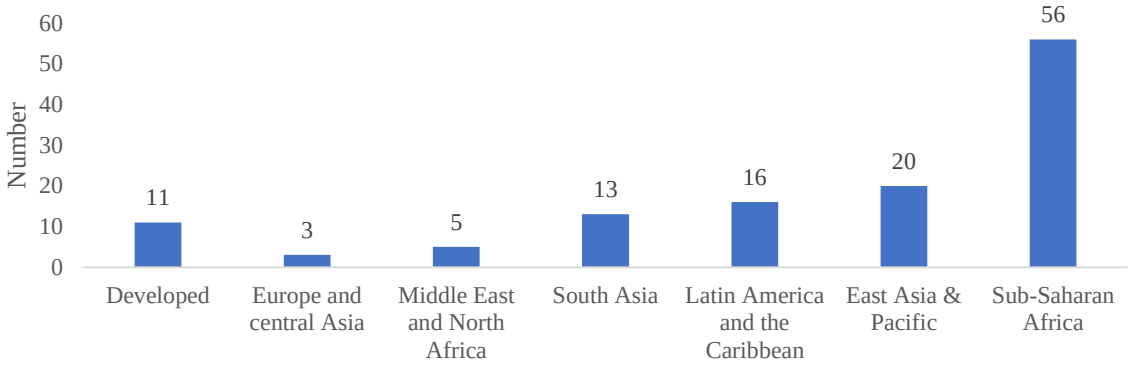
Mobile money platform of mobile banking technology (digital banking) has the potential to transform the lives of 1.8 billion people, globally, with access to a mobile phone but not a bank, according to USAID (2012). Therefore, aided by mobile telephony technology, mobile money platform can connect the last mile to basic financial services. Mobile money transaction, which is a key aspect of mobile banking technology, was projected to become a $617 billion industry by 2016, as revealed in Botsman (2014). In this direction, a continent often regarded as lagging behind the rest of the World, Africa, is leading the way in mobile money transaction in the world (Botsman, 2014) as shown in Figure 1.1 below. Digital banking through the mobile money platform as aided by mobile telephony technology will give the poor more control over their

assets and help them transform their lives and the key to this is mobile phones, according to Bill and Melinda Gates Foundation (2015).

"Two billion people who do not have bank account today will be storing money and making payments on their phones by 2030 and that full range of financial services, from interest-bearing accounts to credit and insurance products, will be available on the phone platform'' (Bill and Melinda Gates Foundation, 2015).

Innovation within the mobile telephony industry was first ignited in Zambia where the first mobile payment was made in April 2002 by Celpay Zambia. This created the platform for the hitherto financially excluded to experience affordable and accessible payment products and services. In 2007, Safaricom in Kenya equally innovated and launched M-PESA (M meaning, mobile; and PESA meaning 'money' in Kiswahili); a mobile network operator-led model; (Kusimba, Chaggar, Gross & Kunyu, 2013). The pursuit of reaching out to the underserved and unbanked populations of Africa engendered a massive introduction of mobile money as alternative payment platform across Africa. As mobile telephony technology via phones have become more widely available, mobile payment transfers have helped reach "the unbanked" in at least eight countries in Africa- including Congo, Uganda, Somalia, Tanzania, Cote d'Ivoire, Kenya, Ghana and Zimbabwe (The Economist, 2015; Adjei, 2016). Figure 1.1 below shows the extent of mobile money deployment across World Bank regions by 2012.

Figure 1.1 Number of Mobile Money Deployments by World Bank Region, March 2012



NB: All figures are in tens.

1.2 Statement of the Problem

It is estimated that 2.5 billion adults, just over half of world's adult population, do not use formal financial services to save or borrow (World Bank, 2016; WOOCU, n.d.). In Sub-Saharan Africa, 325 million people (80% of the adult population) remain unbanked as compared to only 8% in high income OECD (The Organization for Economic Cooperation and Development) countries; (Chaia, Dalal, Goland, Gonzalez, Morduch & Schiff, 2009). Smith (2015) observed that only a little over 40% in the developing world have traditional/formal financial account. This is because these accounts are expensive to maintain and require credit history for which the poor is excluded thereof (ibid). According to Demirguc-Kunt and Klapper (2012), approximately three-quarters of adults living on less than $2 a day (i.e. the absolute poor) do not have an account at a financial institution. In that regard, Cult (2015) maintained one-third of adults without an account blame cost of operating and maintaining an account or the banks being too far away as the causes for their unbanked status. Meanwhile, at least in 28 countries around the world, there are more mobile money agent outlets which employed varied mobile telephony technologies to serve basic financial transaction needs of clients than formal bank branches (Claire, 2012). In

Sub-Sahara Africa (SSA), traditional banking is severely hampered by poor understanding and knowledge of the formal banking system on the part of illiterate masses, inefficient transportation system and other infrastructure deficiencies as well as high level of low-income earners, thereby increasing the level of the 'unbanked' population (Subbarao, 2009; Cult, 2015; World Bank, 2016).

Furthermore, traditional banks have little regard for low value transactions that the chunk of the poor or low-income earners may engage in (Smith, 2015). The banks' preference lies in the high-frequency transaction-based businesses which they deem as cost-effective. Again, banks are often hesitant to set up and maintain branches in remote rural areas, where mostly the poor and the vulnerable are heavily concentrated, due to the large fixed cost investments and issues of operating costs exceeding operating profits (Cult, 2015). Invariably, this to a large extent proves disincentive to efforts at promoting effective financial inclusion, especially among the poor and the women, (Smith, 2015; Acquah, 2015).

It is observed that whilst mobile money banking covers 16% of the banking market shares, only 12% of SSA population without a formal bank account ("unbanked") uses mobile telephony technologies via their mobile phones to access financial services through payments and withdrawal transactions (World Bank, 2016). This indicates a considerable number of the SSA populace still lack access to financial services, hence excluded financially. This lack of formal financial services limits access to credit, savings, remittances, insurance, and other instruments that play significant role in providing the poor and vulnerable populations with financial protection from health care costs (Subbarao, 2009; USAID, 2012). Consequently, it can be inferred that the poor is the most financially excluded, especially where the traditional banking institutions dominate the financial industry (Smith, 2015).

Therefore, without any intervention, the banks cannot facilitate accelerated financial inclusion effectively, as argued in Bill and Melinda Gates Foundation (2015). However, despite the over 100 mobile money products deployments around the world to facilitate financial inclusion, only a handful has reached economies of scale (USAID, 2012). This implies that a large proportion of the population can be said to have no bank account or no formal banking relationship. Such exclusion from formal financial services; that is financial repression, has economic and social impact which may exacerbate existing poverty levels. Evidence abounds that the financial repressions, from both formal and informal sources of finance interact with many other economic, social, and demographic factors (Mahindra, 2016). Clearly the services provided by the traditional banks cannot be deemed sacrosanct to help in facilitating financial inclusion; thus, a hand-held technology, such as the mobile phone, with high penetration rate capable of helping the underserved and the unbanked in performing basic financial transaction may hold the key.

There is also available literature that suggests that there is a gap between banking penetration and mobile phone penetration in developing economies; meaning that while many people do not have access to financial services, they do have mobile phones (Bello & Adenuga, 2013). The ubiquity of mobile phone services therefore offers the possibility of service in remote areas of a country where it would be otherwise economically unsustainable to provide banking services by the traditional banks. These services could enhance financial inclusion especially when appropriate model(s) is/are well implemented and adopted (Bello & Adenuga, 2013). According to USAID (2012), 1.8 billion people across the globe with access to mobile phones but without a bank account will potentially have their lives transformed through mobile technology. However, to what extent the unbanked proportion of Ghanaians have been financially included through

alternative medium other than traditional banks, such as the mobile telephony technology remains the focal point of this study.

Notwithstanding the over 120 years of banking experience in Ghana; (Fry, 1976); banking penetration hovered around 36% by 2015; (Pricewaterhouse Coopers, 2016). This indicates that more than half of adult population in Ghana has no formal bank account; that is, unbanked.

On the other hand, it can be seen from Table 1.1 below, that in a space of less than a decade, precisely 8 years, mobile phone voice subscription increased by 153.5 per cent, showing an extreme growth in that sector. Reports from the National Communications Authority, Jan. 2017, reveals that as at the end of December 2016, Ghana's mobile phone penetration was at 136.43 per cent with a market share of 38.3 million mobile voice subscription. Given the above indication and with an estimated country population of 26.3 million; (Ghana Statistical Service, 2014), it can be inferred that mobile telephony technology could be the leading tool to bring financial inclusion to the unbanked and the under-served in Ghana, just as any developing economy. However little literature is available to show how the adoption and usage of mobile telephony technology drive financial inclusion, especially in the developing world. For instance, Table 1.1 below shows the result of National Communications Authority's study of mobile phone penetration and voice subscription; the study however did not indicate the relationship between mobile phone penetration and financial inclusion. Similarly, Deloitte (2012) found that mobile communication services have become an essential part of how economies work and function. However, Deloitte (2012) did not go further to specify which of the mobile communication services are essential to specifically drive financial inclusion, as an element of the macroeconomic space and how that works. Furthermore, in his assessment of the Indian economy, Subbarao (2009) concluded that financial inclusion is very critical for reducing

poverty simply because it is a necessary condition for sustaining equitable growth. Subbarao (2009) failed to show how that will happen and through what medium. Hence, the focus of this study remains;

How the technology of mobile telephony can influence accelerated financial inclusion in Ghana, just as any other developing economy.

Table 1.1: MOBILE PHONE SUBSCRIPTION & PENETRATION TREND

Source: Ghana National Communication Authority, Jan. 2017.

1.3 Objectives of the Study

The study seeks to investigate how mobile telephony technology can be leveraged on, to bring about accelerated financial inclusion in Ghana. On that basis, the study also seeks to investigate the effects of the determinants of mobile technology adoption in Ghana. Hence the objectives of the study are:

i. To investigate the determinants of mobile technology adoption in Ghana.

ii. To examine the effects of mobile technology on financial inclusion in Ghana.

1.4 Research Questions

This study seeks to address the following questions:

i. What factors drive the adoption of mobile phone technology in Ghana?

ii. Can mobile phones be leveraged to enhance financial inclusion in Ghana?

1.5 Significance of the study

This study aims to eventually not only fill literary key gaps but also confirm findings of previous studies in the literally landscape of mobile technologies and financial inclusion in the context of a developing country such as Ghana. Therefore, how mobile telephony technology contributes to financial inclusion in Ghana is established from this study. Furthermore, the study highlighted the factors that influence adoption of mobile phone technology as a tool for financial inclusion in Ghana. To that extent, it reveals the importance of households' location (rural or urban), gender, age, educational level and income level amongst others in determining the adoption of mobile phone technology in Ghana. Whilst these findings will eventually define the adoption pattern of mobile phone technology in Ghana, it would also have the propensity to galvanize Mobile

Network Operators to promote and market relatively cheaper mobile phones for consumers with government ensuring sound regulatory environment and the relevant policy framework. Again, the findings of this study provide grounds for further investigation and probing of the sector so as to improve upon financial inclusion efforts in Ghana in particular and the SSA Region in general.

1.6 Scope and Limitation of the Study

The study looks at assessing the determinants of mobile phone technology as well as establishing how the mobile telephony technology affects financial inclusion, especially among the financially excluded in Ghana. The study examines the driving factors behind mobile phone adoption and how that can be leveraged to achieve financial inclusion in Ghana.

As in most empirical research, this study has some limitations which create the scope for future researchers to delve into. Firstly, the study is limited to a year-long period, hence constrained by time. The study was also constrained logistically. Finally, the study did not delve into how the facets of mobile phone technology, such as mobile money and mobile banking impact on financial inclusion in Ghana. The study did not also isolate people with access to both traditional bank services and mobile financial services.

1.7 Organization of the Study

The report of this study is presented in five chapters. Chapter one dwelt on the introduction of the study which highlighted the background and context as well as the motivation for this work; the problem statement. It also articulates the objectives and questions the study intends to address and find answers to, as well as the significance and scope of the study.

Chapter two presented the literature review in line with the study's objectives to establish the conceptual framework for the modeling which informs the study's approach. It thus highlights and discussed various concepts and definitions relating to the literature of the study.

Chapter three of the study discussed the methodology, including research design, approaches and the sample size applicable in the context of this study. This chapter as well reviewed the instrumentation used for data collection and how data collected was analyzed.

Chapter four highlighted the results of the data so analyzed and discussed findings by juxtaposing it with existing literature relative to the context of this study. This provided the researcher an opportunity to connect data with objectives of this study to determine if the research questions have been answered by the findings thereof.

Chapter five, being the final chapter, summarized the study's findings and highlights the practical implications as emanating from the findings. Therefore, suggestions and recommendations relative to the findings of this study were proffered in addition to the conclusion.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter purposely reviewed existing literature from varied authorities, researchers and writers alike concerning financial inclusion trends and how it is affected by mobile telephony technology. In that regard, this chapter contains definition and evaluation of key concepts of the study. In addition, evaluation of varied but appropriate theoretical dispositions and empirical research findings were presented and analyzed respectively towards projecting the gap(s) inherent in the literature of financial inclusion and ultimately building the conceptual framework upon which this study is hinged.

2.2 Financial Inclusion

The definition of financial inclusion had received inputs from both academics and policy makers and continued to be in evolution (Sinclair, 2001). The terminology 'financial exclusion' was first used in the context of limited physical access to banking services because of woefully insufficient quantum of bank branches by geographers (Leyshon & Thrift, 1993). Over time, the term evolved and seems to be used broadly for the first time to refer to 'people who have constrained access to mainstream financial services' as observed in Kempson and Whyley (1999). In contemporary literature, the term Financial Inclusion has evolved so much that policy makers as well as academia have adopted it as a social goal worth pursuing beyond just a terminology. In the past decade, the goal of financial inclusion has been to ensure that every individual has access to quality and affordable financial service and has since become an

increasing priority and possibility worldwide (Mertz, 2010). Financial inclusion aims at benefiting the world's poor; the clear majority of whom do not use formal financial services of the sort provided by banks, insurers or Microfinance Institutions (MFIs) (ibid).

In its basic understanding, according to Cult (2015), financial inclusion relates to ensuring 'financial identity' among the citizenry, especially the excluded. This implies the extent of access to at least a basic minimum financial service among the citizenry (Bill and Melinda Gates Foundation, 2015). Financial inclusion or inclusive financing is the delivery of financial services at affordable costs to sections of disadvantaged and low-income segments of society (Mahindra Comviva, 2017). In a similar way, financial inclusion has been put forward as a set of measures to promote full financial integration of people excluded from the financial sector because they are in a situation of economic and social difficulties (Kempson *et al.,* 2000; Anderloni, 2003).

Clearly, the definitions above, as relates to financial inclusion, largely concentrated on two key variables- *Access* to basic financial services/products and Poor/Excluded/Vulnerable/Lower-Income groups with none indicating what the specific services/products were. However, this study examined level of access to specific financial services/products in relation to mobile technology adoption as a *driving* as well a *consequent* factor, in the Ghanaian context.

Therefore, conceptually, this study focused on not only access to financial service/product but the extent of it as a function of mobile phone technology adoption and vice-versa. Consequently, the general operative definition of financial inclusion for this study, as advanced by De Koker and Jentzsch, (2013), is the process of ensuring high level of access to formal financial services/products at an affordable cost in a fair and transparent manner. The provision of financial services seeks to meet the payments, savings, credit, insurance, financial management and investment needs of the excluded. It is argued that as banking services are public good, the

availability of banking and payment services to the entire population without discrimination is the prime objective of financial inclusion public policy (Mahindra Comviva, 2017). For instance, in Sub-Saharan Africa (SSA), traditional banking is severely hampered by inefficient transportation system and other infrastructure (Cult, 2015). Consequently, this becomes a disincentive to effective financial inclusion as it increases the level of the unbanked population (Smith, 2015; Acquah, 2015). Hence, 'financial exclusion as a function of financial infrastructure gap and more visible in most African countries' is a truism (Andrianaivo & Kpodar, 2011).

Similarly, the Alliance for Financial Inclusion (AFI) defines financial inclusion as 'all initiatives that make formal financial services available, accessible and affordable to all segments of the population (Ackah & Asiamah, 2014). The AFI argues that, special attention be directed to the financially excluded segments of the population as a result of their low income level, gender, location, type of activity and level of financial literacy.

In his simplistic view, serving as the Governor of Reserved Bank of India, Subbarao (2009) advanced that those that do not have access to financial services, in any form, are said to be financially excluded. It is easier to understand inclusion from an understanding of what it is not – i.e. **Financial Exclusion.** Inclusion has failed when poverty, combined with the high cost of delivery of inclusion and lack of regulation, makes it unviable for financial services to be provided or is underserved; hence financial exclusion sets in (Mahindra Comviva, 2017). The term financial exclusion has also been defined as a process whereby people encounter difficulties accessing and/or using financial services and products in the mainstream market that are appropriate to their needs and enable them to lead a normal social life in the society in which they belong (European Commission, 2008).

Furthermore, Leyshon and Thrift (1993) have broadly explained 'financial exclusion' as the inability to provide required financial services in an appropriate way to needy borrowers or users arising out of conditions of the needy, difficulty in accessing the service, prices of the financial products and services, self-exclusion due to discouraging experiences or perceptions of individuals or entities and marketing inefficiencies.

Access Exclusion: This refers to the imposition placed on people to access financial services and products arising from risk assessment process.

Condition Exclusion: This refers to the situation where conditions attached to financial products render them unsuitable for the needs of some people.

Price exclusion: Price exclusion refers to instances where pricing of financial products and services are so high that they become unaffordable to people. Hence, only few people can afford financial services and products at this price.

Marketing Exclusion: This is the intentional and deliberate exclusion of certain category of people from the target market by financial service providers. This category of people so excluded is not covered under any of the marketing or sales promotional activities conducted by the bank.

Self-Exclusion: This refers to the state of people believing that they are barred from accessing financial products and services by the bank and hence do not envisage any need to apply for financial services and products.

Interrogating the forgone respective category descriptions of exclusion, such exclusion resulted from the actions or inactions of the formal traditional/orthodox banking institutions. As noted in Smith (2015), such actions are deliberately carried out to ensure only the middle class with the

requisite addressing system; stable job and literate are encouraged to bank with the elite banks in most developing countries.

This study, meanwhile, tried to examine how the financially excluded, irrespective of their social statuses can access such financial inclusiveness access platforms other than formal/traditional/orthodox banks that enable them to be captured in the financially inclusive net in Ghana.

2.2.1 Mobile Telephony Technology

Tcheng (2007) defined mobile telephony technology in terms of Information and Communication Technology (ICT) characteristics. In that regard, according to Tcheng (2007), ICT development is increasingly considered a factor in economic growth rather than a consequence of it. Three characteristics of ICT explain this view: (i) ICT is omnipresent in most business sectors, (ii) ICT improve continuously and therefore reduce costs for the users, and (iii) ICT contributes to innovation and to the development of new products and processes. In Gates notes, mobile telephony technology was described in relation to mobile banking as it was defined as a simple digital device that allows individuals not only to communicate but transact/access basic financial services without much difficulty (Bill and Melinda Gates Foundation, 2015). According to Iddi (2015), mobile telephony technology serves as device(s) for the purposes of communication, storage, reminders, calendars, identification and now increasingly used for banking transaction. In this regard, IGI Global (2017) had defined mobile telephony technology in terms of services that enable phones to move freely than stay fixed in a location, in offering range of benefits for the user. Mobile telephony is observed to be one of the key technologies

that have drastically transformed the way in which consumers and businesses operate in developing countries (Deloitte, 2012).

Inferring from the descriptions of mobile telephony technology above, both Iddi (2015), Bill and Melinda Gates Foundation (2015) had made conscious efforts to relate their respective definitions to mobile banking and by extension financial inclusion. However, such approach failed to recognize the extent to which mobile telephony technology relate specifically to financial inclusion, not necessarily within the formal mobile banking sector. Again, IGI Global (2017) and Deloitte (2012) were more concerned on mobile telephony technology impact on economic growth instead of financial inclusion specifically, especially in the informal sector of the economy. In that regard, this study sought to primarily establish the extent mobile telephony technology impacts on financial inclusion as a sub-sector of the economy. In that direction, this study considered mobile telephony as not just a *push-factor* toward financial inclusion or economic growth as alluded to in the varied descriptions but the *extent* of that push.

2.3 Theoretical Perspectives

2.3.1 Economic Growth, Mobile Telephony as ICT Scheme and Financial Inclusion

ICT development is increasingly considered a factor in economic growth rather than a consequence of it, as argued in Tcheng, Huet, Viennois and Romdhane (2007). As technology develops, mobile (telephony) services have the potential to further impact economic development through the provision of high value 3G and 4G data services accessed via smart phones, tablets and dongles that deliver mobile data services to businesses and consumers, as maintained in Deloitte (2012). The mobile telecommunication sector continues to offer unprecedented opportunities for economic growth in both developed and developing markets and

mobile communication services have become an essential part of how economies work and function, as further posited by Deloitte (2012). This very disposition was strongly supported by demonstrating the huge quantum of jobs the mobile telephony industry in Ghana generated by close of 2015 in Adjei (2016).

Andrianaivo and Kpodar (2011), in their work using quantitative approach in assessing sampled African countries relative to ICT, financial inclusion and growth, posited that financial infrastructure gap exists in Africa which adversely affects growth. Among the number of schemes deployed to overcome the challenge is ICT in mobile banking to aid branchless banking services; for instance, mobile financial services are increasingly popular as maintained by Andrianaivo and Kpodar (2011). In this instance, ICT schemes can lead to better financial inclusion and therefore facilitate financial development, as argued further by Andrianaivo and Kpodar (2011). In his perspective, as he delivers his remarks during Reserved Bank of India's Club meeting in Kolkata, Subbarao (2009) made a strong argument for the need for effective financial inclusion due to its enormous effect on growth. Financial inclusion is important simply because it is a necessary condition for sustaining equitable growth, argued Subbarao (2009). There are few, if any, instances of an economy transiting from an agrarian system to a post-industrial modern society without broad-based financial inclusion (Subbarao, 2009). As people having comfortable access to financial services, we all know from personal experience that economic opportunity is strongly intertwined with financial access (ibid). Such access is especially powerful for the poor as it provides them opportunities to build savings, make investments and avail credit (Mahindra, Comviva, 2017). Importantly, access to financial services also helps the poor insure themselves against income shocks and equips them to meet emergencies such as illness, death in the family or loss of employment. Needless to add that

financial inclusion protects the poor from the clutches of usurious money lenders, concluded Subbarao (2009).

There is another benefit of financial inclusion which we have yet to fully appreciate let alone exploit; financial inclusion will make it possible for governments to make payments, such as social security transfers as posited by Subbarao (2009). This has the propensity to minimize transaction costs including leakages. Financial inclusion provides an avenue for bringing the savings of the poor into the formal financial intermediation system for investment. Secondly, the large number of low cost deposits will offer banks an opportunity to reduce their dependence on bulk deposits and help them to better manage both liquidity risks and asset-liability mismatches (Subbarao, 2009). The conviction that inclusive and efficient financial markets have the potential to improve the lives of citizens, reduce transaction costs, spur economic activity, and improve delivery of other social benefits and innovative private-sector solutions, looks grounded. (Mahindra Comviva, 2017). In their time-series quantitative analysis of sampled African Countries, Andrianaivo and Kpodar (2011) concluded that mobile phone telephony technology fosters economic growth through better financial inclusion. Using Generalized Method Moments (GMM) estimator in their work, Andrianaivo and Kpodar (2011) confirmed that mobile telephony adoption contributes significantly to economic growth in African Countries and that the positive effect on growth was partly due to greater financial inclusion. Well-functioning financial systems serve a vital purpose, offering savings, credit, payment, and risk management products to people with a wide range of needs.

Inclusive financial systems allowing broad access to financial services without price or non-price barriers to their use are especially likely to benefit poor people and other disadvantaged groups (Demirguc-Kunt & Klapper, 2012). In the perspectives of Demirguc-Kunt and Klapper (2012),

without inclusive financial systems, poor people must rely on their own limited savings to invest in their education or become entrepreneurs; and small enterprises must rely on their limited earnings to pursue promising growth opportunities. This can contribute to persistent income inequality and slower economic growth, concluded Demirguc-Kunt and Klapper (2012). Financial inclusion will provide poor individuals with the opportunity to improve their standard of living, asserted by (Mertz, 2010). It can enable companies, especially financial services providers to do good while gaining access to many profitable new customers in dynamic and high-growth markets, continued (Mertz, 2010). For countries, it has the potential to stimulate economic activity and improve the overall quality of life of their citizens. The potential for positive social and economic impact is tremendous, maintained by (Mertz, 2010).

As a mobile technology consultant organization, Mahindra Comviva (2017) agreed that mobile telephony technology is one of the key initiatives driving financial inclusion. However, that alone was observed as not sufficient to push the financial inclusion drive (ibid). Policy as well as regulation remains the key cornerstone in driving financial inclusion in any jurisdiction, especially the developing world where more than half of the population are unbanked (Mahindra Comviva, 2017). Similarly, Iddi (2015) advocated for a strong policy regulation to streamline the sector. This is a strong catalyst to reduce the threats of conflict (silent war) between key players in the financial sector and that of mobile network operators (MNOs), which by extension will enhance the sector for the benefit of the consumer, argued by Iddi (2016).

Observing the dispositions above, whilst the theories have concentrated much on how mobile telephony, as a scheme of ICT could drive financial inclusion and by extension stimulate growth, none of the theorists have related to specific determinants of mobile technology in the scheme of ICT in promoting financial inclusion. In their approach, Deloitte (2012) concentrated specifically on the relationship between mobile telephony technology penetration and economic growth.

In this regard, determinants of the mobile technology and their effect(s) on growth a consequent of partly financial inclusion were not clearly and sufficiently defined. Again, Demirguc-Kunt and Klapper (2012) as well as (Mertz, 2010) were on financial inclusion as a driving factor of economic growth, whilst Mahindra Comviva (2017) projected the relevance of policy regulation aside technology in driving financial inclusion. Therefore, this study probed and assessed determinants of mobile telephony technology and how they affect financial inclusion specifically.

2.4 Determinants of Mobile Telephony Technology Relative to Financial Inclusion

As many initiatives to promote financial inclusion have failed, some experts argued that technology is the answer (Thatte, 2017). But not all technologies are suitable for all-inclusive finance due to affordability, accessibility, security and privacy, countered by Sumanjeet (2008). However, many literally works have established that mobile telephony technology had been recognized as a suitable technology platform for e-banking among mostly unbanked population (Botsman 2014; Smith, 2015; Bill and Melinda Gates Foundation, 2015).

In this regard, available literature provides various reasons or factors that explain the adoption/acceptance of information technology, including electronic banking and mobile telephony technology. One notable and frequently used theory is the Technology Acceptance Model (TAM), propounded by Davis (1989). The TAM seeks to explain the acceptance of systems with the ability to predict their adoption. According to Davis (1989), the TAM is built on two constructs, namely, *perceived usefulness* and *perceived ease of use*.

'Perceived usefulness' refers to the 'degree' to which a person believes that using a particular system would enhance his or her job performance. Consequently, if a system is viewed to be relatively high in perceived usefulness, it increases user's level of acceptability of that system.

'Perceived ease of use' refers to the 'degree' to which a person believes that using a particular system would be free of effort- where effort is understood to include both physical and mental effort as well as how easy it is to learn to use the system; (Davies, 1989). Consequently, if the system is viewed to be too difficult to use, to the extent that the benefits to be derived pale into insignificance as compared to the effort of using the system itself, it will lead to rejection by users. It has been shown through several empirical researches and established that, TAM ('perceived usefulness' and 'perceived ease of use') is superior to other models given its ability to predict intention towards adoption of information technology, including e-banking and mobile telephony technology; (Pikkarainen, Pikkarainen, Karialuoto & Pahnila, 2004).

On this note, Thatte (2017), Bill and Melinda Gates Foundation (2015) as well as Andrianaivo and Kpodar (2011), concluded that mobile phone device fits well into the picture of e-banking among the underserved and unbanked population because of its suitability in meeting the TAM constructs.

Hand-Held Mobile Phone Device/ Smartphones

To evaluate the efficacy of mobile technology in attainment of accelerated financial inclusion through mobile banking in the Indian context, Thatte (2017) defined the determinants of mobile telephony technology relative to the following parameters: The mobile phone, extended battery-life of the phone and interconnection infrastructure with bank. In view of Thatte (2017), having put these parameters in place, mobile banking has the potential to increase the efficiency of payment systems, reduce reliance on cash, and broaden access to financial services (Peha & Khamitov, 2005) and most importantly lowering the cost of offering formal financial services. For example, transactions cost involved in mobile banking as it can be observed from the mobile services of Kenya and the Philippines, where a typical transaction through a bank branch costs

the bank US$2.5; it would cost only US$0.50 if it were automated by using mobile phone (Thatte, 2017).

A solution based on mobile phones can therefore substantially reduce the cost of spreading financial services over many retail environments; at least in areas with relatively high mobile phone penetration, concluded by Thatte (2017). Another benefit is the "anywhere/anytime" characteristics of banking that mobile phones have which is very important for rural people. A mobile phone is almost always with the customer (Thatte, 2017). As such it can be used over a vast geographical area (ibid). Customer does not have to visit the bank branch or ATM to avail himself/herself of the bank's services. Research indicates that the number of footfalls at a bank's branch has fallen drastically after the installation of ATMs (Thatte, 2017). Thatte (2017) continued that the bank could remind customers of outstanding loan repayment dates, dates for payment of monthly instalments, electricity, and water bill or simply tell them that a bill has been made on the card, maintained by Thatte (2017).

Mobile telephony allows expansion and access to financial services to previously underserved groups in developing countries (Andrianaivo and Kpodar, 2011). It reduces the costs of transaction, especially the costs associated with running brick and mortar branches. The increase in the use of mobile telephony in developing countries has contributed to the emergence of branchless banking services, thereby improving financial inclusion (Andrianaivo and Kpodar, 2011). This increased access to financial services for underserved people helps narrow the financial infrastructure gap, especially in developing economies where the costs of distance and time are very high for formal banking services, concluded by Andrianaivo and Kpodar (2011).

Meanwhile, Subbarao (2009) defined mobile telephony technology relative to financial inclusion in terms of a *hand-held-mobile* device that can be electronically linked to banks for banking transaction. In this direction, Subbarao (2009) referred to the current Indian Electronic Benefit Transfer (EBT) technology as a celebrated success in ensuring 100% financial inclusion in some Indian provinces. The Reserved Bank of India (RBI) encourage banks to extend some level of benefits to villages that have topped in using mobile phones to transact not only private business, but pay public utility bills in their respective provinces in the country. In developing economies, banking penetration is low while there is high penetration of mobile phone users, advanced in Mahindra Comviva (2017). This presents *mobile phones* as an ideal ICT platform to increase the outreach of financial services (ibid). This is the same position observed in Subbarao (2009).

For a Bank to reach its customers as well as to widen its customer base without investments in physical infrastructure, like branches and ATMs, mobile banking presents a good opportunity to undertake branchless banking, observed by Mahindra Comviva (2017). Mobile banking can dramatically reduce cost of acquisition and servicing a customer, and the service area that can be 'banked' (ibid). Mobile banking not only is greatly beneficial to customers, but also allows banks to increase their clientele base by enrolling customers who are outside the range of their traditional bricks and mortar service delivery, as further argued by Mahindra Comviva (2017). On this basis, WOCCU (n.d.), described their approach at improving financial inclusion through the basic mobile phone as a Field-Officer led model. In the field officer model, according to WOCCU (n.d.), designated credit union staff regularly travel to rural communities to provide the credit union's services in an informal group setting. Field officers use Personal Digital Assistants (PDAs) or smart phones, such as the iPhone, to remotely create or access member accounts (WOCCU, n.d.). Furthermore, WOCCU (n.d.) argues that it relied on its bargaining power as a

global organization in microcredit and centralized services, to create a significant network that reduces operational costs of implementing the field officer-led/smartphone model, to enhance financial inclusion in its catchment areas- most especially in the South American countries. In this regard, the networking is made possible using a designed software application which is integrated into the WOCCU's core banking systems. This explains the interconnection infrastructure with the banks as observed in Thatte (2017).

Mobile Payments Platform

Having concentrated much on mobile banking, Mahindra Comviva (2017) went further to make a case for mobile payments which distinguishes its works as a communication consultant organization from both Thatte (2017) and Subbarao (2009). To enumerate the determinants of mobile telephony technology relative to financial inclusion, aside mobile banking technology, Mahindra Comviva (2017) noted that mobile payments require a prepaid amount to be available for a transaction to be allowed. Such types of prepaid are Prepaid Payment Instruments (PPI) which also present a business case for financial inclusion, argued in Mahindra Comviva (2017). Prepaid Payment Instruments, according to Mahindra Comviva (2017), are those instruments which permit transactions for value stored in them. The prepaid instruments can be issued as smart cards, prepaid cards, internet accounts, mobile accounts, mobile wallets or any such instruments which can be used to access prepaid digitized cash, asserted by Mahindra Comviva (2017). These prepaid instruments can provide payment services and small value deposits and hence become an alternate method of financial access, concluded by Mahindra Comviva (2017). This is a step further to improve upon the determinants observed in Thatte (2017) as well as Subbarao (2009) as Mahindra Comviva (2017) tried to situate how mobile payments, instead of mobile banking can improve financial inclusion.

How Prepaid Payment Instruments, as determinants of mobile telephony technology, work in improving financial inclusion?

When money is deposited in the PPI (e.g. digital/mobile wallet) it is stored in an Escrow account with the partner bank, described by Mahindra Comviva (2017). The money of the customer is as safe as it is in a bank account, asserted by Mahindra Comviva (2017). To that extent, mobile prepaid payment companies provide the same level of security features like SMS alerts, PIN and helplines to ensure the security of customer money and transactions. Prepaid Mobile Wallets can offer under-banked and digitally underserved consumers, access to traditional banking functionalities and access to features like utility payments, online merchants and anytime recharge. Moreover, governments too can use prepaid wallets for making social benefit payments to customers because it has cheaper infrastructure costs and is less operationally challenged (Mahindra Comviva, 2017).

The significance of Prepaid Payment Instruments (PPIs):

Mobile Payment platforms are important for several reasons - not only have they changed the dominant cash culture, they have also provided financial inclusion to the unbanked but to a more limited degree than mobile banking. Mobile Payments has now gone main stream, according to Mahindra Comviva (2017). In Kenya, there's the example of unprecedented success of M-Pesa (meaning 'mobile money' in Kiswahili), but other examples of success in mobile payments implementations are now growing in numbers and include Orange-Money, MTN-Money, Airtel-Money, Eco-Cash, and Tigo-Pesa. Sixteen countries have more mobile money accounts than bank accounts. These include Burundi, Cameroon, Democratic Republic of Congo, Gabon,

Guinea, Kenya, Lesotho, Madagascar, Paraguay, Rwanda, and Republic of Congo, Swaziland, Tanzania, Uganda, Zambia and Zimbabwe (GSMA, 2014).

ICT rollout, mobile *phones* with prepaid contracts, is growing rapidly in developing countries, especially in Africa as observed by Andrianaivo and Kpodar (2011). Considering the growth of *mobile* technology—its use and spread—and considering low access to financial services, mobile financial services are considered as an opportunity to reach out to the excluded and as a new source of profits for MNOs (Andrianaivo and Kpodar, 2011).

Savings-led Approach to Mobile Technology/ Electronic Monies

In its technical guidelines for members, World Council of Credit Unions (WOCCU) (n.d.), went beyond mobile payments platform in determining mobile telephony technology elements. WOCCU (n.d.) identified savings-component (i.e. electronic cash) as part of the determinants of mobile telephony technology relative to financial inclusion. The increasing popularity of transaction and payment services through cell phones and mom-and-pop shops have revealed the tremendous potential to expand financial inclusion through mobile technology (WOCCU, n.d.). These "electronic money" models have already improved the lives of millions by reducing the need to carry cash or spend time travelling over long distances to reach the nearest point of service (ibid). Nonetheless, successful models linking electronic money to interest-bearing savings, loans and other financial services have been limited, observed in WOCCU (n.d.).

Observing the theoretical dispositions above, as relates to mobile telephony technology as a driver of financial inclusion, little did the clarity of mobile networks operators' (MNOs) roles in ensuring smooth delivery of financial services were articulated. This approach will eventually demonstrate the extent to which MNOs actions or inactions affect the smooth operations of those

determinants identified. For instance, in the works of Suedekum and Berthaud (2014), as they engaged in quantitative evaluation of Tunisian Experience in mobile telephony and financial inclusion, observed that MNOs offer mobile telephone, fixed and mobile Internet, and even mobile television services. On that basis, the Tunisiana Banka (Bank of Tunisia) service enables clients to pay their bills and top up their phones using the MNOs network infrastructure. Tunisie Telecom and Orange Tunisia offer very similar financial services, aside communication. This shows that the determinants of mobile telephony technology in relation to financial inclusion goes beyond the smartphone device, PPIs and Savings components to include Mobile Network Operators' (MNOs) infrastructure. Again, both Mahindra Comviva (2017) and WOCCU, just as other writers, had indicated how critical an enabling regulatory environment and compliance, respectively are in ensuring financial inclusion through mobile telephony technology. Nonetheless, there exist some equally critical determinants of mobile phone technology relative to adoption and penetration, especially in the African context. However, observing the forgone literary works little had been said or investigated into the extent of how mobile phone technology can be leveraged to achieve financial inclusion. On that note, this study focused on such mobile telephony determinants deemed crucial relative to financial inclusion in the Ghanaian context and Africa in general.

2.5 The Ghanaian Context

The introduction of banking in Ghana predates independence from the British colonial masters. Standard Chartered Bank formerly called British Bank of West Africa (BBWA) was the first to start commercial banking business in the then Gold Coast in 1896 (Fry, 1976). Barclays Bank Ghana Limited (1917) and the Ghana Commercial Bank (1953) subsequently entered the fray of commercial banking in that order (Woldie, Hinson, Iddrisu & Boateng, 2008;

PricewaterhouseCoopers, 2016). One hundred and twenty years on, the banking landscape of Ghana is awashed with as many as 33 licensed banks with a total branch network of 1,282 as at June 2016 (Bank of Ghana, 2016; PricewaterhouseCoopers, 2016). This development has heightened competition in the Ghanaian banking landscape with an increasing use of technology becoming more a strategy than a differentiator. Ghana has been undergoing a process of financial sector restructuring and transformation as an integral part of a comprehensive strategy for some time (Acquah, 2006). These developments notwithstanding, formal banking account penetration stood at 36% in 2015 (PricewaterhouseCoopers, 2016). However, banking account penetration only suggests account ownership which may differ from account usage or accessing any other banking services (that is, access rate). Meanwhile, access rate to mobile account services which stands at 29% (mobile money) is almost at par with access rate to traditional banking which also stands at 39% in Ghana by close of 2015, as revealed by FII survey in 2015, funded by CGAP; (Zetterli, 2015). This development notwithstanding, by 2017, the access rate to traditional banking in Ghana has increased marginally to 40%; (Bawumia, 2017). This implies that a large proportion (over half) of the population can be said to have no bank account or no formal banking relationship.

Clearly, without any alternate intervention to complement the effort in the banking industry, the formal traditional banks alone cannot facilitate financial inclusion effectively. This can be traced to the fact that, traditional banks have little regard for low value transactions (Smith, 2015). Their preference lies in the high-frequency transaction-based businesses which they deem as cost-effective. The traditional bank account holders are nearly twice as likely to have an active bank account that has not been used in the last three months than mobile wallet holders (Zetterli, 2015). Consequently, Mobile Network Operators in Ghana (MNOs) identified a clear business

opportunity in offering mobile-technology-based financial transaction services that include payment/transfer, credit and insurance services to their customers.

The mobile-technologically-based financial transactions in Ghana reached GH₵30 billion in the first half of 2016. The annual transaction shot up from GH₵400,000 per annum in 2011 to ₵35 billion in 2015 and to 51.4 billion in 2016, according to the Ghana Chamber of Telecos (Adjei, 2016). This is reflective in more than 80,000 job opportunities created by 2016 along chain of operations in the mobile-technology-based financial sector as almost 27 million people are being served (ibid). The active customers in the sector, according to the Central Bank of Ghana, stands at 8 million even though about 18.8 million people have registered as mobile-technology-based financial services customers as at close of 2016. As a result, financial exclusion has been nearly halved in Ghana, falling by 43% in 5 years, Zetterli (2015) further indicated. The main driver of this change is a substantial increase in access to non-bank formal financial services, such as the mobile-technology-based financial services, which tripled in the last five years (Zetterli, 2015). On this basis, it is of great investigative interest to probe the extent mobile phone technology adoption had impacted financial inclusion in Ghana as well as the determinants of such technology as a tool in accelerating financial services to mostly the unbanked and underserved.

2.6 Empirical Literature

Analysis of the global financial inclusion by Demirguc-Kunt and Klapper (2012), measures how adults in 148 economies save, borrow, make payments and manage risk. The results, among other things show that, only 50% of adults globally have account at a formal financial institution (Demirguc-Kunt and Klapper, 2012). This indicates that half of adults worldwide remain unbanked, according to Demirguc-Kunt and Klapper (2012). Among this unbanked proportion,

35% had alluded to barriers to account use that might be addressed by public policy- e.g. minimum requirements for opening a formal account; however, 65% reported lack of money/poverty as the basic reason for not able to open and operate a bank account (Demirguc-Kunt & Klapper, 2012). Similarly, the analysis indicated 25% and 20% citing bank accounts is too expensive to operate and banks too far away, respectively (Demirguc-Kunt & Klapper, 2012). In as much as the approach of this study had centered on formal banking system, the non-banking methods are equally critical in accelerating financial inclusion but had a very little focus. Therefore, this approach does not give much appreciable picture of the level of financial service access and hence broad picture of the degree of financial inclusion. Nonetheless, it is clear Demirguc-Kunt and Klapper (2012) focused on how banking technology encourages financial inclusion or otherwise. This does not demonstrate the basic determinants of the technology. Based on the enumerated shortfalls in the above empirical work, this study provides basis of analysis relative to non-formal banking method of financial inclusion. Hence, mobile telephony technology impact on financial inclusion in Ghanaian context within the West African Sub-Saharan Region. In Sub-Saharan Africa (SSA) in general, 34% of adults have formal bank account, whilst 12% of adults have an active *mobile money accounts* compared to just 2% globally (Adjei, 2016). In this regard, World Bank (2016) put the figure of adults engaged in *mobile banking* in SSA at 16%.

The Global Systems for Mobile Communication Association (GSMA) estimates that there will be 1.7 billion unbanked customers globally with mobile phones by 2012; also noted in Andrianaivo and Kpodar (2012) as they examined the relationship between mobile phone penetration and growth in Africa. Meanwhile mobile usage, especially across developing world has jumped from 29% to 77% as noted in Smith (2015) in his analysis of Third World's investment climate. Again, Botsman (2014) in an article to evaluate forgone studies relative to

mobile-based financial activities in Africa to come up with lessons thereof, indicated that many people in SSA who do not have a formal bank account have a basic mobile phone. Today, there are more than 500 million mobile phones in Africa, maintained in Botsman (2014). This provides fertile ground for financial transaction through mobile phones as argued in Andrianaivo and Kpodar (2012) that mobile phone diffusion had proven to be a powerful tool capable of overcoming the financial infrastructure gap that exist, mostly in developing world such as Africa. As found in a survey by Bill and Melinda Gates Foundation (2015), 2 billion people who do not have a bank account today will be able to at least store money and make payments with their basic mobile phones. This indicates an extent of a non-banking method, like mobile telephony technology (i.e. mobile money) impact on financial inclusion, especially in developing economies of which Ghana is included.

Inclusion continues to grow through simple mobile-based financial activities using the instance of Kenya, Zimbabwe and the Democratic Republic of Congo. The value of mobile-based financial transactions as a percentage of GDP (2013) was significantly higher than in other economies in Africa (IMF, 2014).

- Kenya: 55.28% of GDP
- Zimbabwe: 43% of GDP
- Democratic Republic of Congo: 38% of GDP

Essentially, a large excluded population access to mobile technology and good regulatory environment created circumstances for penetration, reported in IMF (2014). Mobile-based financial service continues to grow and is available through 255 services across 89 countries by 2014 in the analysis of GSMA (2014) relative to mobile technology adoption and its effect on growth. The GSMA (2014) analysis further revealed that 21 of these services have over 1 million active users. There were 103 million active mobile money accounts globally by December 2014

(ibid). Mobile technology-based financial service was projected to become a $617 billion industry by 2016 and beyond, observed in Botsman (2014). For instance, EcoCash is the mobile-based financial service launched by Econet Wirelesss, the largest operator in Zimbabwe (Mahindra Comviva, 2017). More than 3.7 million Zimbabweans use EcoCash and transactions valued at more than $5 billion are processed by the system annually (ibid). Again, mobile-based financial transaction reached GH₵30 billion by first half of 2016, as related in Adjei (2016). The total value of transaction through mobile technology in Kenya was around $24 billion; more than half of the country's GDP, in 2013. According to World Bank (2016), analysis of adults reporting using a mobile technology for financial transactions globally, Kenya leads by 68%, followed by Sudan 52%, Gabon 50%, Algeria 44%, and Congo Republic 37%. Others included Somalia 34%, Albania 31%, Tajikistan 29%, Uganda 27% and Angola 26% (World Bank, 2016). In relation to the above statistics, Deloitte (2012) carried out a quantitative study to establish the impact of mobile telephony technology penetration on economic growth among 96 countries globally, under the auspices of GSMA and sponsored by CISCO technology. The study revealed that for a given level of total mobile penetration, for instance 10% substitution from 2G to 3G, penetration increases GDP per capita growth by 0.15% point (Deloitte, 2012). Furthermore, Deloitte (2012) indicated that for every 10% increase in mobile penetration, Total Factor Productivity in the long run increases by 4.2% points.

In as much as Deloitte (2012) findings are very insightful and enhances our appreciation of mobile telephony technology's contribution to growth, the study was deficient in relating the aspect of the growth supported through financial inclusion by the technology. In effect, the study failed to demonstrate how the telephony technology specifically impacted on financial inclusion aspect of the economy. In that sense, the contribution of the financial services as a function of mobile telephony technology penetration needs to be examined accordingly. It is therefore

against this backdrop that this study assumed investigative interest to the researcher to specifically focus on mobile telephony technology relationship with financial inclusion within the economy, albeit in the Ghanaian context. Again, the findings of this study sought to eventually confirm or disconfirm the earlier empirical findings enumerated in the works of Andrianaivo and Kpodar (2012); Botsman (2014); IMF (2014); GSMA (2014); Bill and Melinda Gates Foundation (2015) and World Bank (2016) as pertains to mobile-based financial services and financial inclusion.

2.7 Conceptual Framework

This section provides the very foundation and basis upon which this study is grounded. Whilst the basis of this study emanated from the literature gap projected in the review of theoretical dispositions as well as the presentation of empirical findings that ensued in the preceding sections, the foundation on the other hand emanated from the research approach and design the researcher intended to employ during the study. The conceptual framework is therefore intended to help promote a conceptual understanding of the topic under investigation in terms of purpose, approach, scope and context. To that extent, a proposed model that is expected to frame this study's findings in relation to the research questions and objectives is developed and presented in Figure 2.1 below.

Figure 2.1 Conceptual Framework of the Study: *Mobile Phone-Financial Inclusion Web*

Source: *Author's Construct, April 2017*

Figure 2.1 shows a schematic presentation of a model framework for this study, called *The Mobile Phone – Financial Inclusion Web*. The framework is divided into four quadrants labeled as; Regulator, Service Provider, Mobile Telephony Equipment Manufacturer/Retailer and User/Client Determinants. The entire model is underpinned by a robust policy framework and

regulatory environment, provided by the Central Bank and the National Communication Authority combined to create an enabling environment that provide the necessary impetus to support smooth functioning and delivery of mobile financial services.

Policy framework and regulatory environment (quadrant one) are critical elements within the financial inclusion framework. The service provider- MNOs/Telcos (quadrant two), within the ambit of the policy framework and regulatory environment can unleash aggregated core mobile telephony capabilities to offer continuous mobile financial services and products onto the market. However, it is the accessibility and the consumption of the mobile financial services and products that bring about financial inclusion to the un-served and underserved members of society. Accessibility is made possible through the provision of mobile telephony devices by manufacturers and retailers of mobile telephony devices on the market (quadrant three). This implies that, mobile telephony devices must be available on the market and equally affordable for people to purchase. However, the decision to own and use a mobile phone is determined by some variables such as income level, age, dwelling locality (rural or urban), employment status, sex, years of education, ownership of radio and television, ownership of savings account, access to credit, bank account, investment and insurance and electricity supply, mobile phone network coverage (quadrant four).

Intuitively, ownership of mobile phone should result in the usage of the device for real benefits to be attained. The usage of mobile phone therefore culminates in the consumption of mobile financial services and products. It is the consumption of mobile financial services and products that ensures crystallization of financial inclusion to the financially excluded segments of society. Thus, mobile phone technology can only be used or its benefits enjoyed when a mobile phone is first owned and subsequently use by people. The extent to which mobile telephony technology

can be leveraged to achieve financial inclusion hinges on how widespread the mobile phone device is owned and used in households, especially in rural areas. Hence, the level of penetration of mobile phones can tell the level of financial inclusion achieved. Financial inclusion is therefore measured not only by access to financial services, but also by its usage (Global Partnership for Financial Inclusion, 2016).

2.8 Summary

Essentially, this chapter created a niche for this study within theoretical dispositions as pertains to financial inclusion works, having reviewed good number of literally works on financial inclusion, mobile-technology-based financial services and economic growth as a function of mobile telephony technology penetration. This is in view of making the results of this study relevant in not only academia but in policy making within both the corporate and public environments. Primarily, the chapter revealed relevant works that indicate relationship between mobile telephony technology and growth as emanated from varied authorities. However, the obvious gap identified has been insufficient work targeting, specifically, financial inclusion because of mobile telephony technology adoption. Most of the works reviewed focused much on effect/contribution of mobile telephony technology on growth, generally. This approach masked the effect/contribution of mobile telephony on specifically financial inclusion as a subsidiary of the broader macroeconomic environment. Therefore, this study made it possible to know not only the contribution of mobile telephony adoption on financial inclusion, but extent of it in the Ghanaian context.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The research seeks to assess the determinants of mobile phone technology adoption and how the mobile phone technology can be leveraged to bring about financial inclusion in Ghana. The study is quantitative in nature and employs econometric methods to analyze data.

This chapter therefore presents the population of the study including the sample size and the sampling procedure employed. It also dwells on the data sources and research instrumentation as well as a discussion on the econometric model that was used with a concise explanation and impact of variables on the model and outcome of the study.

3.2 Target and Study Population

The study is undertaken in Ghana and cuts across all the 10 regions and the 216 districts. Thus, both urban and rural households were targeted in the study. According to the 2010 Population and Housing Census (2010 PHC) Report by the Ghana Statistical Service, estimated count of households in Ghana is 6.6 million households.

3.3 Sampling Procedure and Sample Size

A two-stage stratified sampling design was employed in gathering data from the GLSS R6 (2014). According to Sekaran (2003), stratified sampling technique involves a process of stratification or segregation, followed by random selection of subjects from each stratum. The design was done in two stages; at the first stage, 1,200 enumeration areas were selected to form primary

sampling units which were allocated into the 10 regions using probabilities proportional to population size of the regions. The first stage ended with the enumeration areas within the regions being further divided into urban and rural localities of residence and taking into consideration the three ecological zones; namely, Coastal, Forest and Savannah. At the second stage, fifteen households from each primary sampling unit were selected systematically.

Hence the total sample size came to 18,000 households. A sample is basically a subset of a population and its study allows a researcher to be able to draw conclusions that would be generalizable to the population of interest (Sekaran, 2003). Sample size used was 18,000 nationwide at the onset; that is, 15 households each in the 1,200 enumeration areas. However, with a response rate of 93.2%, a total sample size of 16,772 was eventually used for the GLSS R6, 2014. Hence the study covered what could be described as nationally representative sample of 18,000 households in 1,200 enumeration areas.

3.4 Types and Sources of Data

The study uses a secondary data source from the Ghana Statistical Service (GSS) reports, which included the Ghana Living Standards Survey Round 6, (GLSS R6, 2014) and 2010 PHC, having primarily sourced across the length and breadth of Ghana by GSS (2012) as well as GSS (2014). Ghana is divided into 10 administrative regions comprising 216 districts with five of them being metropolitan. These five metropolitan districts were further divided into 29 sub-metropolitan districts. Ghana is further divided into three ecological zones; namely, coastal, forest and savannah with Western, Brong Ahafo and Volta Regions cutting across two ecological zones.

The study is quantitative in nature which enables the researcher to apply relevant quantitative constructs through statistical techniques in data analysis and presentation.

Ghana Living Standards Survey is a research project that was initiated in 1980 by the Policy Research Division of the World Bank and customized by implementing countries, including Ghana. The Ghana Living Standards Survey was first conducted in 1987 with the sixth and latest one conducted between October 2012 and October 2013. The GLSS R6 is regarded as an authentic, very comprehensive, reliable and up-to-date statistics and indicators to monitor and evaluate the impact of development policies and programs on the living conditions of Ghanaian citizens; (GLSS R6, 2014).

3.5 Research Instrument

Data collection method employed by the Ghana Statistical Service was administration of questionnaire to respondents across Ghana. Various categories of questionnaires were used to capture household and community characteristics etc. The household questionnaire amongst other things captured demographic characteristics, education and skills training, employment, household income and expenditure, remittances, credit and use of financial services. Community questionnaire captured general information on facilities available in the communities.

3.6 Econometric Model and Explanation of Variables

Model used for the study is Latent Simultaneous Variable Model employing seemingly unrelated bivariate probit. A general representation of this model is shown below:

$$y_{1i}^{*} = \beta_1 y_{2i}^{*} + \gamma_1 x_{1i} + \varepsilon_{1i} \ldots\ldots\ldots\ldots\ldots(1)$$

$$y_{2i}^{*} = \beta_2 y_{1i}^{*} + \gamma_2 x_{2i} + \varepsilon_{2i} \ldots\ldots\ldots\ldots\ldots(2)$$

The two equations, (1) and (2), contain endogenous regressors, and hence the usual probit model cannot be used to derive unbiased estimates. Consequently, the two equations are estimated using seemingly unrelated bivariate probit procedure. The intuition behind the model is that, the financial inclusion status of the household is predicated on the decision of the household to own or use a mobile phone or the financial inclusion status of household enables the household to own or use a mobile phone. A bi-causal relationship exists between the two endogenous variables; the regressand/dependent variable in equation (1), a latent variable and dichotomous in nature becomes an endogenous regressor in the second equation. Similarly, an endogenous independent variable in the equation (1) becomes the latent dependent and dichotomous variable in the equation (2); (Maddala, 1983). The model chosen therefore addresses the latent endogeneity, heterogeneity and correlation and thus allow for efficient and unbiased estimates to be obtained. By intuition, it is expected that individuals who are financially included will have a relatively better chance of owning mobile phones than those who are not. It may also be that; it is the ownership of mobile phone that helps a household to become financially included. In view of this endogeneity problem, we modeled ownership and usage of mobile phone and financial inclusion of household simultaneously. The proxies used for mobile penetration (mobile phone technology) are the variables: ownership of mobile phone, taking the value 1 if household owns a phone and 0 otherwise and usage of mobile phone, taking the value 1 if household uses a phone and 0 otherwise. The measure of financial inclusion used are the variables; bank account, taking the value 1 if household has bank account and 0 otherwise; insurance, taking the variable 1 if household has insurance policy and 0 otherwise; savings account, taking the value 1 if household has savings account and 0 otherwise; credit access, taking the value 1 if household has access to formal credit and 0 otherwise; investment, taking the value 1 if household has investment

account and 0 otherwise. Since mobile phone penetration and financial inclusion are dichotomous, the following latent simultaneous model, Greene (2003) is specified:

$$y_{1i}^{*} = \gamma_1 x_{1i} + \beta_1 y_{2i}^{*} + \varepsilon_{1i},\ y_{1i} = 1(y_{1i}^{*} > 0) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

$$y_{2i}^{*} = \gamma_2 x_{2i} + \beta_2 y_{1i}^{*} + \varepsilon_{2i},\ y_{2i} = 1(y_{2i}^{*} > 0) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where $\begin{pmatrix}\varepsilon_1\\ \varepsilon_2\end{pmatrix} \sim N\left[\begin{pmatrix}0\\0\end{pmatrix}\begin{pmatrix}1 & \rho\\ \rho & 1\end{pmatrix}\right]$

From above, the two error terms are determined jointly with zero mean, constant variance and correlation coefficient, ρ. The correlation coefficient, ρ, must be significant to warrant the joint determination of the equations. When $\rho = 0$, it implies that the two equations are unrelated and hence they cannot be determined jointly. Therefore, we test the null hypothesis that $\rho = 0$.

y_1^* is a latent variable representing the unobservable latent variable, mobile phone penetration;

y_1 is the observed decision to own mobile phone and use mobile phone;

y_1 takes the value 1 if the household owns a mobile phone and zero otherwise;

y_2^* is the latent financial inclusion status of the household;

y_2 is the observed financial inclusion status of the household;

y_2 takes the value 1 if the household is financially included and 0 otherwise;

x_1 is a vector of exogenous variables measuring household and community characteristics that explain the decision to own or use a mobile phone;

x_2 is a vector of exogenous variables comprising household and community variables that explain the financial inclusion status of the household;

$\beta's$ and $\gamma's$ are vectors of parameters.

Essence of Marginal Effects in Probit Model

In standard probits, changes in the outcome probability when particular variables are changed one at a time is known as marginal effects; (Arulampalam, 1998). Arulampalam (1998) opined that, it is customary to provide the marginal effects when estimating probit regressions. Anderson and Newell (2003) also posit that under this model specification, marginal effects are interpreted as the change in predicted probability associated with percent changes in the continuous independent variables. Buis (2010) additionally confirms that the marginal effect is an approximation of how much the dependent variable is expected to increase or decrease for a unit change in an explanatory variable: that is, the effect is presented on an additive scale.

The marginal effects are nonlinear functions of the parameter estimates and the levels of the explanatory variables, so they cannot generally be inferred directly from the parameter estimates (Anderson & Newell, 2003). Thus in general, one cannot interpret the coefficients from the output of a probit regression; one rather needs to interpret the marginal effects of the regressors; that is, how much the (conditional) probability of the outcome variable changes when you change the value of a regressor, holding all other regressors constant at some values.

Interpretation of 'marginal effects' is therefore different from the linear regression case where one directly interprets the estimated coefficients. This is so because in the linear regression case, the regression coefficients are the marginal effects. Of utmost interest is the effects of changes in

the regressors affecting the features of the outcome variable - this is the notion that marginal effects measure.

This study employed probit regression to analyze output data using marginal effects denoted as dy/dx in the output tables.

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Description and Classification of Variables

The variables have been grouped into five categories; namely, mobile phone penetration variables, financial inclusion variables, household characteristics variables, household asset variables and community infrastructure variables. Table 3.1 below shows the classification, categorization and description of variables.

Table 3.1: Description of Variables

Variable	Description	Type of Variable and Measurement	Expected Impact	Variable Category
OWN_FON	Measures household ownership of at least one mobile phone	Dummy (1 for yes, 0 otherwise)	Positive	Mobile Phone Technology
USE_FON	Measures household usage of mobile phone	Dummy (1 for yes, 0 otherwise)	Positive	Mobile Phone Technology
BANK_ACT	Measures if household has a bank account	Dummy (1 for yes, 0 otherwise)	Positive	Financial Inclusion
CRED_ACESS	Measures access to credit of household head from a financial institution	Dummy (1 for yes, 0 otherwise)	Positive	Financial Inclusion
INSURE	Measures if household head has insurance policy	Dummy (1 for yes, 0 otherwise)	Positive	Financial Inclusion
INVEST	Measures if household head has investment account	Dummy (1 for yes, 0 otherwise)	Positive	Financial Inclusion
SAV_ACCT	Measures if household head has a savings	Dummy (1 for yes, 0 otherwise)	Positive	Financial Inclusion

	account			
LOC	Measures area of residence (urban or rural)	Dummy (1 for rural, 0 otherwise)	Positive	Household Characteristics
AGE	Measures age of household head	Continuous. Years	Positive	Household Characteristics
EDUYEARS	Measures years of education of household head	Continuous. Years	Positive	Household Characteristics
GENDER	Measures the gender or sex of household head	Dummy (1 for male, 0 otherwise)	Positive	Household Characteristics
EXPDT	Measures the real per capita expenditure of household head	Continuous. Ghana Cedis	Positive	Household Characteristics
EMPSTAT	Measures employment status of household	Dummy (1 for yes, 0 otherwise)	Positive	Household Characteristics
RADIO	Measures the ownership of radio in household	Dummy (1 for yes, 0 otherwise)	Positive	Household Asset
TELE	Measures the ownership of television in household	Dummy (1 for yes, 0 otherwise)	Positive	Household Asset
MTRROAD	Measures whether there is motorable road	Dummy (1 for yes, 0 otherwise)	Positive	Community Infrastructure

	to community			
COMPOFF	Measures whether community has post office	Dummy (1 for yes, 0 otherwise)	Positive	Community Infrastructure
COMMKT	Measures the presence of permanent daily community market	Dummy (1 for yes, 0 otherwise)	Positive	Community Infrastructure
COMMBK	Measures if there is a bank in community.	Dummy (1 for yes, 0 otherwise)	Positive	Community Infrastructure
CTYELECT	Measures whether community has electricity	Dummy (1 for yes, 0 otherwise)	Positive	Community Infrastructure
NTFONETW	Measures the nearest mobile phone network from community	Continuous. Kilometers	Positive	Community Infrastructure

OWN_FON and USE_FON are proxies for mobile phone technology denoting ownership of at least one mobile phone and usage of mobile phone respectively. The proxies for financial inclusion are BANK_ACCT, CRED_ACESS, INSURE, INVEST and SAV_ACCT. These variables are latent and dichotomous in nature as well as endogenous leading to a bi-causal relationship between the proxies of mobile phone technology and proxies of financial

inclusion. The argument therefore is; is it the ownership of a mobile phone that causes a person to be financially included or a person owns and uses a mobile phone because he is financially included. The independent variables; age, sex, years of education, income level, employment type (occupation) are control variables as proposed by Khayyat and Heshmati (2013) regarding the adoption and usage of mobile telecommunication service. The remaining variables; community electricity, employment status, mobile phone network, employment status and community bank can be considered as other control variables and hence no theoretical justifications required for their use; (Khayyat & Heshmati 2013).

Mobile Phone Technology Variables

The proxies for mobile phone technology used in this study are mobile phone ownership and mobile phone usage. The extent of mobile phone ownership and usage will demonstrate the penetration level of mobile phones.

Financial Inclusion Variables

The proxies for financial inclusion are bank account, insurance, credit access, investment and savings account. Bank account gives an indication of the fact that, a holder of a bank account stands the chance of qualifying for a loan to demand for goods and services including mobile phone. Insurance refers to whether one has a personal insurance policy or not. Insurance policy allows holder to receive financial assistance when disaster strikes or old age vulnerabilities. Credit access indicates if a person has applied for a loan from a financial institution in the last 12 months and hence an indicator of formal credit access. Investment determines if a person has an investment account. Ownership of an investment account implies that, one can invest surplus

income for higher returns. Savings is an aspect of financial inclusion and thus the count of savings account will demonstrate or reflect the extent of financial inclusiveness of society.

Household Characteristics

Sex in this study refers to male or female (gender) who have attained the age of 15 and above in Ghana. In Ghana, whilst the legal age for opening a personal account with a bank/financial institution starts at age 18, minimum age of respondents for the GLSS R6 report was 15 years. The study also seeks to investigate which gender is more prone to being financially included due to mobile phone ownership and usage. The population of Ghana shows a gender distribution of 48.3% and 51.7% of male and female respectively; (Ghana Statistical Service, 2014). One's income level has a bearing on his savings propensity as well as his spending pattern. To the extent that financial inclusion is measured on the frequency of usage of financial services and not the mere holding of an account, the level of one's income would determine if one will have surplus to save or not. 30 percent of non-account holders worldwide cite lack of enough money or irregular income streams as the reason; (Demirguc-Kunt & Klapper, 2012). Thus, in developing countries, adults in the highest 20 percent income bracket are more than twice as likely to have an account as those in the lowest 20 percent income bracket; (Demirguc-Kunt & Klapper, 2012). It can therefore be inferred that high-income earners will have a higher propensity to save than low income earners. Locality types in Ghana per the GLSS R6 report are two; rural and urban. Whether rural or urban dwellers are more predisposed to own and use mobile phones to achieve financial inclusion is an issue worth determining in the pursuit of hastening financial inclusion of the underserved and the excluded in Ghana. The urban and rural population represents 50.2% and 49.8% respectively of Ghana's total population; (Ghana Statistical Service, 2014). To what extent does location play a role in the adoption of mobile

phone technology is also worth examining by the researcher. A key factor for their widespread use of mobile phones is the ease of use. All things being equal, ownership and usability of the mobile phone would be impacted by the level of one's education. Hence years of education of a person are a strong determinant of mobile phone technology. Employment status refers to whether a person is employed or not employed. Clearly to a very large extent, the ownership of a mobile phone has basis in the resource or financial capability of the person seeking to own the mobile phone. This study seeks to confirm if an unemployed person can own a mobile phone. Again, can an unemployed person achieve financial inclusion? To what extent is financial inclusion possible for an unemployed person who receives remittances? The study will seek to provide answers to these questions.

Community Infrastructure

Community infrastructure variables included in the regression are motorable road, community market, community post office, phone network, electricity in the community and bank in the community. Smooth operation of mobile phone technology heavily hinges on reliable and resilient network. It is the responsibility of Mobile Network Operators to provide infrastructure for the availment of a reliable phone network capability to facilitate mobile phone operations. Network unavailability would ultimately lead to unavailability of mobile phone services rendering the technology unusable. Again, disruptions of telecommunications services critically affect financial services processes; (Ramezani, 2008). Network availability is therefore crucial in ensuring access and usage of mobile phone technology. Availability of electricity in a community would go a long way in determining mobile phone ownership and usage of households. This is because continuous usage of one's mobile phone can only be sustained using

electric power to charge the handset. The incentive to own a mobile phone in a community without electricity would therefore be low and at worst non-existent. Accessibility to banks refers to the visibility and availability of basic products and services as provided by the traditional banks and financial institutions in the community. Hence a bank sited within a community creates that visibility and availability for the dwellers in that community. This ensures that high cost of accessing banking products and services, which is one of the key issues that create barrier for financial inclusion is reduced; (De Koker & Jentzsch, 2013).

Cost of transportation remains part of the cost borne by people in accessing banking services. Bad roads apart from being a disincentive for a person to move over a long distance to access banking services also increase the cost of transportation. Hence motorable road remains a key factor in facilitating financial inclusion. Post office represents an edifice that has the potential of providing an avenue for financial services to the people (Rao, 2015). Accordingly, postal services seek financial sustainability to the broad public in view of its extensive network (ibid). Post office within the community is therefore vital in facilitating financial inclusion. Market represents a dedicated place that enables traders to market their goods and services. It is normally fitted with some amenities, including electricity amongst others. The provision of electricity in the market allows market participants to make use of electrical gadgets that include charging of mobile phones. By this, households that do not have access to electricity are able to have their mobile phones charged for a fee. The provision of a permanent or daily market therefore serves as incentive for households that otherwise would not patronize mobile phones to do so as they will have access to electricity for charging their phones.

CHAPTER FOUR

ANALYSIS AND DISCUSSION OF RESULTS

4.1 Introduction

This chapter presents analyses through discussions following from the findings of the study - i.e. results. The analyses, for that matter the discussions are based on the data collated through desk study tools used during the study. It also presents results from the analyses of the data gathered in relation to the objectives that this study seeks to realize. Among the key variables this study gathered data on, included household mobile phone ownership, the mobile phone usage, bank account ownership, savings account ownership, determinants of mobile phone adoption, financial services such as, insurance, investment and credit access etc. through mobile platforms.

This sub-chapter fundamentally captures the specific results of the study along each of the variables that allow the researcher to realize the objectives of the study. Essentially, this study hugely relied on quantitative data of secondary sources to carry out various quantitative analysis aimed at realizing the objectives of this study. The result as emanated from the analyses provided rich basis for further discussion, alongside prevailing literature to make meaning out of the results, relative to meeting the objectives of this study.

4.2 Descriptive Statistics

Descriptive statistics is used in this study to describe the basic features of data collated. This provided the researcher with rich basis for quantitative analysis. In almost all the regression tables (Tables 4.1 – 4.6), they simply describe what data this study used and the significance of the data to this study.

Table 4.1: Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Continuous Variables					
AGE	16772	45.8388	15.8926	15	98
EXPDT	16772	1,112.13	1,169.89	2.3	7,322.66
EDUYEARS	16772	6.4429	5.3833	0	19
NTFONETW	16772	2.5048	5.7816	0	54

Categorical Variables

Variable	Percentage
OWN_FON	76%
USE_FON	95%
BANK_ACT	42%
INVEST	1%
CRED_ACESS	9%
SAV_ACCT	27%
INSURE	26%
EMPSTAT	97%
GENDER	72%
LOC	56%
RADIO	64%
TELE	48%
CTYELECT	74%
MTRROAD	77%
COMMBK	2%
COMMKT	3%
COMPOFF	1%

Source: Ghana Statistical Service, 2014

Table 4.1 shows descriptive statistics of the study with 16,772 observations. The table is in two-halves - namely continuous and categorical variables. Whilst the first half of the table shows continuous variables, that of the second shows categorical variables. Among the continuous variables that make up the first half include the Average age of respondents/household (AGE) which indicates average age of household respondent. In that regard, the average age of a respondent is 45.8 years, with minimum and maximum ages of 15 and 98 respectively. Again, captured in EXPDT, the mean annual household expenditure in real terms is GH₵1,112. This expenditure figure is deemed lower than the absolute poverty line of GH₵ 1,314 per annum as indicated by the Ghana Statistical Service, 2015.

The mean years of education of household head is 6.4 years with a minimum of zero and maximum of 19 years as indicated against EDUYEARS. This implies that some household heads have never gone through any education system with some showing primary six as the highest education attainment. The mean distance of nearness to mobile phone network, shown as FONNETW_NST is 2.5 kilometers, with zero as minimum and maximum of 54 kilometers. This implies that some localities do not have access to mobile phone network coverage.

The second half of Table 4.1 (categorical variables) indicates that as much as 76% of households own mobile phones whilst 96% of households use mobile phones. This indicates that the extent of penetration of mobile phones in Ghana is deep and pervasive. Again, this result resonates well with findings of Smith (2015), which indicated mobile phone usage across Africa reached more than 77% by 2015. Similarly, based on its studies, Bill and Melinda Gates Foundation (2015) projected more than 2 billion households will be using mobile phones across developing world by 2025. Likewise, Andrianaivo and Kpodar (2012) observed in their studies that, 1.7 billion people who do not have bank account have mobile phones. The findings of this study, just as

previous researches, re-echo the fact that mobile phone usage is and may continue to be on the rise.

The five variables upon which financial inclusion variables were proxied show that financial inclusion is still very low among most households. As shown in the categorical variables table, only 42% of households' own bank account with a paltry 1% having investment account. Again, the table indicates only 9% of households in Ghana have access to formal credit; whilst 27% and 26% have savings account and insurance policy respectively. Previous study has shown that formal banking penetration in Ghana stood at 36%, with access rate recorded at 40% (Pricewaterhouse Coopers, 2016; Bawumia, 2017). Therefore, the result of this study regarding access to a formal banking account is consistent with that of the previous studies observed.

Furthermore, this study revealed (as seen in Table 4.1) that only 2% of households have access to a bank, confirming the fact that 56% of respondent households have residence in rural areas. This revelation confirms the fact that urban areas experience greater access to financial services than in the rural areas; (Finscope Ghana, 2010). Again, due to the regularity of income sources of urban households, traditional banks tend to target such households (Ackah & Asiamah, 2014). From Table 4.1, it is also revealed that 1% of households have access to post office services within their communities.

As much as 97% of households are employed with 72% of such households being headed by males. A relatively higher population of households (56%) dwells in rural areas with as much as 77% having access to motorable roads whilst 74% enjoy access to electricity. 64% of households' own radios with 48% owning televisions whilst 3% have access to community markets. Ownership of household electronic appliances (Radio and TV) ensures that households

are kept abreast of mobile phones, the benefits of using mobile phones as well as costs of mobile phones.

4.3 Regression Results

In all the five tables (Tables 4.2 – 4.6), the Wald statistics point to the fact that the independent variables are significant and jointly explain mobile telephony penetration and the financial inclusion status of households. The diagnostic tests generally show that the models have correctly been specified and the control variables largely having the expected signs. The log likelihood ratio test of rho is significant at 0; this indicates that the two equations of mobile telephony technology and financial inclusion demonstrate dependency (on each other) and as such must be estimated simultaneously. All estimates for the correlation coefficients, rho, are negative; this shows that the unobserved factors that impact mobile telephony technology and financial inclusion are negatively correlated.

Table 4.2 shows report of the seemingly unrelated bi-probit estimates for mobile phone penetration and bank account (used as proxy for financial inclusion). Whilst mobile phone ownership, that is, (FON_OWN); and usage, (FON_USE) have been used as measure of mobile phone penetration in columns 1 and 3 respectively, ownership of bank account (BANK_ ACT) was used as one of the measures of financial inclusion in columns 2 and 4. Table 4.2 shows that mobile phone technology and financial inclusion exhibit a bi-causal relationship which further points to justification for estimating model simultaneously. Observation shows that mobile phone ownership and usage both increases the probability of financial inclusiveness of households and vice-versa. However, mobile phone ownership with higher marginal effects (0.5469) portrays a relatively higher and positive impact on financial inclusion than mobile phone usage with lower

marginal effects (0.4727). This observation is equally true as the probability of mobile phone ownership (0.4877) and usage (0.27.26) increases with unit increase in financial inclusion of households. Thus, a strong bi-causal relationship between mobile phone technology and financial inclusion exists.

Other statistically significant variables per Table 4.2 are LOC (rural or urban), GENDER, EMPSTAT, MTRD, RADIO and TV. The probability of the financial inclusion of rural household decreases by up to 10.3% more than urban dwellers (columns 2 and 4). Similarly, the probability of financial inclusion increases by 14.3% for households that are employed. The report shows that, households headed by males are about 7% (column 4) more probable to be financially included than females. Furthermore, the probability of opening a bank account (proxy for financial inclusion) increases by 5.7% (column 4) for localities with motorable roads. Finally, mass communication media of radio and television positively impacts mobile phone ownership; the probability of mobile phone ownership increases by 4.2% and 4.9% for households that own radio and television respectively (column 1).

Table 4.2 Effects of Mobile Phone Technology on Financial Inclusion (Bank Account)

	(1)		(2)		(3)		(4)	
VARIABLES	**FON_OWN**	**dy/dx**	**BANK_ACCT**	**dy/dx**	**FON_USE**	**dy/dx**	**BANK_ACT**	**dy/dx**
FON_OWN			1.847***	0.5469*				
			(0.0231)					
FON_USE							1.937***	0.4727*
							(0.0565)	
BANK_ACT	1.827***	0.4877*			1.909***	0.2726*		
	(0.0235)				(0.0457)			
AGE	-0.00484***	-0.0015	0.00362***	0.0014	-0.000117	-0.0000	0.000578	0.0002
	(0.000608)		(0.000608)		(0.000749)		(0.000715)	
LOC	0.0471*	0.0147*	-0.135***	-0.0532*	0.149***	0.0210*	-0.260***	-0.1030*
	(0.0240)		(0.0215)		(0.0252)		(0.0236)	
EMPSTAT	0.0855	0.0274*	0.154**	0.0595*	-0.137	-0.0174*	0.389***	0.1483*
	(0.0676)		(0.0700)		(0.125)		(0.0682)	
GENDER	0.00494	0.0015*	0.0775***	0.0303*	-0.0501	-0.0069*	0.176***	0.0695*
	(0.0217)		(0.0214)		(0.0339)		(0.0252)	
EDUYEARS			0.0286***	0.0112			0.0609***	0.0242
			(0.00182)				(0.00231)	
EXPDT	1.36e-05	4.25e-06	0.000165***	0.0001	-8.56e-05***	-0.0000	0.000239***	0.0001
	(1.43e-05)		(1.05e-05)		(1.90e-05)		(1.15e-05)	
MTRD			0.102***	0.0397			0.145***	0.0572*
			(0.0179)				(0.0188)	
COMMBANK			0.0132**	0.0052*			0.000257	0.0001*
			(0.00553)				(0.100)	
COMMMKT			0.00271	0.0010*			0.00909	0.0036*
			(0.0692)				(0.0709)	
COMMELECT	-0.00139	-0.0004*	-0.00121	-0.0005*	-0.0907**	-0.0122*	0.0181	0.0072*
	(0.0258)		(0.0250)		(0.0413)		(0.0260)	
COMMPTOF			-0.0594	-0.0232*			-0.0637	-0.0252*
			(0.120)				(0.129)	
RADIO	0.133***	0.0420*			0.0542**	0.0076*		
	(0.0131)				(0.0227)			
TV	0.158***	0.0491*			0.108***	0.0151*		
	(0.00846)				(0.0290)			
NTFONETW	0.00253	0.0008			-0.00209	-0.0003		
	(0.00167)				(0.00284)			
Constant	-0.139*		-2.325***		0.764***		-3.156***	
	(0.0823)		(0.0846)		(0.137)		(0.103)	
Diagnostics								
Observations	16,772		16,772		15,181		15,181	
Rho (ρ)	-1.0000				-1.0000			
	(1.31e-10)				(4.19e-09)			
Wald chi2	12067.15				6801.56			
Log likelihood	-12995.449				-9676.1676			
Likelihood ratio test of rho	0				0			

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1 ---- (*) dy/dx is for discrete change of dummy variable from 0 to 1

Table 4.3 shows report of the seemingly unrelated bi-probit estimates for mobile phone penetration and insurance (used as proxy for financial inclusion). Whilst mobile phone ownership, that is, (FON_OWN); and usage, (FON_USE) have been used as measure of mobile phone penetration in columns 5 and 7 respectively, ownership of insurance policy (INSURE) was used as one of the measures of financial inclusion in columns 6 and 8.

Similarly, Table 4.3 also exhibits the bi-causal relationship between mobile phone technology and financial inclusion; whereas both mobile phone ownership (39.8%) and usage (28.5%) drive financial inclusion, financial inclusion can also be seen to drive mobile phone ownership by 39.3% and 20.3% for mobile phone usage.

Locality (rural or urban) is seen to impact both mobile phone ownership and usage, with mobile phone ownership showing a higher decrease of 1.8% than usage (1.7%). Thus, the probability of mobile phone ownership decreases for households that dwell in the rural areas. Expectedly, the probability of financial inclusion (take up of insurance policy) of rural dwellers decreases by 5.3%.

Table 4.3 also shows that gender of household heads does have an impact on mobile phone ownership and usage as well as financial inclusion. The report suggests that it is more probable (6.5%) for males to own mobile phones than females (column 5). Similarly, financial inclusion (take up of insurance policy) decreases by 6.6% for females more than males.

Table 4.3 further highlights the statistical significance of the variables, MTRD, COMMELECT, RADIO and TV ON estimates obtained. The probability of financial inclusion increases by up to 4.6% for households in areas with motorable roads (columns 6 and 8). Intuitively, the probability of mobile phone usage decreases by 1.9% for households in areas without electricity in

community. Similarly, the probability of financial inclusion increases by 1.4% for households in areas with electricity in community. Finally, Table 4.3 highlights the fact that ownership of radio and television positively drive mobile phone ownership and usage. Consequently, households that own radio and television are more probable to own mobile phone (3.4%) and use mobile phone (3.7%). However, the probability of mobile phone usage increases by 2.2% more for households that own television than those who do not.

Table 4.3 Effects of Mobile Phone Technology on Financial Inclusion (Insurance)

	(5)		(6)		(7)		(8)	
VARIABLES	**FON_OWN**	**dy/dx**	**INSURE**	**dy/dx**	**FON_USE**	**dy/dx**	**INSURE**	**dy/dx**
FON_OWN			1.591***	0.3982*				
			(0.0238)					
FON_USE							1.622***	0.2851*
							(0.0680)	
INSURE	1.648***	0.3933*			1.635***	0.2031*		
	(0.0211)				(0.0448)			
AGE	-0.0122***	-0.0040	0.0128***	0.0044	-0.00839***	-0.0015	0.0107***	0.0035
	(0.000630)		(0.000616)		(0.000763)		(0.000727)	
LOC	-0.0545**	-0.0180*	0.0174	0.0060*	0.0922***	0.0169*	-0.159***	-0.0531*
	(0.0221)		(0.0222)		(0.0306)		(0.0239)	
EMPSTAT	0.0441	0.0147*	0.0621	0.0212*	-0.159	-0.0264*	0.326***	0.0976*
	(0.0561)		(0.0544)		(0.119)		(0.0683)	
GENDER	0.191***	0.0646*	-0.187***	-0.0660*	0.140***	0.0266*	-0.106***	-0.0357*
	(0.0211)		(0.0211)		(0.0260)		(0.0243)	
EDUYEARS			0.0101***	0.0035			0.0303***	0.0101
			(0.00156)				(0.00224)	
EXPDT	4.17e-05***	0.0000	4.36e-05***	0.0000	-5.13e-05**	0.0000	0.000136***	0.0000
	(1.18e-05)		(9.01e-06)		(2.52e-05)		(1.02e-05	
MTRD			0.0728***	0.0250*			0.141***	0.0457*
			(0.0160)				(0.0126)	
COMMBANK			0.00577	0.0020*			0.0337	0.0113*
			(0.0978)				(0.0605)	
COMMMKT			0.0231*	0.0080*			0.0289	0.0097*
			(0.0125)				(0.0680)	
COMMELECT	-0.0166	-0.0055*	0.0150	0.0052*	-0.108***	-0.0191*	0.0426*	0.0141*
	(0.0226)		(0.0220)		(0.0279)		(0.0255)	
COMMPTOF			-0.0234	-0.0081*			-0.0843	-0.0273*
			(0.131)				(0.0716)	
RADIO	0.103***	0.0342*			0.0437**	0.0081*		
	(0.0122)				(0.0213)			
TV	0.113***	0.0373*			0.119***	0.0217*		
	(0.0139)				(0.0320)			
NTFONETW	0.00237***	0.0008			-0.000833	-0.0015		
	(0.000610)				(0.00186)			
Constant	0.436***		-2.450***		1.239***			
	(0.0746)		(0.0748)		(0.130)			
Diagnostics								
Observations	16,772		16,772		15,181		15,181	
Rho (ρ)	-1.0000				-1.0000			
	(6.59e-12)				(1.18e-08)			
Wald chi2	8271.33				4081.11			
Log likelihood	-13367.269				-9565.121			
Likelihood ratio test of rho	0				0			

Table 4.4 shows report of the seemingly unrelated bi-probit estimates for mobile phone penetration and saving account (used as proxy for financial inclusion). Whilst mobile phone ownership, that is, (FON_OWN); and usage, (FON_USE) have been used as measure of mobile phone penetration in columns 9 and 11 respectively, savings account operation (SAV_ACCT) was used as one of the measures of financial inclusion in columns 10 and 12. The bi-causal relationship between mobile telephony technology and financial inclusion is also evident in Table 4.4 as in Tables 4.2 and 4.3; that is, mobile telephony technology as a driver of financial inclusion and vice-versa; columns 9, 10, 11 and 12 refers.

Table 4.4 also highlights the negative correlation between locality of residence and financial inclusion of households; the probability of financial inclusion decreasing more (by 7.5%) for households in rural areas than urban areas. It also shows that, it is more probable for mobile phones to be used in urban areas than in rural areas. This report further indicates that it is more probable (by 7.1%) for mobile phones to be used by employed household heads than unemployed household heads. Male household heads have also been identified to be more probable (by 7.6%) of getting financially included than females. On the other hand, the probability of mobile phone usage by female household head decreases by 2.1% more than male household heads.

Similarly, as seen from previous tables, the probability of financial inclusion increases by 2.4% for households in communities with motorable roads. Electricity in community though not too significant, is identified to be a driver of financial inclusion. Finally, ownership of radio and television by household heads are determinants of mobile phone technology.

Table 4.4 Effects of Mobile Phone Technology on Financial Inclusion (Savings Account)

	(9)		(10)		(11)		(12)	
VARIABLES	**FON_OWN**	**dy/dx**	**SAV_ACCT**	**dy/dx**	**FON_USE**	**dy/dx**	**SAV_ACCT**	**dy/dx**
FON_OWN			1.852***	0.4270*				
			(0.0288)					
FON_USE							1.928***	0.3106*
							(0.0666)	
SAV_ACCT	1.833***	0.4124*			1.936***	0.2219*		
	(0.0295)				(0.0528)			
AGE	-0.00599***	-0.0019	0.00418***	0.0014	5.42e-05	0.0000	0.000326	0.0001
	(0.000690)		(0.000729)		(0.000820)		(0.000732)	
LOC	-0.0121	-0.0039*	-0.0487**	-0.0166*	0.136***	0.0232*	-0.219***	-0.0746*
	(0.0253)		(0.0238)		(0.0257)		(0.0237)	
EMPSTAT	0.209***	0.0714*	-0.116**	-0.0407*	0.00556	0.0009*	0.0816	0.0271*
	(0.0556)		(0.0569)		(0.0679)		(0.0617)	
GENDER	-0.0238	-0.0077*	0.105***	0.0354*	-0.127***	-0.0207*	0.230***	0.0758*
	(0.0246)		(0.0254)		(0.0262)		(0.0249)	
EDUYEARS			0.0149***	0.0051			0.0357***	0.0121
			(0.00174)				(0.00227)	
EXPDT	4.42e-05***	0.0000	5.34e-05***	0.0000	-7.54e-05***	-0.0000	0.000137***	0.0000
	(1.45e-05)		(9.70e-06)		(1.48e-05)		(1.00e-05)	
MTRD			0.0374	0.0127*			0.0703***	0.0236*
			(0.0232)				(0.0224)	
COMMBANK			-0.00725	-0.0025*			-0.0249	-0.0084*
			(0.0238)				(0.105)	
COMMMKT			-0.0235	-0.0079*			-0.0171	-0.0058*
			(0.0226)				(0.0629)	
COMMELECT	0.0402	0.0131*	-0.0501*	-0.0172*	-0.0318	-0.0053*	-0.0284	-0.0097*
	(0.0269)		(0.0267)		(0.0259)		(0.0253)	
COMMPTOF			-0.00688	-0.0023*			0.00473	0.0016*
			(0.126)				(0.138)	
RADIO	0.131***	0.0428*			0.0552***	0.0095*		
	(0.0238)				(0.00692)			
TV	0.132***	0.0425*			0.0695***	0.0118*		
	(0.0243)				(0.0227)			
NTFONETW	0.00316	0.0010			-0.00208***	-0.0004		
	(0.00208)				(0.000369)			
Constant	0.0258		-2.249***		0.812***		-2.983***	
	(0.0778)		(0.0738)		(0.106)		(0.102)	
Diagnostics								
Observations	16,772		16, 6772		15,181		15,181	
Rho (ρ)	-1.0000				-1.0000			
	(0.0000)				(2.07e-10)			
Wald chi2	7638.62				3593.68			
Log likelihood	-12879.606				-9400.3829			
Likelihood ratio test of rho	0				0			

Table 4.5 shows report of the seemingly unrelated bi-probit estimates for mobile phone ownership and credit access (used as proxy for financial inclusion). Whilst mobile phone ownership, that is, (FON_OWN) has been used as measure of mobile phone penetration in column 13, credit access (CRED_ACESS) was used as one of the measures of financial inclusion in column 14. Missing from the report is mobile phone usage (measure of mobile phone penetration) against credit access as a measure of financial inclusion. This is because the interaction between the two variables failed to achieve convergence and hence report could not be generated.

The bi-causality of the relationship between mobile phone penetration and financial inclusion can be observed in Table 4.5 as well; the probability of mobile phone ownership increases by 27.5% for households' heads that are financially included (have access to credit); correspondingly, the probability of financial inclusion (access to credit) increases by 24.2% for household heads that own mobile phones. As seen from previous tables, the probability of mobile phone ownership decreases by 10.1% for household heads that dwell in rural areas. However, the probability of financial inclusion (access to credit) increases by 8.6% for household heads that dwell in urban areas.

Though status of employment is not too statistically significant, Table 4.5 shows that the probability of mobile phone ownership increases by 3.5% for household heads that are employed. The report further shows that the probability of mobile phone ownership increases by 7.8% for households headed by males. Again, the report highlights that the probability of access to credit (financial inclusion) decreases by 6.6% more for households headed by females than males. Electricity in community shows a positive correlation with mobile phone ownership and a negative correlation with financial inclusion (credit access). Ownership of radio and television by household heads also show a positive correlation with mobile phone ownership.

Table 4.5 Effects of Mobile Phone Technology on Financial Inclusion (Credit Access)

VARIABLES	(13) FON_OWN	dy/dx	(14) CRED_ACESS	dy/dx
FON_OWN			1.669***	0.2421*
			(0.0322)	
CRED_ACESS	1.790***	0.2747*		
	(0.0311)			
AGE	-0.00910***	-0.0028	0.00628***	0.0014
	(0.000693)		(0.000901)	
LOC	-0.336***	-0.1010*	0.388***	0.0860*
	(0.0257)		(0.0258)	
EMPSTAT	0.109*	0.0346*	0.121	0.0257*
	(0.0620)		(0.138)	
GENDER	0.245***	0.0775*	-0.275***	-0.0664*
	(0.0234)		(0.0253)	
EDUYEARS			-0.00103	-0.0002
			(0.00236)	
EXPDT	0.000190***	0.0000	-9.04e-05***	-0.0000
	(1.33e-05)		(1.19e-05)	
MTRD			0.0379*	0.0085*
			(0.0218)	
COMMBANK			0.0947	0.0225*
			(0.127)	
COMMMKT			-0.00309	-0.0007*
			(0.0963)	
COMMELECT	0.0823***	0.0255*	-0.101***	-0.0234*
	(0.0237)		(0.0237)	
COMMPTOF			-0.0329	-0.0073*
			(0.132)	
RADIO	0.169***	0.0525*		
	(0.0185)			
TV	0.254***	0.0770*		
	(0.0258)			
NTFONETW	0.00493***	0.0015		
	(0.00122)			
Constant	0.380***		-2.609***	
	(0.0797)		(0.152)	
Diagnostics				
Observations	16,772		16,772	
Rho (ρ)	-1.0000			
	(6.17e-10)			
Wald chi2	5370.20			
Log likelihood	-10488.753			
Likelihood ratio test of rho	0			

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
(*) dy/dx is for discrete change of dummy variable from 0 to 1

Table 4.6 shows report of the seemingly unrelated bi-probit estimates for mobile phone ownership and investment (used as proxy for financial inclusion). Whilst mobile phone ownership, that is, (FON_OWN) has been used as measure of mobile phone penetration in column 15, investment (INVEST) was used as one of the measures of financial inclusion in column 16. Missing from the report is mobile phone usage (measure of mobile phone penetration) against investment as a measure of financial inclusion. This is because the interaction between the two variables failed to achieve convergence and hence report could not be generated.

Table 4.6 shows a positive correlation between mobile phone ownership and financial inclusion (investment). Conversely, there is also a positive correlation between financial inclusion (investment) and mobile phone ownership. Thus, the probability of mobile phone ownership increases by 18.4% more for households' heads that are financially included than households head that are excluded. Similarly, financial inclusion (investment) increases by about 6% more for household heads who own mobile phones than household heads that do not own mobile phones.

Again, report suggests that, it is less probable (5.3%) for household heads who dwell in rural areas to own mobile phones than those who dwell in urban areas. Employment status comes across as a strong determinant of mobile phone ownership; where probability of mobile phone ownership increases by 10.3% more for employed household heads than unemployed heads.

Gender is also a significant variable that impacts mobile phone ownership but impacts financial inclusion marginally. The probability of male household heads owning mobile phones increases by 4.7% more than female household heads. Ownership of radio and television by household heads clearly are positive determinants of mobile phone ownership.

Table 4.6 Effects of Mobile Phone Technology on Financial Inclusion (Investment)

VARIABLES	(15) FON_OWN	dy/dx	(16) INVEST	dy/dx
FON_OWN			1.855***	0.0599*
			(0.113)	
INVEST	1.892***	0.1844*		
	(0.115)			
AGE	-0.0106***	-0.0028	0.00578**	0.0003
	(0.000738)		(0.00267)	
LOC	-0.202***	-0.0531*	0.122	0.0066*
	(0.0291)		(0.0906)	
EMPSTAT	0.342***	0.1032*	-0.174	-0.0113*
	(0.0650)		(0.240)	
GENDER	0.172***	0.0471*	-0.0805**	-0.0046*
	(0.0264)		(0.0368)	
EDUYEARS			0.0162**	0.0009
			(0.00751)	
EXPDT	0.000286***	0.0000	-0.000109***	-0.0000
	(1.77e-05)		(2.59e-05)	
MTRD			0.00271	0.0001*
			(0.110)	
COMMBANK			-0.168	-0.0079*
			(0.178)	
COMMMKT			0.0453	0.0026*
			(0.0624)	
COMMELECT	0.0462*	0.0124*	-0.00918	-0.0005*
	(0.0268)		(0.0666)	
COMMPTOF			0.0735	0.0043*
			(0.123)	
RADIO	0.339***	0.0937*		
	(0.0245)			
TV	0.735***	0.1919*		
	(0.0290)			
NTFONETW	0.00855***	0.0023		
	(0.00212)			
Constant	0.0909		-3.492***	
	(0.0849)		(0.325)	
Diagnostics				
Observations	16,772		16,772	
Rho (ρ)	-1.0000			
	(8.32e-09)			
Wald chi2	3345.06			
Log likelihood	-7731.6717			
Likelihood ratio test of rho	0			

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
(*) dy/dx is for discrete change of dummy variable from 0 to 1

From all the tables above (Tables 4.2 – 4.6), it is very clear that mobile phone ownership increases the probability of financial inclusiveness of households. Varied reasons account for why mobile phone ownership will lead to higher probability of financial inclusiveness of households. Mobile phone ownership marks the beginning of experiencing the technology that comes with it. For instance, one needs to own a mobile phone before availing oneself of the services that comes with mobile phone technology; such as mobile banking and mobile money. It in this direction that Thatte (2017), defined the determinants of mobile telephony technology relative to the following parameters: the mobile phone, extended battery-life of the phone and interconnection infrastructure with bank. In view of Thatte (2017), having put these parameters in place, mobile banking has the potential to increase the efficiency of payment systems, reduce reliance on cash whilst broadening access to financial services (Peha & Kahmitov, 2005); and most importantly lowering the cost of offering formal financial services. Again, mobile telephony allows expansion and access to financial services to previously underserved groups in developing countries (Andrianaivo & Kpodar, 2011). Therefore, the findings of this study largely confirm earlier studies as stated, regarding the relationship between mobile phone ownership and financial inclusion.

Based on 2010 Population and Housing Census (PHC) data, the bankable population of Ghana stood at 14,397,576 (i.e. working population) comprising 56% urban and 44% rural (Ghana Statistical Service, 2012). According to Bawumia (2017), only 40% (access rate) of the bankable population have access to formal banking services and this resonates with the 42% revealed in this study in relation to access rate to Bank; as shown in categorical table under Table 4.1. Meanwhile according to the Central Bank of Ghana, active mobile users of mobile phone telephony to transact financial services stands at about 8 million as at close of 2016. This represents 56% of the bankable population who access financial services through mobile

telephony technology as against the 40% that access financial services from formal traditional banks.

This certainly indicates a relatively higher proportion of the bankable population is financially included through mobile telephony platforms than that of formal banking (i.e. 56% against 40%). Not surprising therefore, this study revealed a positive correlation almost between phone ownership/usage and each of the financial inclusion variables (throughout Tables 4.2 – 4.6), as seen in most of the marginal effects (dy/dx) between the columns; e.g. columns 2 & 3 and columns 6 & 7, etc. Meanwhile, it is possible to have a proportion of the bankable population who access financial services from both platforms of formal traditional banks and mobile telephony technology simultaneously. Hence, the findings of this study provide rich basis for further probe in that regard; that is, to examine such convergence among the bankable population.

Furthermore, this study revealed that financial inclusion status of a household affects mobile phone ownership and usage. This is evidenced in the relationships between columns 1&2, 3&4, 5&6, 7&8, 9&10, 11&12, 13&14 as well as 15&16, as can be seen throughout Tables 4.2 – 4.6. It can be observed that households that are financially included have significant impact on mobile phone ownership and usage in the relationships enumerated. The respective positive coefficients suggest that households that are financially included have a higher probability of owning mobile phones. This is because since a mobile phone has value, it stands to reason that a certain amount of money will be required to enable a person to purchase one. The marginal effects of bank account (financial inclusion proxy in Table 4.2) are 0.4877 and 0.2726 for mobile phone ownership and mobile phone usage respectively. This is further evidenced in the relationship (dy/dx) between column 1&2 on one hand and column 3&4 on the other. These

results express that the household which suffers financial exclusion may be unable to own mobile phone, let alone used it for mobile-based financial services.

The significance of this finding is that, whilst many previous studies have focused on how financial inclusion has been driven by mobile telephony technology, this study went further to examine the opposite relationship as well. For instance, IMF (2014) concluded that, inclusion continues to grow through simple mobile-based financial activities, especially in SSA region. Similarly, Mahindra Comviva (2017) revealed that SSA has the highest rate of adoption of financial transaction through mobile phones, despite high incidence of poverty. Whilst Boatman (2014), found out that there are over 500 million mobile phones in Africa, Andrianaivo and Kpodar (2012) maintained that it provides fertile grounds for non-banking financial transaction, as mobile phones has proven to be a powerful tool capable of overcoming the financial gap in Africa. Whilst these findings indicate the positive effect of mobile telephony ownership as well as usage on financial inclusion, little did any of the studies point to the reverse situation.

Hence the relevance of the findings in this research, regarding financial inclusion impact on phone ownership as well as usage, instead of the reverse. Indeed, this study went further to defy the usual approach to prove the reverse is equally critical in driving financial inclusion as well as its effect on household's ability to own and use mobile phone device.

Household characteristics have mixed effects on mobile phone ownership and usage as well as financial inclusion status of the household. The probability of mobile phone ownership increases more for a household head that is employed than one that is not employed. Furthermore, when a household head is unemployed, the probability of mobile phone usage decreases accordingly.

The intuition is that, one needs source of funds to purchase a mobile phone. Hence the more one is employed; the more one can purchase and for that matter own a mobile phone. When a household head is employed, the probability of getting financially included increases more than

an unemployed household head. Conversely, when a household head is unemployed, the probability of the financial inclusion status decreases accordingly. All these are evident in Tables 4.2 – 4.6.

The gender of household head was also realized to impact mobile phone ownership and usage as well as financial inclusion status. Males are more probable to own and use mobile phones than females. It can also be inferred from Tables 4.2 – 4.6 that males are more probable of getting financially included than females.

The reports further show that, those who are more educated have a higher probability of getting financially included than those who are not. The probability of getting financially included increases up to 2.4% (Table 4.2) for those who are more educated than those who are not. Interestingly, it is found out that income does not really play any role in one's ability to own mobile phone or getting financially included (Tables 4.2 – 4.6). The intuition is that, one can own a mobile phone because of a gift. Again, one can be financially included not because he earns income but because of say, remittances.

It also emerged that, age of household head has impact on mobile phone ownership and usage as well as financial inclusion. The reports suggest that the probability of mobile phone ownership decreases by up to 0.4% (Table 4.3) for older people. Again, Table 4.3 shows that the probability of older people getting financially included increases by up to 0.4% than for younger people.

The results also show the extent to which community infrastructure, such as bank, permanent or daily community market, electricity, motorable road to community and post office impact on mobile phone penetration and financial inclusion. Tables 4.2- 4.4 show a positive correlation between the presence of community infrastructure and financial inclusion. Sub tables 1 and 2 show that financial inclusion of households increases (by up to 0.5%) when there is a bank in the

community. Similarly, sub table 3 points to the fact that, the absence of a bank in the community decreases the probability of households getting financially included by up to 0.8%.

Similar results hold true for the presence of a permanent or daily community market; the probability of households getting financially included rises to 0.97% as seen in sub tables 1 and 2. Sub table 3 confirms that the absence of a permanent or daily community market decreases the probability of financial inclusiveness of households by up to 0.8%.

Throughout Tables 4.2 – 4.6, there emerges interesting findings on how mobile phone penetration and financial inclusion are impacted by the absence or presence of electricity in the community. The absence of electricity in the community decreases the probability of both mobile phone ownership and usage; the probability of mobile phone usage decreases by as much as 1.9% whilst the probability of mobile phone ownership decreases by 0.6% (as seen in sub table 4.3). Conversely, the presence of electricity in the community increases the probability of mobile phone ownership by up to 2.6%. Similarly, the absence or presence of electricity in the community does have both negative and positive effect on financial inclusion; the probability of households getting financially included decreases by up to 2.3% (Table 4.5) and increases by up to 1.4% (Table 4.2).

Finally, the absence post office in community has a negative effect on financial inclusion; the probability of a household financial inclusion status decreases by 2.7% when community does not have post office.

Results on network coverage on mobile phone ownership and usage, was found to be statistically significant but with very negligible impact as evidenced from Tables 4.2 – 4.6 refers.

Results from this study further shows that household assets, such as Radio and Television do have positive correlation with mobile phone ownership and usage. The probability of households to own a mobile phone and to use a mobile phone increases when the household owns a Radio.

Similarly, the probability of a household owning and using a mobile phone increases when the household owns a Television. Intuitively, these hold true as Radio and Television remain media for mass communication and hence knowledge and appreciation of various types of mobile phones as well as the costs and benefits of owning a mobile phone can easily be ascertained for a decision to own or not to own a mobile phone. Radio and Television remain a more effective and better means of communication than the print media and more especially for those in the rural areas who are largely not literate.

In depth as this study is, so does the result pointed to insightful observations in the study of mobile phone telephony and financial inclusion. Unlike other findings from works in similar terrain, this study had revealed the dual relationship (back-to-back) between phone ownership/usage and financial inclusion, instead of the one-way direction of relationship between the two variables, as indicated in Thatte (2017); IMF (2014); Andrianaivo and Kpodar (2011).

Again, not only did this study consider many independent variables as possible, aside financial access/employment status, in examining the determinants of mobile phone adoption in terms of ownership and usage relative to accessing financial services, it further examined the extent each determinant identified contribute to mobile phone adoption. In this regard, Thatte (2017) defined the determinants of mobile telephony technology relative to the following parameters: The mobile phone, extended battery-life of the phone and Interconnection infrastructure with bank.

Also, Subbarao (2009) defined mobile telephony technology relative to financial inclusion in terms of a *hand-held-mobile* device that can be electronically linked to banks for banking transaction. However, Mahindra Comviva (2017) went further to identify Prepaid Payment Instruments (PPIs) to add on the earlier identified determinants of the mobile telephony technology in respect to driving financial inclusion. Nonetheless, this study went on to identify

good number of relevant determinants in addition to what the previous works determined in relation to promoting financial inclusiveness. These determinants are adequately presented in Table 4.1 under the categorical variables.

Interestingly, whilst some studies in similar fields had projected insightful findings relative to mobile telephony technology adoption and growth, this study focused on the specific effect of that adoption on financial inclusion aspect of the economy, instead on the entire GDP. Andrianaivo and Kpodar (2011) confirmed that mobile telephony adoption contributes significantly to economic growth in African countries and acknowledged that the positive effect on growth was partly due to greater financial inclusion. The mobile telecommunication sector continues to offer unprecedented opportunities for economic growth in both developed and developing markets, and mobile communication services have become an essential part of how economies work and function, as further posited by Deloitte (2012). Deloitte (2012) indicated that for every 10% increase in mobile penetration, Total Factor Productivity in the long run increases by 4.2% points.

The study revealed that for a given level of total mobile penetration, for instance 10% substitution from 2G to 3G penetration, increases GDP per capita growth by 0.15% point (Deloitte, 2012).

Meanwhile, this study sought to project the effective contribution of financial inclusion through mobile telephony technology ownership and usage, to the total growth as shown throughout Tables 4.2 – 4.6. However, the very margin of contribution due to financial inclusion that emanates from mobile telephony technology usage may be probed in further study to establish the rate.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter being the concluding one presents an apt summary of the research findings upon which the researcher draws conclusion in respect of the study objectives. On that basis, the researcher outlines some relevant recommendations, in respect to policy and practice in relation to driving financial inclusion through the mobile telephony technology. This chapter is a build-up of chapter four.

5.2 Summary

The main objective of this study is to determine how mobile telephony technology contributes to financial inclusion in Ghana, considering the upsurge in the adoption of the technology in Ghana as well as the increasingly inability of the formal traditional banking institutions to adequately capture majority of the bankable population in Ghana. To that extent, the researcher made an effort in meeting the two key specific objectives as stated in chapter one of this report. Based on the Ghana Living Standard Survey of Round 6, as reported by Ghana Statistical Service (2014), the researcher identified the determinants that drive mobile telephony adoption by household in Ghana. Once, a household adopts the use of mobile telephony, the technology which the device comes along with is also put into use depending on the need of the user. Among the technologies that the mobile telephony comes along with includes mobile-based financial service transactions platform. On that basis, the researcher went further to examine the extent to which the mobile telephony technology usage as well ownership had affected financial inclusion in Ghana over the years.

The study revealed that numerous variables (i.e. determinants) combined to determine ownership as well as usage of mobile telephony in Ghana, likewise the operationalization of the technology that comes with it, especially in accessing financial services on the go. The determinants had proven to be critical in not only owning a mobile phone but how to utilize them in relation to financial service transaction. Among the key variables identified as the determinants included location, age, employment status, income level, access to mass media communication, stable power supply as well as network service.

Interestingly, the study confirmed that mobile telephony technology adoption has positive effect on financial inclusion in Ghana. In this regard, the study revealed a positively high correlation between mobile phone adoption (ownership/usage) and financial inclusion (convenient access to financial services like savings account, credit, insurance, investment, access to credit etc). On the reverse side, this study went further to probe how financial inclusion could also affect mobile telephony adoption; as such probe had received little attention in the body of literature. The result indicated that effective financial inclusion positively affects mobile phone adoption in Ghana.

5.3 Conclusions

The pervasiveness of mobile phone ownership in Ghana has really risen phenomenally in recent years per the available statistics revealed in this study. Whilst the study revealed 76 per cent ownership of mobile phones, usage of mobile phones is shown to be at 95 per cent. Consequently, mobile phone is currently not only much more than a phone to both the rich and poor households, but to the unbanked and underserved population in Ghana as well.

Mobile phones have been transformed into moving banks and money wallets in the hands and pockets of people. Mobile financial services can be pointed out to be on track to yield greater integration in the financial habits of Ghanaians whilst providing avenue for employment opportunities in addition to driving the financial inclusion agenda.

To the extent that accessibility of the device drives financial inclusion, makes it imperative for more attention to be paid to the telecommunications sector. The development of this sector will yield significant benefits to households and the economy at large in view of its high propensity to drive financial inclusion. It will contribute to boost domestic savings, serve to increase money transfers to the rural areas and remittances from overseas. It will also lead to the reduction in the cost of financial transactions, with the propensity to lower the cost of doing business which will ultimately benefit small and medium enterprises.

The increased access to mobile phones by the underserved and unbanked Ghanaians would be the most cost-effective and economically efficient way to provide financial products and services to a large majority of Ghanaians.

The study clearly established the criticality of the determinants of mobile telephony technology in Ghana. Critical examination of the key variables identified as determinants can be utilized to further enhance the proliferation of mobile phones to help chart a path for accelerated financial inclusion in Ghana.

5.4 Recommendations

The mobile phone revolution has indeed caught up with Ghana where most households have adapted to its usage. However, this adaptation is bedeviled by low incomes and high levels of illiteracy in the acquisition and use of mobile phones. These obstacles are further exacerbated by high tax regimes and high cost of mobile phones amongst others. However, these challenges can

be addressed by key stakeholders; notably the Central Bank and the National Communication Authority through policy reforms.

Additionally, the Ministry of Communications can assist to scale up investment in the ICT sector. Again, accessibility to mobile phones can be improved from the perspective of the MNOs where mobile phones can be given out to consumers on contract basis and paid for over time. This will surely increase mobile phone ownership and thus help to drive financial inclusion in Ghana. Furthermore, in the area of mobile financial services, there is the need for a concerted partnership between traditional banks and the mobile network operators (MNOs) to enhance the level of synergy in order for appropriate products and services to be developed for the benefit of consumers which include reduction in cost.

There is also the need for the regulators (Central Bank and National Communication Authority) to support a single integrated framework called interoperability to increase penetration and reduce cost of operation for consumers. This is because, it is currently impossible for users to send money through one mobile network and for recipients to withdraw it through another network. Consequently, a large proportion of mobile money users have two sim cards to avoid being penalized by the lack of communication between the two mobile network operators. However, in so doing, consumers end up bearing increased costs for using mobile phones.

Regulators can again do a lot to increase bank penetration and access. This can be achieved in the context of digital data sharing between banks and the MNOs in an attempt for banks to access mobile data to open accounts for low-income users. This has the potential to allow greater access to savings and access to credit for existing mobile money customers.

Some important aspects relevant to the findings above, such as community infrastructure must be given serious consideration by the state to deepen financial inclusion in Ghana; for instance, erection of markets, provision of motorable roads etc. in communities especially in the rural

areas. Provision of markets, motorable road and electricity supply in the community have been shown by this study to impact financial inclusion as well as ownership and usage of mobile phone. Consequently, the State and its actors at the District level must do well to create and enhance such community infrastructure in a bid to deepen financial inclusion.

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