FINANCIAL INNOVATIONS AND FINANCIAL DEEPENING OF COMMERCIAL BANKS IN KENYA

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Financial Innovations and Financial Deepening of Commercial Banks in Kenya

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University

Signature……..…… Date…….....

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This thesis has been submitted for examination with our approval as University supervisors.

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DEDICATION

I dedicate this PhD thesis to my lovely wife Bernice Njeri for her love, unconditional support and encouragement throughout the entire period. I dedicate also to my children Nathan Mwai and Nevin Kanja for their patience and encouragement. Further dedication to my dear parents Joseph Mwai and Esther Nyaguthii for their support during the entire study period.

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TABLE OF CONTENTS

DECLARATION ..... **ii**

DEDICATION ..... **iii**

ACKNOWLEDGEMENTS ..... **iv**

TABLE OF CONTENTS ..... **v**

LIST OF TABLES ..... **xiv**

LIST OF FIGURES ..... **xvii**

LIST OF APPENDICIES ..... **xviii**

ABBREVIATIONS AND ACRONYMS ..... **xix**

DEFINATION OF KEY TERMS ..... **xxi**

ABSTRACT ..... **xxiii**

CHAPTER ONE **1**

INTRODUCTION **1**

1.1 Background of the Study 1

1.1.1 Global Perspective between Financial Innovation and Financial Deepening 2

1.1.2 Regional Perspective between Financial Innovation and Financial Deepening 4

1.1.3 Local Perspective between Financial Innovation and Financial Deepening 5

1.1.4 Kenya Commercial Banking Sector and Financial Innovation 6

1.2 Statement of the Problem 7

1.3 Objectives of the Study 8

1.3.1 General Objective 8

1.3.2 Specific Objectives 8

1.4 Research Hypotheses 9

1.5 Justification of the Study 9

1.5.1 Regulatory Authorities 9

1.5.2 Commercial Banks 10

1.5.3 Scholars 10

1.6 Scope of the Study 10

1.7 Limitations of the Study 11

CHAPTER TWO 13

LITERATURE REVIEW 13

2.1 Introduction 13

2.2 Theoretical Review 13

2.2.1 Financial Intermediation Theory 13

2.2.3 Innovation Diffusion Theory 14

2.2.4 Agency Theory 16

2.2.5 Transaction Cost Theory 17

2.2.6 Financial Repression Theory of Financial Deepening 19

2.3 Conceptual Framework 20

2.3.1 Mobile Phone Banking 22

2.3.2 Automated Teller Machine Banking 22

2.3.3 Online banking 23

2.3.4 Agency Banking 23

2.3.5 Bank Size 24

2.3.5 Financial Deepening 24

2.4 Empirical Literature Review 25

2.4.1 Mobile Phone Banking and Financial Deepening of Commercial banks 25

2.4.2 Automated Teller Machine and Financial Deepening 45

2.4.3 Online Banking and Financial Deepening 55

2.4.4 Agency Banking and Financial Deepening 63

2.4.5 Bank Size and Financial Innovation 71

2.5 Summary of Literature Review 75

2.6 Critique of Existing Literature 76

2.7 Research Gaps 77

CHAPTER THREE 79

RESEARCH METHODOLOGY 79

3.1 Introduction 79

3.2 Research Philosophy 79

3.3 Research Design 80

3.4 Target Population 80

3.5 Data Collection Instruments 81

3.6 Data Collection Procedure 81

3.7 Data Processing and Analysis 81

3.8 Statistical Modelling 82

3.9 Variable Measurement 82

3.9.1 Financial deepening 83

3.9.2 Financial Innovations Composite Index (FICI) 83

3.9.3 Mobile Phone banking 83

3.9.4 ATM Banking 84

3.9.5 Online Banking 84

3.9.6 Agency Banking 85

3.10 Diagnostic Tests 85

3.10.1 Tests of Normality....85
3.10.2 Stationarity Test....85
3.10.3 Multicollinearity Tests....86
3.10.4 Test for Homoscedasticity....86
3.10.5 Auto-correlation Test....86
3.10.6 Panel Granger Causality....86
3.10.7 Fixed Effects or Random Effects....87
CHAPTER FOUR....88
RESULTS AND DISCUSSIONS....88
4.1 Introduction....88
4.2 Descriptive Statistics....88
4.2.1 Descriptive Statistics for Commercial Banks in Kenya....88
4.2.2 Descriptive Statistics for Mobile Phone Banking....90
4.2.3 Descriptive Statistics for ATM banking....92
4.2.4 Descriptive Statistics for Online Banking....93
4.2.5 Descriptive Statistics for Agency Banking....95
4.3 Panel Data Diagnostic Tests....96
4.3.1 Panel Unit Root for Commercial Banks in Kenya....97

4.3.2 Panel Unit Root for Mobile Phone Banking 99

4.3.3 Panel Unit Root for ATM Banking 100

4.3.4 Panel Unit Root for Online Banking 101

4.3.5 Panel Unit Root for Agency Banking 102

4.4 Multi-Collinearity Test 103

4.4.1 Multicollinearity Test for Commercial Banks in Kenya 103

4.4.2 Multicollinearity Test for Mobile Phone Banking 104

4.4.3 Multicollinearity Test for ATM Banking 104

4.4.5 Multicollinearity Test for Online Banking 105

4.4.6 Multicollinearity Test for Agency Banking 106

4.5 Correlation Analysis 106

4.5.1 Correlation Analysis for Commercial Banks in Kenya 107

4.5.2 Correlation Analysis for Mobile Phone Banking 108

4.5.3 Correlation Analysis for ATM Banking 109

4.5.4 Correlation Analysis for Online Banking 110

4.5.5 Correlation Analysis for Agency Banking 111

4.6 Panel Heteroskedasticity Test 112

4.6.1 Panel Heteroskedasticity for Commercial Banks in Kenya 113

4.6.2 Panel Heteroskedasticity for Mobile Phone Banking 113

4.6.3 Panel Heteroskedasticity for ATM banking.....114

4.6.4 Panel Heteroskedasticity for Online banking.....115

4.6.5 Panel Heteroskedasticity for Agency Banking 116

4.7 Panel Serial Autocorrelation Test 116

4.7.1 Panel Serial Correlation for Commercial Banks in Kenya 117

4.7.2 Panel Serial Correlation for Mobile Phone Banking.....117

4.7.3 Panel Serial Correlation for ATM Banking 118

4.7.4 Panel Serial Correlation for Online Banking 118

4.7.5 Panel Serial Correlation for Agency Banking.....119

4.8 Panel Granger Causality Test.....119

4.8.1 Panel Granger Causality Test for Commercial Banks in Kenya.....119

4.8.2 Panel Granger Causality Test for Mobile Phone Banking 121

4.8.3 Panel Granger Causality for ATM Banking.....122

4.8.4 Panel Granger Causality of Online Banking.....123

4.8.5 Panel Granger Causality of Agency Banking 124

4.9 Panel Hausman Test.....124

4.9.1 Panel Hausman Test for Model without Moderation.....125

4.9.2 Panel Hausman Test for Moderated Model of Commercial Banks in Kenya 126

4.9.3 Panel Hausman Test for Mobile Phone Banking 127

4.9.4 Panel Hausman Test for ATM Banking.....128

4.9.5 Panel Hausman Test for Online Banking.....129

4.9.6 Panel Hausman Test for Agency Banking 130

4.10 Hypothesis Testing.....130

4.10.1 Effect of Mobile Phone Banking on Financial Deepening of Commercial Banks in Kenya 130

4.10.2 Effect of ATM-Banking on Financial Deepening of Commercial Banks in Kenya 132

4.10.3 Effect of Online Banking on Financial Deepening of Commercial Banks in Kenya 134

4.10.4 Effect of Agency Banking on Financial Deepening of Commercial Banks in Kenya 136

4.11 Moderating Effect of Bank Size on the Effect of Financial Innovations and Financial Deepening on Commercial Banks in Kenya 138

CHAPTER FIVE.....144

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS 144

5.1 Introduction.....144

5.2 Summary of Findings 144

5.2.1 Mobile Banking and Financial Deepening of Commercial Banks in Kenya 144

5.2.2 ATM Banking and Financial Deepening of Commercial Banks in Kenya ... 145

5.2.3 Online Banking and Financial Deepening of Commercial Banks in Kenya . 145

5.2.4 Agency Banking and Financial Deepening of Commercial Banks in Kenya 145

5.2.5 Bank Size Moderating Effect on Relationship between Financial Innovations and Financial Deepening of Commercial banks in Kenya 146

5.3 Conclusions 146

5.4 Recommendations 147

5.5 Areas of Further Research 148

REFERENCES 150

APPENDICES 175

LIST OF TABLES

Table 4.1: Overall Descriptive Statistics for Commercial Banks in Kenya.....89

Table 4.2: Descriptive Statistics for Mobile Phone Banking.....91

Table 4.3: Descriptive Statistics for ATM Banking.....93

Table 4.4: Descriptive Statistics for Online Banking.....94

Table 4.5: Descriptive Statistics for Agency Banking.....96

Table 4.6: Panel Unit Root for Commercial Banks in Kenya.....98

Table 4.7: Panel Unit Root for Mobile Phone Banking.....99

Table 4.8: Panel Unit Root for ATM Banking.....100

Table 4.9: Panel Unit Root for Online Banking.....101

Table 4.10: Panel Root for Agency Banking.....102

Table 4.11: Multicollinearity Test for Commercial Banks in Kenya.....103

Table 4.12: Multicollinearity Test for Mobile Phone Banking.....104

Table 4.13: Multicollinearity Test for ATM Banking.....105

Table 4.14: Multicollinearity Test for Online Banking.....105

Table 4.15: Multicollinearity Test for Agency Banking.....106

Table 4.16: Correlation Analysis for Commercial Banks in Kenya.....108

Table 4.17: Correlation Analysis for Mobile Phone Banking.....109

Table 4.18: Correlation Analysis for ATM Banking 110

Table 4.19: Correlation Analysis for Online Banking 111

Table 4.20: Correlation Analysis for Agency Banking.....112

Table 4.21: Panel Heteroskedasticty for Commercial Banks in Kenya 113

Table 4.22: Panel Heteroskedasticty for Mobile Phone Banking 114

Table 4.23: Panel Heteroskedasticty for ATM Banking.....115

Table 4.24: Panel Heteroskedasticty for Online Banking.....115

Table 4.25: Panel Heteroskedasticty for Agency Banking 116

Table 4.26: Panel Serial Correlation for Commercial Banks in Kenya 117

Table 4.27: Panel Serial Correlation for Mobile Phone Banking 117

Table 4.28: Panel Serial Correlation for ATM Banking.....118

Table 4.29: Panel Serial Correlation for Online Banking.....118

Table 4.30: Panel Serial Correlation for Agency Banking.....119

Table 4.31: Panel Granger Causality Test for Commercial Banks in Kenya.....120

Table 4.32: Panel Granger Causality Test for Mobile Phone Banking.....121

Table 4.33: Panel Granger Causality of ATM Banking.....122

Table 4.34: Panel Granger Causality of Online Banking.....123

Table 4.35: Panel Granger Causality of Agency Banking 124

Table 4.36: Panel Hausman Test for Commercial Banks in Kenya.....126

Table 4.37: Panel Hausman Test for Moderated Model of Commercial Banks in Kenya 127

Table 4.38: Panel Hausman Test for Mobile Phone Banking.....128

Table 4.39: Panel Hausman Test for ATM Banking.....129

Table 4.40: Panel Hausman Test for Online Banking.....129

Table 4.41: Panel Hausman Test for Agency banking.....130

Table 4.42: Random Effect Model on Effect of Mobile Banking on Financial Deepening of Commercial Banks in Kenya.....132

Table 4.43: Random Effect Model on Effect of ATM Banking on Financial Deepening of Commercial Banks in Kenya.....134

Table 4.44: Random Effect Model on Effect of Online Banking on Financial Deepening of Commercial Banks in Kenya.....136

Table 4.45: Random Effect Model on Effect of Agency Banking on Financial Deepening of Commercial Banks in Kenya 138

Table 4.46: Random Effect on Effect of Financial Innovations on Financial Deepening of Commercial Banks in Kenya.....140

Table 4.47: Moderating Effect of Bank Size on the Effect of Financial Innovations and Financial Deepening Commercial Banks in Kenya.....142

Table 4.48: Summary of Statistical Hypotheses Testing Results.....143

LIST OF FIGURES

Figure 2.1: Conceptual Framework 21

LIST OF APPENDICIES

Appendix I: Introduction Letter.....175

Appendix II: Secondary Data Collection Instrument.....177

Appendix III: Study Population: List of Commercial Banks in Kenya 178

ABBREVIATIONS AND ACRONYMS

ATM	Automated Teller Machine
CBK	Central Bank of Kenya
CRBs	Credit Reference Bureaus
EASE	East Africa Stock Exchange
ECB	European Commercial Bank
FDI	Foreign Direct Investment
FICI	Financial Innovation Composite Index
FINTECH	Financial Technology
FSD	Financial Sector Deepening
GCI	Global Competitiveness Index
GCR	Global Competitiveness Report
GDP	Gross Domestic Product
ICT	Information Communication Technology
IMF	International Monetary Fund
KNBS	Kenya National Bureau of Statistics
KYC	Know Your Customer
MFC	Mortgage finance company

NSE	Nairobi Securities Exchange
POS	Point-of Sale
R&D	Research and Development
ROA	Return on Assets
SMS	Short Message Services
TAM	Technology Acceptance Model
TCT	Transaction Cost Theory
VIF	Variance Inflation Factor
WEF	World Economic Forum

DEFINATION OF KEY TERMS

Agency banking Agency banking is a type of branchless banking that allows the traditional banks to extend their network of branches and services in a cost-efficient manner through authorized agents. Agency banking is gaining popularity due to various reasons like product availability, risk management, improvement in financial inclusion, and many more. (Modupe, 2010).

Automated teller machine (ATM) An automated teller machine (ATM) is an electronic banking outlet that allows customers to complete basic transactions without the aid of a branch representative or teller. (Adewoye, 2013).

Financial deepening The provision of low cost, attainable and relevant financial products to persons and firms who had previously not been able to enjoy their satisfaction (Kumar & Mohanty, 2011)

Financial Innovation the development by financial institutions of new financial products and processes for the transmission of money and the lending and borrowing of funds, for example, telephone banking services, direct debit systems, credit cards, etc. These developments have augmented the traditional means of transmitting money (cash, cheques) and may have served to increase the velocity of circulation of money (Kithuka, 2012).

Mobile banking	Mobile banking is the act of making financial transactions on a mobile device. (Anyasi & Otubu, 2009).
Online banking	Access to internet supported banking service (Kithuka, 2012).

ABSTRACT

Technological innovation has conceived digital financial products which has enhanced access to financial banking services. Historic institutions, out of fashion technology encompassed by consumer unfriendly methodologies have ripened the financial industry for financial technology transformation. Subsequently, there has been a surge in fintech innovations in the emerging markets and despite significant progress in their adoption, there are still enormous swathes of global population with limited or no access to formal finance. These financial innovations have altered traditional banking services and its ultimate value addition to financial services cannot be ignored. Consequently, the current study was undertaken with the general objective of establishing the effect financial innovations have on financial deepening of commercial banks in Kenya. Mainly, the study explored the effect of mobile banking, ATM banking, online banking and agency banking on commercial banks financial deepening. In addition, moderating effect of bank size on the effect of financial innovations and commercial banks financial deepening was examined. Secondary data was collected from Kenya National Bureau of Statistics, World Bank website, Central Bank of Kenya, published financial accounts statements of all the 43 commercial banking institutions in Kenya, and the Banking survey publications for a time period ranging between 2012 to 2018.The study was anchored on financial intermediation, innovation diffusion, agency, transaction cost and financial repression theory of financial deepening. The study adopted descriptive cross-sectional research design. The five research hypothesis were estimated using panel data techniques of random effect model. The study analyzed time series secondary panel data. Target population comprised of 43 commercial banks licensed and operational in Kenya. Panel secondary data was collected through use of document check index. Inferential and descriptive statistics were adopted for data analysis. Positive significant relationship between mobile phone banking, automated teller machine, online banking, agency banking and financial deepening were reported. Bank size had positive moderating effect on financial innovations and financial deepening of Commercial banks in Kenya. In secondary data collection, one of the variables agency banking had only 18 operational agents hence the study utilised point of sale in order to gather sufficient data to give conclusive results. It was recommended that government ought to develop polices geared towards adoption of financial innovation to amplify access to financial services. There is need to invest on internal controls and security management to mitigate against risk exposure due to alternative service provision strategies. Since mobile banking may over step and overtake some commercial banking functions, there is need to regulate and confine it to its main objective of remittances. The Central bank must urgently come up with regulations that ensure that all mobile banking transactions are tracked to avoid huge cash balances ‘floating’ outside the formal system which then threaten liquidity in the economy. Banks should come up with thoughtful policies that permit them to be intermediaries or agents for the non-bank led product which has deeper access to people in order to lubricate the cash constraints and make the product more convenient.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Recently business environment has become very turbulent owing to influx of technology in decision making and ease of transferring information amongst stakeholders. Consequently, there is decreased information access costs and development of strategic business solutions which are customized to addressing unique customer needs. Banking sector have not lagged behind and has persistently incorporated information communication technology, thus altering tradition banking operations (Adewoye, 2013). Business competition has too intensified and can be deemed too complicated due to globalization. Hence, demand for banking services to match recent trends is unavoidable otherwise commercial banks has to shrink and ultimately close down (Aker, 2010).

Commercial banking financial innovations have adopted hierarchical approach from ATM, online banking, mobile banking and agency banking (Castillo, 2009). Although, these efforts are geared towards enhancing commercial banks performance their contribution in financial deepening cannot be overlooked due to alteration on banking loans and savings. According to Central Bank of Kenya (CBK), these innovations have been achieved courtesy of technological development in hardware, software and telecommunications. It is worth noting synchronization of commercial banking services has amplified financial deepening since customers can open and operate their accounts without physical banking visits (CBK, 2014).

Financial deepening is the provision of low cost, attainable and relevant financial products to persons and firms who had previously not been able to enjoy their satisfaction (Kumar & Mohanty, 2011). According to Omwansa and Waema (2014) growth of telecommunication and mobile phones penetration has amplified financial deepening especially amongst those who were unbanked and those who earn their living

in the informal sector. Individuals who are able to access financial services enjoy a myriad of benefits over those who are financially excluded such as smooth income transactions and financial security provided by savings build up. It is therefore indispensable that financial institutions ought to expand their financial products and services via the embrace of adaptation and diffusion of innovative financial instruments for investment, service for operational efficiency and payment channel for intermediation efficiency Financial system development is attributed to its ability to bridge the gap between deficit saving units and surplus units and introduction of non-banked population to banking services.

1.1.1 Global Perspective between Financial Innovation and Financial Deepening

Financial innovation is regarded as the apparatus driving the financial system towards its goal of improving the economy. Merton (1986) cites the U.S national mortgage market, the development of international markets for financial derivatives and the growth of the mutual funds and investment industries as examples where financial innovation has produced enormous social welfare gains.

A study of trends in Brazil, Peru and Colombia explains a slow implementation of agent banking during the first two years followed by an increase in the third or fourth year. However, data after Mexico's first year of allowing agent banking leads to the prediction that there will be a rapid increase in banking agents in the initiative's second year, one that can be compared to increases in Colombia's fourth year and Peru's sixth. Mexico's new regulations to allow more types of financial institutions to operate through bank agents and to allow the opening of savings accounts will have a significant impact on financial deepening and place Mexico among the leaders in agent banking in Latin America (Celina, 2012).

Traditionally innovation was perceived as cost minimization strategy, risk reduction, market penetration and service efficiency enhancement and amplified commercial entity growth (Francesca & Claeys, 2010). The situations have been altered since it's currently

viewed owing to sporadic and turbulent business environment which has altered commercial entities performance targets (Gardachew, 2010). Through financial products engineering business dynamism response can be easily managed. According to Henderson and Pearson (2011) there are chances of information asymmetry which may create chances of business losses but through technological innovations due diligence prior to commercial enterprise engagement can be easily evaluated.

Financial innovation is viewed as a key driving force in the financial system towards its objective of improving the economy. Merton (1986) cites the U.S national mortgage market, the development of international markets for financial derivatives and the growth of the mutual funds and investment industries as examples where financial innovation has produced enormous social welfare gains. Despite of commercial entities amplifying financial innovation there is need for empirical enquiry on their contributions towards economic development through financial inclusion and deepening.

Empirical enquiry on contribution of financial innovation has attracted attention from (Nofie, 2011; Nyangosi & Arora, 2011) has escalated its empirical value amongst strategic and marketing researchers. These calls for customized enquiry on its contribution on financial deepening. According to Lout, Skina, Elena and Strahan (2009) most institutions have enhanced their survival capacity upon adoption of innovative products development. Despite of the findings confirming innovation leads to profitability and competitive advantage, their contribution on economic development via financial deepening calls for in depth enquiry to document it. Furthermore, economic value addition of financial institutions will be dependent on quality and quantity of services accorded to customers since the duo will enhance customer retention and loyalty.

Innovation in banking sector lead to operational costs reductions and enhanced customer satisfaction, this is due to amplification on banking services access upon adoption of digital financial products. It has been argued that unless commercial banks adopt digital financial products then there are low chances of enhancing their performance and

retaining their customers since there will exude to those institutions which have incorporate innovations in their strategic plans (Jegede, 2014). This can only through continued interrelationship between all stakeholders such as regulatory institutions and political elite who are bestowed with the responsibility of legalizing banking operating guidelines through passing of relevant legislations.

1.1.2 Regional Perspective between Financial Innovation and Financial Deepening

In developing countries, over three billion people still lack access to basic financial services and mostly this is acute in Sub-Saharan Africa where only around five to twenty-five percent have access to formal relationship with financial institutions. (FSD, 2018)

According to International Monetary Fund (2012) a financially deep economy has reliable, efficient and easily accessible banking services and has integrated its financial players with the sole purpose of promoting economic growth and development. According to Goyal, Marsh, Narayanan, Wang, and Ahmed (2011) financial deepening attracts informally banked funds to be incorporated into formal banking systems and this will be led to provision of loan services amongst those seeking for borrowing. It also promotes liquidity in the economy which stimulates the level of economic activities and hence economic growth (Torruam, Chiawa, & Abur, 2013).

Allen, Demirguc-Kunt, Klapper, and Peria (2012) indicate that the critical aspect of financial deepening is identifying the barriers to participation of the population into the mainstream or some sort of formalized financial services and ensuring that there are alternatives that remove these barriers and the unbanked feel that they have an equitable access to these financial services unhindered.

Innovation is perceived as logical flow of concepts to improve the current existing status on service delivery. Banking financial innovation is adoption of alternative strategies on service delivery so as to improve quality of services accorded to customers. Through financial innovation commercial banks are enabled to assure their customers on capacity to provide efficient and reliable services. Courtesy of these assurance commercial banks will be strategic and will be competitively positioned (Chang & Dutta, 2012). According to Cracknell (2012) financial innovation can be credited to product developments and customized evaluation criterions when commercial banks are lending or recruiting new customers.

1.1.3 Local Perspective between Financial Innovation and Financial Deepening

Mwangi (2013) argued in favour of considering customers interest whenever developing innovative products because despite turbulence of business environment adoption of new innovation is paramount for its success. Similar, arguments were put forth by Joshua (2010) who argued that net present value of investment project can only be achieved through incorporation of all stakeholder's interest and in situations where commercial banks are driven by desire to enhance efficiency they must consider customer needs and ease of using new development.

In Kenya the situation on financial innovation have intense competition from telecommunication communications such as Safaricom M-pesa services. This innovation is credited for its easy to use human user interface and due to this it has escalated financial innovation to the extent of creating overdraft facility for its users. According to Weil, Mbiti and Mwega (2012) financial innovations has reduced turnaround time for banking services such as withdrawals, deposit and loan approval process. Despite of this documented evidence its contribution on economic development through financial deepening is barren empirical ground.

According to Kithuka (2012) financial innovations have endeavored to match information and communication technology advancement. It is worth noting that financial innovations have deployed hierarchical approach on incorporation and introduction of new financial products such as ATM, internet banking, agency banking and mobile banks. Due to these changes commercial banks has persistently reduced their operational costs and amplified their profit capacity. Mwangi (2013) attributed these changes to continued liberalization in the financial sectors for example National Payments Systems Act 2011 enabled commercial banks to interlink their services with point of sale systems and mobile payments platforms. This has escalated contribution of innovation on commercial banking service provision and its paramount to note that ATM growth and penetration in Kenya is overwhelming to 2381 in 2013 from 100 in 2000.

1.1.4 Kenya Commercial Banking Sector and Financial Innovation

One of the key functions of commercial banks is intermediation. To achieve this there are at least 44 banking institutions licensed in Kenya (Banking Supervision Annual Report, 2015). CBK is the sole regulator of microfinance banks, foreign exchange trading bureaus, credit reference bureaus and commercial banks. Commercial banks are distributed as 31 local banks, 3 publicly owned and 28 privately held banks and 13 are foreign. Currently, only 11 commercial banks are listed in Nairobi securities exchange. Moreover, Chase, Imperial and Dubai banks are under receivership. Though, Chase has been taken over by SBM bank.

According to Ongore and Kusa (2013) commercial banking realization of financial intermediation is dependent on individual institution extent of financial innovation and customized development of financial products. In fact, there is need for financial institutions to embrace the value of technology based financial services for them to remain profitable and optimal in their operations.

KPMG Africa banking survey (2014) highlights that banking players are confronted with challenges including those on new regulations which the banks should adopt to remain compliance. In East Africa, Kenya's financial sector with specificity to Commercial banks has received numerous accolades in its mobilization of deposits, reduction of volume of trade and coming up with innovations to enhance financial access.

1.2 Statement of the Problem

Commercial banks are not immune of competition from other stakeholders in financial system. Hence, the wave of financial innovation CBK (2016), banks in Kenya are now facing exorbitant operational costs, management inefficiencies and liquidity difficulties characterized by mergers, restructuring, acquisitions and closure of banks in a span of nine months among them; Imperial bank, Chase bank, Dubai bank.

There is no empirical coherence on the influence of financial innovations on financial deepening of commercial banks for example Gennaioli, Shleifer and Vishny (2012) did a study on neglected risks, financial innovation and financial fragility found that the benefits of financial innovation promote greater efficiency and facilitates the smooth consumptions and investment decisions with considerable benefits to clients. Lerner and Tufano (2011) attributed it to escalation on transactions and ease of information management and they recommended need for subsequent enquiry to authenticate its contribution on financial access more so with emergence of technology driven products. In Kenyan context (Ngumi, 2014; Mwangi, 2013) relied on primary data and found that innovations had significant contribution on profitability. There was no consensus between theoretical and empirical findings since some were positive, negative, significant or non-significant.

The bulk of the literature on financial deepening focuses mainly on the macroeconomic perspective and its implications for growth (Chortareas et al., 2011). The study shifts its focus to its microeconomic implications, especially the firm-specific effects, by

modelling the environment within which banks operate in ensuring financial deepening is enhanced.

It is paramount to note that despite of these studies being carried out there are glaring methodological challenges attributes to subjective sampling procedure, fitting regression model with no classical regression results. Exploring of direct link between financial innovation and performance with no moderating effect of bank size is what the previous studies have had a deficiency on. It's against this the current study explored the effect of financial innovations on financial deepening of commercial banks in Kenya as well as its size moderation.

1.3 Objectives of the Study

The objectives of the study include general and specific objectives that informs the study as outlined

1.3.1 General Objective

The general objective of this study was to analyze the effect of financial innovations on financial deepening of commercial banks in Kenya.

1.3.2 Specific Objectives

Specifically, the following objectives guided the study:

i. To determine the effect of mobile phone banking on financial deepening of commercial banks in Kenya.
ii. To examine the effect of ATM banking on financial deepening of commercial banks in Kenya.
iii. To establish the effect of online banking on financial deepening of commercial banks in Kenya.

iv. To find out the effect of agency banking on financial deepening of commercial banks in Kenya.

v. To determine the moderating effect of bank size on the relationship between financial innovations and financial deepening of commercial banks in Kenya.

1.4 Research Hypotheses

The following hypotheses were adopted in the study:

H_{o1}: There is no significant effect of mobile phone banking on financial deepening of commercial banks in Kenya.

H_{o2}: There is no significant effect of ATM banking on financial deepening of commercial banks in Kenya.

H_{o3}: There is no significant effect of online banking on financial deepening of commercial banks in Kenya.

H_{o4}: There is no significant effect of agency banking on financial deepening of commercial banks in Kenya.

H_{o5}: There is no significant moderating effect of bank size on the relationship between financial innovation and financial deepening of commercial banks in Kenya.

1.5 Justification of the Study

The findings of this study were important to the following stakeholders:

1.5.1 Regulatory Authorities

The study was of importance to the central bank of Kenya as a regulatory authority to grow the financial services sector by adopting ICT strategies that may lead to financial

deepening and enhance financial access and inclusion. Regulatory authority will liberalize operations of commercial banks so as to optimize on benefits associated with commercial adoption of technology adoption of financial deepening.

1.5.2 Commercial Banks

New empirical evidence will ignite realignment of commercial banks strategic plans so to align themselves with Kenyan vision 2030. Further, increase levels of financial deepening may amplify economic development and growth.

1.5.3 Scholars

Existing findings inconclusiveness will be further explored and alternative methodical approaches recommended to explore the nexus further. Financial innovation and practitioners may learn invaluable information on how the impact of their work in development of the financial system.

1.6 Scope of the Study

Institutions that comprise financial industry in Kenya include the stock exchange, commercial banks, microfinance banks, insurance companies, investment banks, and pension funds. The limited contextual scope specific to current research was commercial banks in Kenya and focus information was provided by Central Bank of Kenya, Statistical bulletin, Kenya National Bureau of Statistics and Nairobi Stock Exchange. The study population was composed of all commercial banking institutions in Kenya registered and operational by the end of the year 2018.

The study concentrated on a period of seven years. The period from 2012 to 2018 was preferable as it represented rapid financial development when financial services digitization had gained rapid increase after the promulgation of the new Constitution 2010. The seven-year period used was assumed to be enough to provide observations that could make conclusive results. The researcher employed a census study.

The Secondary data employed was time-series and cross-sectional. TSCS are designs that have been considered and preferred for studies of causation. In addition to their ability to detect causal relationships, TSCS designs give advantages that are varied when unbalanced panel data regression analysis is in use. The current study assumes that all commercial banks' annual audited financial statements will be available for the researcher to use. To address sample size limitations which has characterized several studies in the past, the current study utilized panel data of all commercial banks which had been in operation between 2012 up to 2018.

The study also utilized a combination of descriptive and correlation research designs. The study had a sample of 43commercial banks that were operational in Kenya. Secondary data was be organized through use of document check index with the help of research assistants. The conceptualized scope of concern in this research underlies on the effect of financial innovations on financial deepening of commercial banks in Kenya. The study specifically examined the effect of mobile banking, ATM banking, On-line banking, agency banking as well as moderating effect of banks' size.

Accordingly, it is worth noting that varying theories have forthwith been brought forward to elaborate on the effect of financial innovations on financial deepening of commercial banks in Kenya. The current study limited itself to financial intermediation theory originated from work done by Gurley and Shaw (1960),innovation diffusion theory postulated by Rogers (1962), agency theory by Jensen and Meckling (1979), transaction cost theory by Coarse (1937) and financial repression theory of financial deepening brought forward by Mckinnon and Shaw (1973).It is within these four theories that the study on financial innovations and financial deepening was anchored and as well scrutinizing the moderating effect of bank size measured by total assets

1.7 Limitations of the Study

Although, the current study adopted use of secondary data it was not void of challenges especially during its collection because it was not initially gathered for this particular

study. Secondary, reliance of secondary data was inhibited to only information which was public through alternative platforms such as Kenya national bureau of statistics, Central bank annual reports and respective commercial banks financial statements. This may have led to taking long time during data collection. Despite of commercial banks having alternative financial innovations; this study limited its enquiry on mobile phone banking, ATM banking, online banking and agency banking owing to their co-movements on their adoption and influx especially after enhanced penetration of information technology.

The current study at a great extent depended on secondary information that was subjected to the limitations inherent on financial statements by banks as published for the general public and under the custody of supervision division of CBK and as published by Kenya National Bureau of Statistics. Although the threshold of these reports was deemed reliable and expected to meet international financial reporting standard requirements, there are chances of undetected errors which may lead to inherited limitations in case of error of original entries. However, this did not affect the validity of the results derived from the study.

Theoretically, the study was anchored on financial intermediation theory, innovation diffusion theory, agency theory, transaction cost theory and financial repression theory of financial deepening. Conceptually, the study explored direct link of the effect of financial innovation on financial deepening of commercial banks and moderation of bank size. The choice of these was based on theoretical, empirical and past suggested areas of empirical examination. Even though, alternative measures had been adopted in the past, there were multiples of each other hence the current study adopted various three parameters of financial innovations as measures of mobile phone banking, ATM banking, online banking while agency banking was measured using point of sale transactions since only 18 commercial banks had operational agents which may have reduced sample size by half so as to be able to gather secondary data for all variables.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This section covers the review of pertinent literature. It reviews literature on commercial bank's financial innovations. Discusses the key determinants of financial innovations, develops a conceptual framework and expounds on the research gaps.

2.2 Theoretical Review

The study was guided by innovation diffusion, agency, technology acceptance model and constraints induced financial innovation. Theoretical arguments and relevance in the study are discussed in the following section.

2.2.1 Financial Intermediation Theory

This theory was postulated by Gurley and Shaw (1960). This theory was established on the premise of cost minimization associated with information generation useful for resolution of problems of incentive in that banking institutions share merits of gross cost in acquisition of the information.

Accordingly, money related intermediation is the degree to which monetary establishments bring shortfall spending units and surplus spending units together (Ndebbio, 2004). A vital inquiry that speculations attempt to answer is the reason do financial specialists initially loan to banks who at that point loan to borrowers, rather than loaning straightforwardly? Contentions indicate out the way that banks can viably screen borrowers and along these lines assume the part of appointed observing (Diamond, 1984).

Diamond explains that lessened checking costs are a wellspring of this similar preferred standpoint. He contends that delegates give benefits by issuing optional budgetary resources for purchasing essential money related resources. On the off chance that intermediary gave no service, financial specialists who purchase the optional securities issued by the go-between should buy the essential securities straightforwardly and spare the middle person's expenses. Money related market gratings can be the basic system for producing steady pay disparity or destitution traps. These market contacts incorporate data asymmetry and exchange expenses and assume a focal point, affecting key choices with respect to human and physical capital amassing and word related decisions. In the process of financial intermediary which results in financial institution expanding in size, it endeavors to extend facilities and offer affordable financial services at low cost to enhance financial deepening (Casu et al., 2006)

For instance, as indicated by Demirguc-Kunt, Asli, Beck, and Honohan. (2008) in hypotheses focusing on capital gathering, money related market flaws decide the degree to which the poor can get to put resources into tutoring or physical capital. Eliminating imperfections in the financial market creates opportunities for increased financial performance hence financial institutions will have enough resources to invest in innovations that will enhance uptake of their financial services and remain competitive in the market. The theory was applied in this study as it highlights the benefits that accrue from investing in financial innovations that financial institutions need undertake to enhance financial deepening and inclusion.

2.2.3 Innovation Diffusion Theory

Innovation diffusion theory was stipulated by Rogers (1962). Theory argues that any institutions aiming to achieve growth must be willing to undertake innovations. This theory posits that there are five key attributes of innovations; improvement of current modes operandi, consistent approach to performance, pre-testing capacity and ease to observe any shortcoming (Frame & Scott, 2001). According to Hirtle, (2005) institutions have capacity to gain competitive advantage and minimize operational costs courtesy of

innovations. Further, institutions would easily penetrate new markets and discover alternative means of serving their customers. Gardachew (2010) argued that they innovation benefits are not void of challenges such as exposure to security threats, resistances from management and customers, complex approach to current situations and need for drastic replacements due to dynamic and sporadic technological changes.

The work of Rogers (2003) diffusion of innovation theory as analyzed within the lens of the Dubin framework presents pertinent gaps in theory that emerge (Lundblad and Jennifer, 2003). Organizations are potrayed as a social system, but within organizations, departments or teams can also serve as social systems. Hitherto the exceptional issues and elements of units or teams within a larger organizational context are not addressed in terms of how these confines affect the adoption of innovation. In addition, boundaries are not explained for instances when diffusion of innovation occurs across organizations, such as between schools of a school district or hospitals and clinics within a health care delivery system (Lundblad & Jennifer, 2003

Accordingly, adoption of a new idea, behavior, or product (i.e., "innovation") does not happen simultaneously in a social system; rather it is a process whereby some people are more apt to adopt the innovation than others. Researchers have found that people who adopt an innovation early have different characteristics than people who adopt an innovation later. When promoting an innovation to a target population, it is important to understand the characteristics of the target population that will help or hinder adoption of the innovation.

A cited by Gardachew (2010), the process of diffusing an innovation is communicated through communication channels among the members of a social system. The innovation-decision process describes the stages an individual can go through while contemplating the adoption of an innovation: after having gained knowledge about it, the individual forms an opinion about the innovation and decides whether or not to adopt it. The individual then starts using the innovation and further reduces the remaining

uncertainty by practice and learning. When the innovation has been adopted, the individual continues to monitor whether adoption still makes sense for her.

There is need for commercial banks financial innovations to be enhanced by mobile phone penetration. Mobile phone penetration would minimize commercial banks performance and eradicate the need for opening of bank branches. It would be economical for commercial banks to incorporate mobile services to minimize service time and amplify penetration of financial services.

2.2.4 Agency Theory

Agency theory was put forth by Jensen and Mackling (1976). The theory argued that there is need for separation of ownership and management of an institution. Adoption of this management approach will lead to increased operational costs due to monitoring and agency costs. This may escalate conflict between relevant stakeholders and ultimately minimize gains to be accrued from an investment. This will discourage investment and mutate agency conflicts. According to.

Henderson and Pearson (2010) commercial banks are propelled by desire to maximize shareholder's wealth and profitability. This can be achieved through reduction in operational costs and enhancement in access of banking and financial services incorporate technological innovations to enhance quality of service provision.

Intrinsic in the Principal-Agent association is understandably that the agent will represent the principal. The agent commits that he/she will be loyal to the principal. He further undertakes a commitment that he/she will comply with the principal's directives and will act properly in the performance his/her duties. An agent is not allowed to take private advantage of the business good successes that the agency position unearths. Similarly, a principal places confidence and trust in the agent. These obligations results in confidence trustee relationship between the Principal and Agent. The CBK initiated measures and ways in the year 2009 to open banking channels to non-bank agents.

Agents were permitted to provide financial services through a modification to the Banking Act (passed as part of the Finance Act, 2009).

In this relationship, there is expectation that both the principal and agent anticipate a gain. For all the decisions especially those that are capital intensive, the management should not put their interest first but rather do an in-depth analysis on the perceived investment to be undertaken to have a win win situation. Green (2012) explains that the association between principal and agents is guided by the agency guidelines.

Accordingly, all decisions undertaken to invest in financial innovations in order to enhance financial deepening and inclusion should be discussed and the agents made aware of their responsibilities to the principal the commercial banks. Moreover, the CBK initiated measures and means in year 2009 to open banking channels to non-bank agents.

Agency theory is relevant for this study because the Principal (Commercial banks) have contracted the agents to do business on their behalf, Agency banking is one of the independent variables in this study. Through, agency, internet and online banking services banking customers will not only access financial services faster but also efficiently. The biggest threat is risk exposure they would face especially when coerced to execute transactions against their wish. Further, though online there is reduced paperwork and accounting opening process is shorted and this ultimately enhances quality of services accorded to customers who would ultimately spread positive news which may end up fostering customer's recruitment drives.

2.2.5 Transaction Cost Theory

This theory was postulated first by Coase (1937), and subsequently intensely advanced by Williamson (1985), TCT holds that there exist costs of transactions that are linked with what Coase advocated to be "price mechanism," and Williamson called it as "market governance." Transaction costs still occur within a company, transacting

between departments or business units. The same concepts of bounded rationality and opportunism on the part of directors or managers can be used to view the motivation behind any decision.

The significance of the notion is the presence of costs linked with transactions negotiation and contracting (transaction costs) incurred on the open market which is reduced by spearheading these in other respect transactions which are independent and undertaken by a single corporate entity. There would exist economies of scale that are contractual, for instance, where costs tracked on a single contract would be extended over several transactions. As Coase (1937) explained, contracts amidst the institution with whom factors being co-operated with, as would be compulsory, if the abetting are from direct price mechanisms. These series of contracts are substituted ones.

Transaction cost will come about when the use of financial innovations will be required to use other platforms to effectively achieve their mandate. For agency banking, there has to be set out branchless centers that will act as agents for the main bank thus transaction cost will be present when banking activities are performed. The theory recommends at what time the firm should plan newer activities to be around firm's boundaries and how institutions can be in a position to accrue benefit out of sharing resources among the businesses that are within firm boundaries. It is a theoretical framework that put across the importance of costs by allowing firms to get greater market power by engaging innovations that will give a competitive edge in the market. From the perspective of transaction cost, firms are to diversify whenever in their businesses they expand in the market power and engage in organizing their extra activities more efficiently than the current market or their competing firms (Aguilera & Jackson, 2010).

There has been various criticism of TCE approach by several scholars. Moran and Goshal (1996) earmarked TCE assumption to be too weighty and claimed misuse of non-realistic facts can limit the relevance of the theory. The opportunism concept is also deemed to posit too cynical view to human stimulus. Moran and Goshal (1996) stated

further that the way used to avoid expediency by close watching and power exercise of control leads to a reduction in performance of employees and henceforth leading to an opposite effect from the intended one.

The theory is relevant to the current study in that management must consider prudently the transaction costs associated with investing in financial innovations and how the innovations will enhance financial deepening. Incorporation of online banking in provision of banking services have necessitated commercial banks to expansively adopt models that may reduce transaction costs while performing online transactions and maintaining a balance of the cost of investing in this innovation (Chipeta, & Muthinja, 2018).

2.2.6 Financial Repression Theory of Financial Deepening

Financial repression theory is associated with the work of Mckinnon (1973) and Shaw (1973). The cliques of development hypothesis theory trust that lack of a developed financial infrastructure restricts economic growth. Thus, the consideration of policy at any given time should be make sure that the financial system functions efficiently such that the real sector will receive the essential support. The acceptance of the hypothesis theory made economic theorists to settle that a measure of intervention is significant and in fact essential for meaningful growth.

A number of policies should thus be put in place to encourage and promote the activities of financial institutions in this regard (Nzotta & Emeka, 2009). The implication of their studies is that financial development would contribute most significantly to economic growth, if monetary authorities did not interfere in the operations of financial institutions and the financial infrastructure generally. The studies by Mckinnon and Shaw observed that financial repression is correlated with sluggish growth in developing countries. Such economies, according 11 to Nnanna and Dogo (1998) are typically characterized by high and volatile inflation and distorted interest and exchange rate structures, low savings and

investments and low level of financial intermediation, as interest rates do not reflect the cost of capital.

Commercial banks are required to develop financial innovations by which the cost can be massive, in order to enhance competitiveness and penetrate the market. In recent times, financial institutions have come up with innovative processes in order to boost the uptake of their financial services to the society and this will in turn will improve their performance and economic growth as well. The broadening of the scope of the banking system, in geographical and functional coverage, is necessary to meet the credit needs of these strategic sectors. (Thairu & Wahome, 2016).

2.3 Conceptual Framework

Conceptual framework can be perceived as logical flow of interaction amongst study variables (Kombo & Tromp, 2009). Direct and moderating effect of bank size on relationship between financial deepening and financial innovations is conceptualized in Figure 2.1.

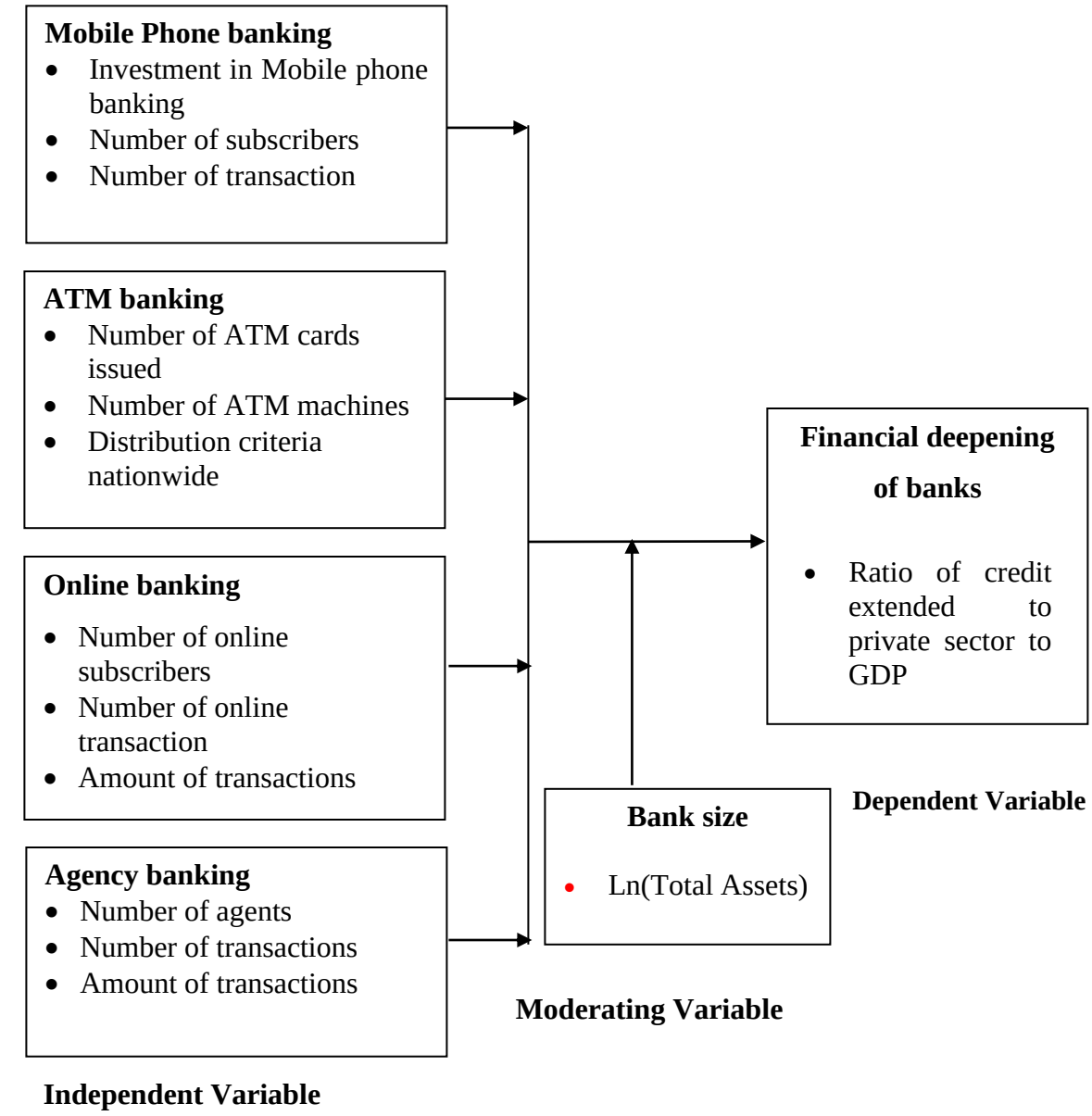

Figure 2.1: Conceptual Framework

2.3.1 Mobile Phone Banking

Use of alternative financial service provision have improved customer satisfaction (Okiro & Ndun's, 2013). This was in congruence with Kefela (2011) who reported that mobile banking increased commercial bank customer retention to 80 percent in rural sub Saharan Africa. This contrasted by Mwangi (2013) who argued that poor telecommunication networks inhibit penetration of financial innovation in rural Kenya. Nguena and Abimbola (2013) called for financial liberalization to enhance likelihood of commercial banks financial innovation penetration. Mobile phone banking was classified into three categories namely; investment in mobile banking, number of subscribers and number of transaction.

Alternative measures of mobile phone banking have been adopted by past studies dominant ones are number of customers recruited in mobile banking platforms, volume of mobile banking transactions and commercial banks investment on mobile banking platforms (Akram & Allam, 2010; Al-Jabir, 2012). These three measures were adopted in the current and forward selection criterion will be adopted the most appropriate measure. Similar approach was adopted by (Mathuva, 2015).

2.3.2 Automated Teller Machine Banking

This is computer enabled banking platforms which provides access to services without human to human interaction (Adeoti, 2011). ATM has advanced payments methods and supported use of plastic money on alternative platforms such as point of sale.

Empirical examination has revealed that adoption of ATM has enhanced delivery of commercial banking service. In fact, interlinking of ATM amongst commercial banks has enhanced their penetration. Also, flexibility and security associated with ATM had precipitated its adoption amongst stakeholders (Adeniran & Junaidu, 2014). Empirical evidence has depicted that dominant measures of ATM amongst commercial banks are annual commercial bank investment on ATM, number of ATM subscription per annum

and volume of ATM transactions (Mwatsika, 2016; Adewoye, 2013; Adeniran, 2014). This study adopted value of automated teller transactions as measure of ATM banking.

2.3.3 Online banking

This is provision of banking services through use of internet supported systems (Batiz-Lazo & Woldesenbet, 2006). Unlike traditional banking which required actual visit to commercial banks, online banking enhances access to banking services through the internet (Hamilton, Jenkinson & Penalver, 2007). Its dominance by client's ability to evaluate his or her account as time falls due with minimal delays.

Although, initially it faced resistance due to internet instability and security threats (Mwangi, 2013). Information technology advanced has enhanced its adoption amongst commercial banks and microfinance institutions. Recent development has seen commercial banks interlink their banking systems with clients such as schools to allow seamless payment of school fees. According to Ngumi (2014) internet banking has created specialized and customized service delivery amongst commercial banks. Empirical evidence has reported positive influence on commercial banks though dominant data has been primary. The current study adopted value of online transaction to evaluate its impact on financial deepening (Sathye, 2015; Cheruiyot, 2010; Chipeta & Muthinja, 2018).

2.3.4 Agency Banking

Agency is provision of banking services through contracted third party. According to Mwachofi (2013) agency banking has amplified financial inclusion. In Kenya provision of banking services in rural areas is inhibited by low number of customers and long distance to regions with reliable infrastructural services (Kinyanjui, 2011).

Empirical evidence has documented that agency banking has enabled provision of banking service amongst non-banked population (Joshua, 2011). According to FSD (2013) innovative provision of financial system services is in tandem with Vision 2030

which calls for inclusion of all bankable non-banked population. Cracknell (2012) argued that agency banking has significant contribution on commercial banking services and it ought to ultimately promote economic development. In this study agency banking was operationalized as value of point of sale transactions since not all commercial had operational banking agents and all of them provided point of sale services

2.3.5 Bank Size

All investments are geared towards maximization of shareholders wealth. Change in firm size can alter the nature and demand for financial innovation and ultimately increase performance (Muhindi & Ngaba, 2018). According to Prastetyantoko and Parmono (2008) large commercial banks have more added advantage compared to small one since they operate on economies of scale. Further, they have the capacity to access alternative sources of finance which may enable them to respond swiftly to technological demands.

Empirical studies have adopted heterogeneous measures of commercial banks size, natural logarithms of total assets, number of employees, natural logarithms of loan books, Tobin's q (Muhindi & Ngaba, 2018; Prastetyantoko & Parmono, 2008; Sreesha, 2014). In this study bank size was operationalized as natural logarithms of total assets.

2.3.5 Financial Deepening

Financial deepening is the capacity of financial institution to allow access of financial services efficiently (Ndege, 2012). Through financial deepening the amount of money in circulation increases and it enables individuals and corporation to access financial products easily. It can be evaluated through alternative measures such as changes in money supply to gross domestic product, money supply to price index, proportion of commercial banks assets to central bank assets, number of bank branches, and proportion of commercial banks assets to its income.

Financial deepening is propelled by regulatory framework, financial intermediaries, political environment and government policies (Mishkin & Eakins, 2007). According to Chortareas et al. (2011) financial deepening waves are too sporadic and they can be easily recognized and failure to incorporate them in general business operations leads to decreased banking performance. In this study financial deepening was determined by percentage growth rate on customers banking transactions per annum.

2.4 Empirical Literature Review

Past empirical studies, methodological and their findings will be presented and gaps emanating from each will be discussed.

2.4.1 Mobile Phone Banking and Financial Deepening of Commercial banks

Achieng (2011) studied the strategic responses of Kenya Commercial Bank to mobile money transfer in Kenya and found out that the money transfer service industry could be described as emerging, rapidly growing or a high-speed market in Kenya and any developing country. The study indicated that with the strategic positioning of the mobile telecommunications providers and the need for banking institutions to partner and 24 integrate with the Mobile money transfer provides in order to remain relevant and share in the huge potential offered to mobile subscribers. A few cross-sectional examinations have been embraced on media communications and financial development pointers in developing nations. In any case, ideas have demonstrated the presence of system externalities in media transmission framework prompting higher development impacts.

Too, Ayuma and Kemboi (2016) examined role of financial innovation and performance in Kapsabet. Descriptive research design was applied and primary data gathered using semi structured questionnaires. Quantitative data was analyzed through inferential and descriptive statistics. Classical regression and correlation revealed positive and significant effect of mobile banking loans, mobile banking funds transfer, mobile payments and commercial banks performance. It was concluded that there is need for

commercial banks to develop measures to access unbanked population since this would enhance banking penetration. From the findings it can be deduced that commercial banking financial innovations has the capacity to include many on its platform courtesy of alternative products and services. Although, classical regression modelling was adopted none of classical regression assumption was tested and this would have created possibilities of drawing biased conclusions.

Ching et al. (2011) examined determinants of mobile banking adoption by commercial banks in Malaysia. Descriptive research design was adopted and simple random sampling used to select respondents. Primary data was gathered through semi structured questionnaires. Content analysis analyzed qualitative data and inferential and descriptive analyzed quantitative data. It was found that perceived usefulness, ease of use, risk management, innovativeness impacted positively on adoption of banking innovations. Social norms impacted negatively on mobile banking innovation adoption. It was concluded that for commercial banks to optimize technological benefits they ought to consistently involve all stakeholders. Gender exclusion strategies to commercial banking services can be eroded through mobile banking innovation since cultural practices do not hinder women from owning mobile phones. Even though, technology adoption may act as tool for propagating financial inclusion there is need to examine applicability of these findings in Kenya since Malaysia is more developed compared to Kenya.

A Bangladesh examination of role of mobile banking on financial performance was put forth by (Rayhan, Sohel, Islam & Mahjabin, 2012). Descriptive research design was adopted and purposive sampling applied to select respondents. Semi structured questionnaire was adopted to gather primary data. Quantitative data was analyzed using classical regression modelling. It was found that mobile banking had positive significant effect on access of banking services which increased their market share. Increased market share through mobile banking could signal positive impact on financial inclusion and deepening. Since Bangladesh and Kenya are in different states of economic development study findings in Bangladesh cannot be generalized in Kenya hence the

need to customize an empirical enquiry. Furthermore, use of purposive sampling to select respondents would have created possibilities of biased selection of respondents.

Al-Jabri (2012) investigated the effect of mobile banking technological adoption on commercial banking performance in Saudi Arabia. Specifically, the study investigated what inhibits or promotes mobile banking. Qualitative and quantitative research design were adopted. Primary data was collected through interview guide and structured questionnaires. It was found that success of mobile banking was dependent on telecommunication penetration, quality network and availability of mobile phones. Technical awareness of respondents impacted penetration of mobile banking. These findings may not be generalized in Kenya since the state of mobile penetration may not be the same. Also, the study limited its inferential statistics to correlation and regression it would have been appropriate to incorporate structural equation modelling.

Wambari (2009) investigated the role of mobile banking on commercial banking performance. Descriptive research design was adopted, purposive sampling applied to select respondents whom semi structured questionnaires were administered. Classical regression and correlation analysis tested hypothesis. Mobile banking impacted banking profitability. It was concluded that commercial banks enhanced commercial banking penetration and enlarged its market through development of demand driven products and services. Use of purposive sampling to select respondents was not appropriate since probabilistic sampling would have accorded respondents an equal chance of being included in the study. Failure to report classical modelling diagnostic tests would have created an avenue for biased findings.

Bansal (2014) evaluated perception of information communication technology in achievement of financial inclusion in India. The economic welfare and growth of a nation depends upon the accessibility of people to financial product and services. Efficiently mobilizing their household saving and allocating them effectively to the growing credit requirement of the economy helps in sustainable development of the country. Govt., RBI and banking sectors are making tremendous effort to bring every

section of the country into the mainstream financial system. Still there exists a significant gap between the growth expectations and the ground realities in context of 'mobilization and utilization of funds' that support inclusive growth of the country. There is also a significant disparity among the people of rural and urban area in availing the services of the financial system. There is a need of effective tools to bridge the gap and bring in every section of people from all parts whether rural or urban to take part in the mainstream financial activities.

Kigen (2010) explored the effect of mobile banking on transactions costs of microfinance institutions in Kenya. Descriptive research design was adopted. Purposive sampling was applied to select respondents. Primary data was gathered through use of semi structured questionnaires. It was found that mobile banking has significant effect on microfinance transaction costs management. It would have been appropriate to combine qualitative and quantitative data this would have mitigated against demerits associated with quantitative data. Further, the study should have considered secondary data in favour of primary data so as to examine the trend which had been documented in the past.

Agwu, Atuma, Aigbiremolen and Iyoha (2014) investigated the impact of information communication technology on strategic management of financial institutions. ICTs have contributed a lot in the strategic and operations management of financial institutions all over the world. Today, ICT is employed in all the departments of most financial institutions such as operations, customer services, marketing, administration, human resource, procurement, accounting, financial management, etc. The general consensus among various academicians is that ICTs have improved the processes of operations and management. It has also played significant roles in strategic and operational management and also determined the marketing mix, strategic decisions, ownerships, management and partnerships such as alliances and mergers. This study investigated the role of ICTs in the strategic and operational management of financial institutions using a qualitative research method involving the interview of top managements and operational staffs of four selected banks in the United Kingdom and Nigeria.

Findings revealed that ICTs have indeed contributed a lot in improving the functioning of all departments of the selected banks such as marketing, operations, human resources, finance, call centers, customer services, etc. The benefits gained by the various banks after the implementation of ICTs include better online and offline support for their customers, ROI justification, profitable sales volume, reduction of queues in the banking halls, and very interactive websites. There are however, many departments and other functional areas where ICTs have not been fully utilized. Moreover, many financial institutions have not fully adopted and applied ICT to all functional areas. The study recommends that these can be resolved through proper training, i.e. the provision of ICT related training to employees with respect to the strategic and operational management of the banks as well as exploration of the importance of the recruitment of external consultants who are specialized in their respective fields to render solid supports.

Kathuo, Rotich and Anyango (2015) investigated the effect of mobile banking on financial performance of commercial banks in Kenya. The study applied descriptive research design and primary data was collected through issue of questionnaires. Census of 42 commercial banks that were operational in Kenya as at December 2014 was considered. Descriptive statistics analysed the data. It was found that there was as improvement in the growth of mobile phone banking in five years preceding 2015. It was concluded that through increased m-banking services there was an increase in customer outreach and financial performance. The study should have adopted panel data so as to examine long run and short run effect of mobile banking on financial performance of commercial banks in Kenya.

Mohammad (2012) investigated factors affecting adoption of electronic banking in Iran. Electronic banking services are being used with increasing frequency in most countries, including Jordan. Although previous studies have confirmed the importance for such services for both banks and customers, the level of electronic banking services' adoption in Jordan is still low. This study aims to identify and understand factors that affect bank customers' use of electronic banking services. This study integrates technology acceptance model with the theory of planned behavior model and incorporates five

cultural dimensions and perceived risk to propose a theoretical model. The primary data were collected from 387 valid questionnaires which were distributed to random banking customers in all 26 licensed banks in Jordan. Multiple regression analysis was employed to test the hypotheses. The main findings of the study are: uncertainty avoidance has a positive and significant impact on perceived ease of use and perceived usefulness. Perceived risk has the stronger impact on customers' attitude, which in turn influences customers' intention to use electronic banking service.

Magboul and Abud (2018) investigated the antecedents of adoption of electronic banking among private banks employees in Sudan. Rapid technological advancement has transformed the business environment dramatically. These advancements particularly the Internet has reshaped the way businesses operate. Over the last decade, the banking industry has become highly complex and competitive and operates in a highly volatile and unpredictable global economy. With the increasing demand for electronic services, banks are harnessing EB technology to improve their products and services. Quantitative research using Structural Equation Modelling was carried out with a sample size of 211 by sending questionnaires to employees of six banks in Khartoum, Sudan. The study is based on different technology theories and models. The study provides insights into the employees' perception of electronic banking adoption in their banking transactions. The results showed that four factors are significant in the adoption of electronic banking in Sudan. However, training and user trust were insignificant in determining its adoption. Moreover, the level of adoption of electronic banking significantly affected private bank performance.

Chibueze, Ogbulu and Ndugbu (2013) investigated the effects of electronic banking on performance of Nigerian banks. This study investigated the profitability performance of Nigerian banks following the full adoption of electronic banking system. The study became necessary as a result of increased penetration of electronic banking which has redefined the banking operations in Nigeria and around the world. Judgmental sampling method was adopted by utilizing data collected from four Nigerian banks. These four banks are the only banks in Nigeria that have consistently retained their brand names

and remain quoted in the Nigerian Stock Exchange since 1997. The profitability performance of these banks was measured in terms of returns on equity and returns on assets. With the data collected, we tested the pre- and post-adoption of electronic banking performance difference between means using a standard statistical technique for independent sample at 5 percent level of significance for performance. The study revealed that the adoption of electronic banking has positively and significantly improved the returns on equity of Nigerian banks. On the other hand, and on the contrary, it also revealed that e-banking has not significantly improved the returns on assets of Nigerian banks. The findings of this study have motivated new recommendations for bank customers, bank management and shareholders with regard to electronic banking adoption for banking operations.

Hauwa, Shagida and Abdul (2017) investigated the effect of mobile banking on performance of commercial banks in Nigeria. Cross sectional research design was adopted and primary data gathered through issue of structured questionnaires among 22 commercial banks selected through simple random sampling. Descriptive statistics analysed the data. It was found that there were notable changes in penetration of banking services upon introduction of mobile banking services. It was concluded that pricing of mobile banking services impacted positively financial performance. It was noted that they promoted efficiency and confidence in provision of banking services. It was recommended that there is need for clarity on pricing of mobile banking products so as to enhance customer's confidence as they seek for services from respective banks. The study should have incorporated bivariate and multivariate analysis techniques so as to examine the degree of causality between mobile banking and financial performance of commercial banks in Nigeria.

Githae, Muriuki and Njeru (2018) investigated the influence of electronic banking on performance of deposit taking microfinance institutions in Kenya. The objectives of the study were to: establish influence of operational efficiency, market outreach, customer service management, new products and accessibility on financial performance of deposit taking microfinance institutions in Kenya. Descriptive research design was applied in

this study. The study population consisted of 12 deposit taking micro finance that had been licensed to operate in Kenya. The study found out that to a great extent operational efficiency, customer relationship management, market outreach, new products and services impacts, accessibility to banking services have positively influenced financial performance of deposit taking microfinance. The study also found out that operational efficiency, market outreach, customer relationship management, new products and services and accessibility to banking services were significantly related to financial performance of deposit taking micro finance. The study concluded that there is evidence for the direct effect of e-banking on financial performance of deposit taking microfinance as suggested by the literature. Accessibility to banking services, new products and services and market outreach emerged as a stronger predictor of financial performance of deposit taking microfinance. The study further concluded that the established regression model was significantly good for foresting and could be used for prediction of financial performance of deposit taking micro finance in Kenya. The study recommended that whereas there is a strong relationship between electronic banking and financial performance of deposit taking microfinance institutions in Kenya, the relationship may not be one of cause and effect hence there is therefore room for isolating all these factors in order to generate better predictive model. The study further recommended similar studies need to be done in other sectors in the financial industry in the country and the results be compared so as to establish whether the models are consistent among the various groups.

Kim, Zoo, Lee and Kang (2018) examined mobile financial services and financial inclusion in Korea. With the flagship success of m-Pesa, financial services via mobile devices have become an important tool to facilitate the financial inclusion of the previously unbanked population in developing countries. Attempts to provide a landscape of academic research findings at the intersection of mobile financial services, financial inclusion, and development have been rather scant. To determine the key issues and gaps in the current academic research, this study conducts a systematic review of 54 academic research papers vis-à-vis the nexus of mobile financial services, financial

inclusion, and development. The results show that the extant literature addresses three major clusters of topics: delivery, environmental factors, and the impact of mobile financial services. Still in the nascent stage of research, the topics covered in the literature indicate a bias towards institutional and individual preconditions for the implementation of mobile financial services, rather than actual supply and demand by users, and its impact on society. The choice of research methods also shows limited variety and depth. This study contributes towards understanding the existing research on mobile financial services for financial inclusion in developing countries and finding research gaps for future study.

Harelimana (2017) investigated the impact of mobile banking on financial performance of Unguka microfinance bank in Rwanda. Time series data was collected over five-year period to examine performance. Qualitative and quantitative was gathered through thematic analysis and questionnaires were issued to gather primary data. Univariate, bivariate and multivariate techniques were adopted for data analysis. It was found that mobile banking was embraced and it had positive impact on financial performance of Unguka microfinance. It was necessary to adopt case study research design and evaluate strategic plans adopted by respective bank in line to penetration in the market.

Muiruri, Richu and Karanja (2015) investigated the impact of mobile banking on financial performance of small and medium enterprises in Nakuru. The specific objectives of the study were to determine timelines and reliability of mobile banking in enhancing financial performance. Descriptive research design was adopted and primary data gathered through administration of questionnaires among 126 respondents selected through simple random sampling. Descriptive and inferential statistics analysed the data. There was positive and significant impact of mobile banking on financial performance of small and medium enterprises.

Mwangi (2012) analysed how information communication technology development affects overall performance results of financial institutions in Kenya. The study used total return on assets owned by the institutions to bring out the benefits of information

communication technology on overall financial results. The respondents were employees of the financial institutions with adequate years of experience and knowledge on the subjects under study. The study established that adoption and implementation information communication technology as part of financial institutions system improved the revenue collection ad minimized operating expenses thereby leading to higher return on shareholder's investments.

Gwako (2012) did a study on the selection of information communication technology on business execution utilizing an instance of little and medium endeavors in Nakuru focal business information communication technology, Kenya. The unit of investigation was the individual entrepreneurs and graphic study plan was received for the study. Likelihood examining was utilized to get respondents chosen utilizing deliberate testing technique. Information communication technology education as a variable of appropriation had a fairly frail relationship with business execution of small and medium enterprises in Nakuru town with comparable results however in an inverse bearing saw regarding information communication technology framework. Utilization of information communication technology in business systems had an extremely frail relationship with the execution pointers while accessibility of assets for selection of information communication technology posted a solid level of relationship with similar indicators.

Wesutsa (2012) examined the impact of information communication technology adoption on overall financial results of financial institutions in Kenya. The study adopted correlation as the research design where it was established that adoption of information communication technology had led to improved operational efficiency and greater profitability. The use of information communication technology has not only increased the market share of commercial banks and gained competitive advantage. Information communication technology has deepened the cash safety nets of banks in the prevailing markets.

Binuyo and Aregbeshola (2014) studied the impact of information communication technology implementation overall financial results of financial institutions in South Africa. The study covered a period of twenty-two years with secondary data. The findings indicated that application of information communication technology in operations improves financial results of the concerned. This also improved the uptake of financial services for the institution and customer convenience. In another study, Basweti, Masese and Onsiro (2013) examined the challenges faced by financial institutions within the Tanzanian economy. The study employed a descriptive research design on a population of 48 bank managers based in Dar es Salaam. The study established the existence of the need to improve the financial results of the bank. Information communication technology gadgets to ensure that the banking industry reaps optimal benefit from information communication technology adoption.

Saeed and Bampton (2013) looked at how information communication technology implementation by financial institutions affected the overall financial results in Lybia. The study sough to seek and demonstrate the possibility of transformation of Libyan commercial banks. The results showed that there was low level of information communication technology adoption among the Libyan banks which constrained the overall financial performance.

Iravonga and Miroga (2018) investigated the effect of mobile banking on financial performance of small and medium enterprises performance in Kakamega County. Exploratory research design was adopted and primary data collected through issue of questionnaires. Simple random sampling was applied to select 373 respondents. Univariate, bivariate and multivariate techniques were adopted for data analysis. Study findings revealed that mobile platforms were applied for sending, receiving, checking balance, depositing and withdrawing money from respective commercial banks. Correlation analysis indicated inverse effect of mobile banking services and financial performance of small and medium enterprises. Since these innovations acted as an avenue to promote adoption of banking services there is need for commercial banks to develop measures aimed at promoting adoption of mobile platforms.

Mageto, Muturi and Abuga (2017) investigated the effect of mobile banking on financial performance of commercial banks in Kisii town. The specific objectives of the study were to evaluate perceived securities of mobile banking, to determine the effect of perceived ease of accessibility of mobile payments, to determine the effect of transaction cost of mobile payment technology on financial performance of commercial banks. Cluster sampling was adopted to select 255 respondents who included operation managers, clients, cashiers and M-pesa paying agents. Primary data was collected through administration of questionnaires. Univariate, bivariate and multivariate techniques analysed the data. It was found that security of mobile payments, perceived costs and perceived access had positive and significant influence on financial performance of commercial banks in Kisii. It was concluded that transaction cost of mobile payment was cheaper and convenient and in most situations transactions were executed as per client's expectations.

Kashif and Muhammad (2016) investigated the effect of cashless banking on profitability of banks in Pakistan. Specifically, the study examined the effect of automated teller machines Transactions, point of sales transactions, call centre banking transactions, mobile banking transactions. Panel research design was adopted and secondary data collected on quarterly basis from 2007 to 2014. Univariate, bivariate and multivariate techniques were adopted for data analysis. It was found that point of sales transactions and mobile banking transactions had positive and significant impact on financial performance. Automated teller transactions and centre banking transactions had negative and significant effect on profitability. It was recommended that commercial banks should sensitize their customers on internet banking services so as to reduce their operational costs. The study should have considered panel diagnostic tests prior to fitting classical regression model.

Sulaiman, Jabbar, Mujahhid and Lakhan (2013) analysed acceptance of mobile banking by customers in Pakistan. The study was anchored on technology acceptance model. Primary data was collected among 200 customers of MCB bank in Pakistan. Univariate, bivariate and multivariate techniques were adopted for data analysis. It was found that

there was positive and significant effect of self-efficacy, mobile access, advertising, quality of services and user perception in relation to convenience of mobile banking that affects tendency to use and accept mobile banking services. Since the study drew respondents from one bank it was not possible to generalize them as true reflection of other banks. The result of data analysis demonstrated the context of the following variables such as speed, self-efficacy (SE), Mobilty Access(MA), Advertising(AT) and quality of service, user perception relates to the convenience of mobile banking that affect the tendency to use and adoption

Mujuka (2018) investigated factors affecting performance of commercial banks in Kenya. The specific objectives of the study were to examine the effect of inflation rate, credit risk, interest rate, technology on performance of commercial banks. Descriptive research design was adopted and data gathered on annual basis. It was analysed through descriptive, correlation and regression analysis. It was found that there was significant effect of inflation rate, credit risk, interest rate, technology and performance of commercial banks in Kenya. The study ought to have considered use of time series or panel variables as predictors of banking performance instead of combining them without stacking.

Alubisia, Githii and Mwangi (2018) investigated the effect of electronic based financial innovations on non-interest income of commercial banks in Kenya. Specifically, the study investigated the effect of adoption of ATMS and cards, internet and mobile banking and adoption of fund transfer systems such as RTGS and electronic fund transfer on non-interest income. Descriptive research design was adopted and primary data gathered through questionnaires administration. It was documented that financial innovation had significant effect on non-interest income of commercial banks in Kenya. It was recommended that all stakeholders in commercial banks should adopt investments aimed at incorporation of technology and improved of non-interest generation.

Uvaneswaran, Kassa and Hamid (2017) investigated challenges in electronic banking and its impact on profitability of commercial banks in Ethiopia. Descriptive research

design was adopted. Primary data was gathered through questionnaires administration and secondary data was gathered via document content analysis. Univariate, bivariate and multivariate techniques were adopted for data analysis. Adoption of electronic banking was challenged by cash shortage, network breakdown, system failure and machine breakdown, power failure, non-availability of internet, unable to access services over the weekend and banking policies on maximum limit to be accessed via E-banking. It was concluded that majority of the customers were satisfied with E-banking. It was recommended that there was need for commercial banking innovation to devise measures aimed at minimizing language barriers.

Muiruri and Ngari (2014) investigated the effect of financial innovations on financial performance of commercial banks in Kenya. Specifically, the study examined the effect of credit cards, mobile banking, internet banking, agency banking and financial performance. Cross sectional research design was adopted and primary data gathered through questionnaires administration among top management of 16 commercial banks. Univariate, bivariate and multivariate techniques were adopted for data analysis. It was documented that commercial banks had intensified adoption of financial innovations with the sole purpose of enhancing performance and provision of quality services. It was found that there was positive and significant effect of internet banking, use of credit cards, agency banking and mobile banking on financial performance of commercial banks. The study ought to have narrowed on either primary or secondary instead of merging them during classical modelling. Document content analysis may have been adopted to gather secondary data and it ought to have been analyzed through thematic and content criterion.

Tuyishime, Memba and Mbera (2015) investigated the effect of deposit mobilization on financial performance of equity bank in Rwanda. The specific objectives of the study were to examine the effect of marketing strategies, interest rate changes, technology adoption on financial performance. Cross sectional research design was adopted and census of 27 employees hailing from Equity bank Rwanda were considered. Descriptive statistics, correlation and regression analysis were adopted for data analysis. Study

findings indicated that 85% of respondents acknowledged that Equity bank had superior brand as compared to its rivals. It was commended that marketing strategies adopted by Equity bank enabled it to attract more customers. Further, there was positive and significant effect between deposits and profitability. Adoption of information technology had recorded significant growth on deposits. Moreover, it enabled provision of banking services among the unbanked population. It was recommended that commercial banks should develop measures aimed at increasing banking deposits and penetration of financial services among lowly banked population.

Aysel and Fatma (2017) analyzed the relationship between financial innovation and performance of Turkish banking system. Through, panel research design the study examined the relationship between online banking, telephone banking, credit cards and profitability of Turkish banks. Quarterly data was collected from 2006 to 2015. Descriptive statistics and simple regression analysis analyzed the data. It was found that there was positive and significant relationship between online banking, telephone banking, credit cards and profitability of Turkish banks. The study should have carried out multiple regression to evaluate the joint effect of online banking, telephone banking and credit cards on profitability of commercial banks in Turkey. These results may not be generalized in Kenyan perspective due to differences in state of economic and technological developments.

Odhiambo and Ngaba (2019) investigated the effect of E-banking on financial performance of commercial banks in Kenya. Through descriptive research design the study specifically examined the effect of agency banking, online banking, mobile banking and Automated Teller Machine (ATM) on financial performance of banks. Univariate, bivariate and multivariate techniques analyzed the data. It was found that there was positive and significant effect f agency banking, online banking, mobile banking and ATM banking on financial performance of commercial banks in Kenya. The study should have considered secondary data so as to examine long and short run effect of E-banking on financial performance.

Siddik, Sun, Kabiraj, Shanmugan and Cui (2016) investigated the impact of electronic banking on financial performance of banks in Bangladesh. Through adoption of panel research design, secondary data was gathered from 13 commercial banks over period 2003 to 2013. Univariate statistics, bivariate and multivariate statistics were adopted for data analysis. Study findings revealed significant effect of electronic banking on financial performance of banks in Bangladesh. The study ought to have considered diagnostic tests prior to fitting classical models and evaluated the appropriateness of static panel modelling.

Gomachab and Maseke (2018) investigated the impact of mobile banking on customer satisfaction in Namibia. Quantitative research design was adopted and primary data gathered through issue of questionnaires. Univariate, bivariate and multivariate techniques were adopted for data analysis. Study findings revealed that majority of banked population aged below 25 years, with 57% females who had acquired high school education. Most of them had mobile phones and courtesy of mobile banking advertisement they were influenced to use M-banking platforms. Mobile banking services were defined as being reliable, convenient, available in alternative networking and cost friendly. The study ought to have considered use of document content analysis to complement primary data gathered through issue of questionnaires. Further, it was appropriate to incorporate qualitative data.

Aluoch, Odondo and Ndede (2018) investigated the effect of alternative delivery channels on performance of commercial banks in Kisumu city. Specifically, the study examined the effect of mobile banking, agency banking and internet banking on banking performance. Cross sectional research design was adopted and primary data gathered through issue of structured questionnaires. Descriptive statistics, correlation and regression analysis were adopted for data analysis. Results of the study revealed positive and significant effect of mobile banking and agency banking and financial performance of commercial banks. Further, there was positive and not significant effect of internet banking on financial performance of commercial banks in Kenya. The study should have applied structural equation modelling to examine joint effect of mobile banking, internet

banking and agency banking on financial performance of commercial banks in Kenya. Since every county may have unique demographic characteristics it will be appropriate to consider examination of alternative sample of respondents instead of generalizing the findings in Kenyan case.

Entele (2019) investigated the effect of mobile banking on financial inclusion in Ethiopia. Cross sectional research design was adopted and primary data gathered among 100 respondents who were account holders. Secondary data was collected from 2010 to 2018. Data was analyzed through use of descriptive statistics and structural equation modelling. Results of the study revealed that there was significant effect of perceived complexity of mobile banking usage, observability, trialability, perceived analog complement, trust on provider of mobile banking technology on financial inclusion in Ethiopia. From the findings it was forecasted that they will be increased mobile banking penetration due to customer's perception on its ease during conduct of business. It was concluded that there is create sensitization and awareness of mobile banking products through creation of relative advantages, trust enhancement, improved mobile banking product features and liberalization of commercial banking regulations. There was calls for government subsidies and incentives which are aimed at promoting use of innovative mobile banking platforms. Consequently, this would increase mobile banking adoption rate and increase banking penetration among banked and non-banked populations.

Sindani, Muturi and Ngumi (2019) investigated the effect of financial distribution channels evolution on financial inclusion in Kenya. Specifically, the study investigated the effect ATM banking, internet banking on financial inclusion. Panel research design was adopted and secondary data collected 2012 to 2017. Census of 44 commercial banks was considered. Descriptive statistics, correlation and multiple regression analysis. The study indicated positive and significant effect of ATM banking and internet banking on financial inclusion. It was concluded that financial inclusion was enhanced by ATM banking and internet banking. This was aligned with their user graphical interface. It was recommended that there is need for policy makers to formulate policies that would

enhance technological development and enhance access of branchless banking services more due to its capacity to tap the unbanked population.

Thairu and Wahome (2016) investigated the effect of financial innovation on inclusions of banks in Nakuru County. Specifically, the study examined the effect of agency banking on financial inclusion. Descriptive research design was adopted and primary data gathered through questionnaires administration. The respondents were 29 banks in Nakuru County and 140 customers were served by the said banks in the month of March 2016. Descriptive statistics, correlation and regression analysis were adopted for data analysis. It was found that technological innovations increased banking sales, increased profits, enhanced provision of quality services and likelihood of bank survival. It was concluded that there was need for adoption of alternative technological innovations so as to enhance provision of banking services, ease of access of services by customers and reduction of geographical distances from areas not covered by banks networks. These findings may not be generalized in other parts of the country due to differences in social demographic characteristics that may have impact on adoption and performance of respective commercial banks.

Dzombo, Kilika and Maingi (2017) investigated the effect of branchless banking strategy on financial performance of commercial banks in Kenya. The specific objectives of the study were to examine the effect of agency banking and electronic banking channels on financial performance of banks in Kenya. Exploratory research design was adopted. Primary and secondary data was collected. Descriptive statistics, correlation and regression analysis analyzed the data. It was found that there was an inverse and significant between agency banking, electronic banking and financial performance of commercial banks in Kenya. It was recommended that there was need for investment in agency banking and electronic banking jointly so as to achieve benefits associated with them. Prior to their adoption, there is need for sensitization of the members of the public to eradicate any resistance that may be associated with technological adoption.

Njeru and Omagwa (2018) investigated the effect of mobile banking and profitability of tier one commercial banks in Kenya. Specifically, the study examined the effect of transactions, electronic funds transfer services and customization on financial performance. Descriptive research design was adopted and primary data gathered through questionnaires administration. Descriptive statistics and multiple regression analysis analyzed the data. The study found that there was significant effect of mobile banking on profitability of tier one commercial banks. Electronic funds transfer and customization did not have significant effect on profitability of tier one commercial banks. Banking customers executed several transactions through use of mobile banking services. It was concluded that there was need to strategically endorse adoption of mobile banking transaction so as to enhance the quality of services accorded to their customers. Further, increased mobile banking transactions would increase revenue generation at decreased transactional banking costs.

Mueni, Makokha and Namusonge (2016) investigated the effect of mobile banking on customer satisfaction in Trans-Nzoia County. The study was guided by the following objectives: -to establish the effect of reliability of mobile banking on customer satisfaction, to determine the effect of responsiveness of mobile banking on customer satisfaction, and to evaluate the effect of accessibility of mobile banking services on customer satisfaction in Trans-Nzoia County. A descriptive survey research design was adopted. The target population was ten selected banks in Trans-Nzoia County. The study was guided by the; innovation diffusion theory, technology acceptance model (TAM), and theory of reasoned action (TRA). The study adopted the descriptive survey research design with the target population being the selected commercial banks personnel in Trans Nzoia County, totaling to 41 respondents. Census method was adopted since the target population was less than the minimum a hundred for sampling to be used for research. A structured questionnaire was used as a data collection instrument that was designed in a Likert scale format. Data analysis was carried out by use of regression and ANOVA using the Statistical Package for Social Sciences (SPSS) version 23 in order to statistically produce the relationship between the independent variables and dependent

variable. From the findings, the researcher concluded that the regression effect was statistically significant indicating a reliable prediction of the dependent variable. The F calculated (F =39.96) greater than 5% level of significance thereby showing that the model was significant where the independent variables explained 85% of the mobile banking customer satisfaction. The study was significant to the banking sector since mobile banking is a phenomenon that has taken off and can't be washed away.

Musau, Muathe and Mwangi (2018) investigated the effect of financial inclusion, banking competitiveness and credit risk of commercial banks in Kenya. Exploratory research design was adopted and panel data collected among commercial banks from 2007 to 2015. Data was analyzed through use of descriptive statistics, correlation and regression analysis. It was found that there was significant effect of bank availability, bank accessibility, bank usage and credit risk of commercial banks. Competitiveness had significant moderating effect on the influence of bank inclusion on credit risk. It was concluded that there was need for commercial banks to embrace financial inclusion mechanisms so as to enhance their credit risk performance. It was recommended that financial inclusion policies adopted by commercial banks should be well informed so as to enhance stability of commercial banks.

Muchingami (2018) assessed customer's perception on mobile banking in Botswana. The technology acceptance model three is an information system theory that transmits phases to be followed by information inquirers in the acceptance, instilling and utilization of new technology to achieve information literacy skills in any sector. To meet the objective of the paper, technology acceptance model three dimensions which include use behavior, perceived usefulness and perceived ease of use were implemented. Descriptive research design was used for this study, where data was collected through self-administered questionnaire from six commercial banks customers in Botswana. It has been exposed that objective usability and computer playfulness are the major components that drives behavioral intentions on the use of mobile banking in Botswana. It was therefore recommended that the banks must engage more technological awareness packages to expose the need to transform from traditional banking to contemporary

models of banking. It is also important that commercial banks should put in place efficient service systems to reduce internet disruptions and ensure instantaneous customer service.

2.4.2 Automated Teller Machine and Financial Deepening

Adewoye (2013) investigated the effect of Automated Teller Machine (ATM) on commercial banking performance in Nigeria. Descriptive research design was adopted. Primary data was collected through use of questionnaires amongst respondents who were drawn purposively. Inferential and descriptive statistics were adopted to analyze the data. It was found that ATM impacted positively on quality of services accorded to commercial banks customers.

Mwatsika (2016) investigated the effect of ATM on banking customer's satisfaction in Malawi. Descriptive research design was adopted. Stratified sampling was used to select respondents whom questionnaires were administered. Inferential and descriptive statistics were used to analyse the data. It was found that ATM impacted customer satisfaction positively. Through, ATM commercial banks were able to cannibalize each other and this triggered innovative ways of attracting and retaining customers. This enhanced access of commercial banking services. It would have been appropriate to blend quantitative data with qualitative which would have been gathered through use of interview guides and focus group discussion. In addition, to classical regression modelling, structural regression model ought to have been adopted so to examine the strength of contribution of each construct.

Jenevive and Anyanwaokoro (2017) investigated the effect of electronic payments and Nigerian banking performance through panel approach. Specifically, the study investigated the effect of automated teller machine, point of sale, mobile payment on profitability of banks. Five banks were selected and secondary data gathered from their annual financial statements from 2009 to 2015. Partial least squares estimation methods was applied for data analysis. It was found that automated teller machines and mobile

phone payment had positive and significant effect on profitability. Although, point of sale had positive effect it was not significant. It was recommended that media sensitization campaigns should be carried out to enhance acceptance of automated teller machine payments and mobile phone payment to boost commercial banks profitability.

Mutiso and Senelwa (2017) investigated the effect of ATM banking on financial performance of listed commercial banks in Kenya. Panel research design was adopted and secondary data gathered from annual financial statements from 2007 to 2016. Univariate, bivariate and multivariate techniques were applied for data analysis. Study findings revealed positive and significant effect between ATM banking and financial performance. It was recommended that more banking functions ought to be incorporated in ATM so as to enhance convenience and efficiency.

Nyang'ate (2015) examined the effect of electronic banking technologies on commercial banking performance in Kenya. Panel correlation research design was adopted. Secondary data of 44 commercial banks was gathered for a five-year period. Classical regression modelling was adopted to analyze the data. It was found that ATM banking innovations had positive significant effect on commercial banks performance. It was concluded that banking penetration and inclusion could be achieved if commercial banks integrated their ATM platform to ease access of their services from their competitors. It was appropriate to carry out diagnostic tests associated with panel data so to minimize likelihood of fitting spurious regression models.

Ahaiwe (2011) investigated the effect of ATM on banking services in Nigeria. Specifically, the study investigated the effect of ATM on market share, profitability and bank risk. Descriptive research design was applied and primary data gathered through questionnaires administration. Descriptive statistics and chi square was applied for data analysis. It was found that adoption of automated teller machines had impact on the market share among Nigerian commercial banks. Chi square test of association revealed significant impact of automated teller machines on banking services in Nigeria.

Gichugu and Oloko (2015) investigated the effect of banking innovations and financial performance of commercial banks in Kenya. They adopted exploratory factor analysis and gathered secondary data from annual financial statements of 43 commercials in Kenya over a five-year period from 2009 to 2013. Descriptive statistics, correlation and regression analysis were applied for data analysis. The study found that there was positive and significant effect of mobile banking, ATM banking and online banking on financial performance of commercial banks in Kenya. It was recommended that commercial banks ought to partner with government and telecommunication industry players so as to achieve synergistic benefits due to symbiotic relationship.

Jegede (2014) investigated the effect of ATM on Nigerian banking performance. Cross sectional research design was adopted and primary data collected through questionnaires administration. Simple random sampling was applied to select 125 respondents from five selected banks which were interlinked with interswitch. Data was analysed through univariate and bivariate techniques. Relationship was evaluated through use of chi square. Study findings revealed that there were less benefits accrued from use of ATM banking due to security threats and escalating frauds. ATM banking quality of service was lower due to comprise of privacy during transactions. It was concluded that commercial banks ought to enhance electronic banking security so as to enhance customer satisfaction and quality of service. To enhance security there is need to adopt security alerts for any transaction carried out so as to authenticate genuine from frauds.

Abdullahi and Nyaoga (2017) investigated the effect of automated teller machines usage and operational performance of commercial banks in Nakuru County. Univariate and bivariate data analysed the data. There was positive causal effect of ATMs usage on commercial banks operational performance in Nakuru County. It was observed that customers executed alternative banking transactions through their ATMs. Although, classical regression analysis was adopted in the study, it failed to report any classical regression assumption, this had likelihood of increasing possibilities of drawing biased findings.

Malikeh and Ali (2015) investigated the impact of electronic banking on customer loyalty. Specifically, the study investigated the cognitive loyalty, emotional loyalty and action loyalty among customers in banking sector in India. Qualitative research design was adopted and document content analysis carried out to gather the data. It was found that electronic banking promoted customer loyalty and retention. It was concluded t6hat there was need for commercial banks to devise measures geared towards promoting customer loyalty. Through these strategies it would be easier for banks to avail services to unbanked population and develop customized products aimed at enhancing quality of service delivery in the target market.

Agape (2014) assessed the impact of electronic banking on customer retention in Exim bank Morogoro branch. Banking has revolutionized modern banking practices with Banks able to offer more efficient services and lower cost and greater reach. This study tries to explorer the impact of electronic banking on customer retention with a case study on Exim Bank Tanzania LTD. Exim bank Tanzania ltd was deliberately chosen as a case study due to its use of E banking services. The study targeted the customers and staff members of Exim Bank Morogoro branch using purposive and random sample of 95 respondents. The study used qualitative data with structured questionnaires and interviews to obtain data. To measure the impact of customer retention the study focused on transaction cost and quality of service variables. The study discovered significant influence of electronic banking on customer retention. Customer retention can be significantly enhanced by electronic banking, quality of service and transaction costs. The study has also revealed significant impact of electronic banking on customer satisfaction at Exim Bank Morogoro Branch. The study recommends that banks should undertake to educate both customers and employees on the use of electronic banking to ensure efficient application of the service and also minimize security concerns such as fraud. Also it's important that the bank invest in a suitable network infrastructure to minimize network problems which can affect customers while using electronic banking services.

Omodele and Onyelwu (2019) investigated the effect of electronic banking quality of service on customer satisfaction in Nigeria. A descriptive survey research design was adopted. The sample size was 93 respondents. The main research instrument used was questionnaire. Data collected were analyzed using descriptive statistic followed by Pearson correlation, and regression analysis to test the hypotheses. The findings revealed that there is a significant relationship between customer satisfaction and the various electronic banking service quality dimensions and electronic banking service quality has significant impact on customer satisfaction. Hence, the study concluded that banks have and still are putting in massive investments into electronic banking infrastructure and as such customer satisfaction is turning into one of the most crucial factor for the success of electronic banking service meaning that the generation of positive customer value on the electronic banking requires the establishment and maintenance of longstanding customer relationship. The study therefore recommended that banks should improve on their e-banking products relentlessly, upgrade their channels (and enhance their software application (such as online application, e-mobile application)

Gyabaah, Danquah and Wayoe (2015) investigated the impact of automated teller machines on delivery of banking services in Ghana. Cross sectional research design was adopted and purposive sampling applied to select 10 banks located in Greater Accra region. A sample of 272 customers was selected through cluster sampling and questionnaires were administered amongst them. Univariate, bivariate and multivariate techniques analyzed the data. Results of the study revealed that 30% of respondents used ATM services once per week, followed by 26.4% who used them on alternative days per week and 22.8% used them once per month. Higher percentage of respondents asserted that they watch out of ATM location prior to carrying out any transaction as accounted for by 84.8%. This is aimed at enhancing security of their transactions. There was calling for commercial banks to increase their ATM branch network so as to enhance access of banking services more so among those who were not in a position to access banking services during their normal working hours. Use of ATM was not void of

challenges since customers complained of inability of ATM machines to dispense cash, ATM located in obstructed areas and failure of ATM to dispense desired cash amounts.

Roozbahani, Hojjati an Azad (2012) examined the role of electronic payment and electronic banking on customer satisfaction in Iran. Since customer satisfaction is a high priority as one of the goals of banks and credit firms, this study aims to investigate the role of e-payment tools and e-banking in customer satisfaction. Methodology: this study is an applied research regarding goal and a correlation type descriptive-survey regarding methodology. The statistical population consists of 80 gold customers of Pasargad bank e-payment company and the sample size was determined 66.35 using Cochran`s equation. Moreover, questionnaires used to collect the information. This questionnaire was developed in two sections by the researcher. The validity of the questionnaire is confirmed by a group of experts, including professors and specialists of the field, and its trust is computed using Cronbach`s alpha (α=90%). Furthermore, SPSS software and Pearson`s correlation test were used to analyze the data. Results of the research indicate that there is a positive and significant relationship between e-payment tools and e-banking. Therefore, the results can help to identify effective factors of customer satisfaction and in turn providing competitive advantage for this and similar organizations.

Ali and Kalu (2016) investigated the impact of automated teller machines on banking services in Nigeria. Expo facto research design was applied and secondary data was collected between 2009 and 2013. Univariate, bivariate and multivariate techniques were applied for data analysis. It was found that ATM banking had significant impact on performance of Nigerian banks. These results may not be applied locally owing to difference in geographical locations, political differences and states of economic development. Moreover, there are changes that have occurred since 2016 and they may have triggered technological changes and ultimately impact on performance of commercial banks locally and in Nigeria.

Rathee and Yaday (2017) investigated perception of customers on quality of digital banking services in India. Intense use of digital technology for delivering banking services is becoming prevalent because of reduced cost and quick delivery of services. Most frequent use of smart phones and growth of e- commerce lead to the digitalization of banking services. This was an empirical investigation and a sample of 180 customers from NCR (Delhi, Noida, Gurugram) has been taken for the study. Out of which 130 responses were found correct and are used for further research. The response rate is 72.22%. This study found that all the dimensions of service quality named responsiveness, reliability, assurance, empathy, system availability and privacy are found significant in digital banking but their perceived level of significance is different. The findings of this study might help the banks to improve the digital banking service quality.

Adaramola and Kolapo (2019) assessed banking technology machine as strategies of raising banking performance in Nigeria. Cross sectional research design was adopted and primary data gathered through questionnaires administration. Descriptive statistics and inferential statistics analysed the data. It was found that majority agreed that mobile banking contributes to strategic marketing initiatives, it was an effective marketing channel, it contributed significantly to banking performance, it enhanced market efficiency, market expansion and bank technology improvement, it contributed to customers' retention strategies. Majority of respondents agreed that use of automated teller machines ensured service delivery to their customers, it enhanced banking services provision, it makes easier marketing strategy and it have been adopted as part of marketing strategy. Multiple regression analysis revealed positive and significant effect of automated teller machine banking, mobile banking and bank size on financial performance of commercial banks.

Akhtar, Raza, Umer, Tahir, Umair and Ijaz (2016) investigated the effect of automatic teller machine quality of service and customer satisfaction in Pakistan banking sector. Convenience sampling was applied to select 100 respondents among whom questionnaires were administered. Descriptive statistics, correlation and regression

analysis analysed the data. Regression analysis revealed that there was positive and significant effect of automated teller machines and customer satisfaction. Quality of customer service was anchored on price, reliability, responsiveness, convenience and security. To minimize likelihood of subjective responses the study ought to have adopted random sampling technique.

Mbah and Obiezekwem (2019) investigated the effect of electronic banking and performance of small and medium enterprises in Nigeria. Specifically, the study examined the effect of automated teller machines, point of sale services, transactions alerts via short message service, mobile banking and performance of small and medium enterprises. Cross sectional research design was adopted and primary data gathered through questionnaires administration. Simple random sampling of 50 small and medium enterprises was carried out and 300 questionnaires issued in them. Descriptive statistics, correlation and regression analysis were adopted to analyze data. Study findings indicated positive and significant effect of automated teller machine, point of sale, transaction alerts via short message services, mobile banking and performance of small and medium enterprises. The preference of electronic banking was attributed to their effectiveness, convenience, security, adversity and accessibility of services. It was recommended that to enhance security features of electronic banking then there is need for participatory approach in improvement of security features. These findings may not be generalized in local perspective due to difference in states of technological development.

Matimbwa and Ochumba (2018) investigated the effect of automated teller machines on customer satisfaction in Tanzania. Quantitative research design was adopted and primary data gathered through questionnaires administration. A 100 respondents were drawn through purposive sampling. Descriptive statistics, correlation and regression analysis were adopted for data analysis. Descriptive statistics indicated that most customers used automatic teller machines to check on their balances and withdraw funds. Regression analysis revealed significant relationship between customer satisfaction and use of

automatic teller machines. The study should have used structural equation modelling to show the nexus between use of automatic teller machines and customer satisfaction.

Jenevive and Anyanwaokoro (2017) investigated the effect of automated teller machines on profitability of banks in Nigeria. Panel research design was adopted and secondary panel data gathered from audited annual financial statements. Purposive sampling was applied to select five commercial banks. Partial least squares method was adopted for data analysis. Results of the study revealed significant association between automated teller machine, mobile phone payment and profitability. Point of sale had positive and non-significant effect on banking profitability. There was calls for sensitization campaigns to be carried out so as to promote adoption of electronic banking services.

Muhammad, Aslam, Afgan and Abbasi (2014) assessed performance of automated teller machines in Pakistan large banks. Cross sectional research design was adopted and primary data gathered through issue of structured questionnaires. Data was analysed through fuzzy model approach. Study findings revealed that there was significant improvement on quality of services accorded to customer's courtesy of automated teller machines. These findings may not be generalized in Kenyan perspective due to difference in state of economic development and degree of technology innovation that may have influence of uptake of innovative products and services by commercial banks.

Chaarani and Abiad (2018) investigated the effect of technology innovation and banking performance of Lebanese banks. Panel research design was adopted and secondary data gathered from 2010 to 2017. Univariate, bivariate and multivariate techniques were adopted for data analysis. Results of the study revealed that there was positive and significant effect of internet banking, automated teller machines and profitability. In contrast mobile banking and investment on computer soft wares and performance of commercial banks was not significantly related.

Emeka, Abba and Fatokun (2013) investigated the effect of electronic banking on financial inclusion in Nigeria. The concept of financial inclusion has continued to gain

global acceptance since it was identified as one of the key drivers of inclusive economic growth and development. Financial inclusion is one of the objectives of the Central Bank of Nigeria's cashless policy introduced in Nigeria in the year 2011. In the light of this, the research examined the impact of electronic banking on financial inclusion in Nigeria. The study used the total number of automated teller machines and point-of-sale devices in Nigeria as proxies for electronic banking and the proportion of banked adult population to total bankable adult population in Nigeria as proxy for financial inclusion. The study adopted correlational and ex-post facto research designs with the aid of computer-based multiple regression analysis. It was observed that automated teller machines do not significantly impact financial inclusion while point-of-sale devices significantly impact financial inclusion in Nigeria. In line with the findings of the study, it is recommended that deposit money banks should remove the bottlenecks associated with the use of their automated teller machines and strive to meet international best practice. Also, more point-of-sale devices should be readily available and easily accessible by customers.

Asare and Sakoe (2014) examined the effects of electronic banking on financial services in Ghana. Electronic banking has redefined the way banking is conducted across the globe and Ghana was not left out. Electronic banking has created a financial supermarket where many different financial services like insurance, investment, loans and current and savings accounts could be provided. Over the last three decades' banks have designed and rolled out many different electronic banking products and services in Ghana. In this study an attempt is made to examine the effects of electronic banking products and services on financial services delivery in Ghana. The study was conducted using the case study approach. Data was collected from the administration of open ended questionnaires to customers and staff of banks in Ghana. Additional data was also collected through interviews conducted with customers and staff of case study institutions. A purposive and simple sampling technique was used to select the case study banks, customers and staff who participated in the study. Results of the study revealed that electronic banking has successfully transformed banking in Ghana. Banks

now provide a one stop-shop for various financial services thereby creating what can be termed as financial shopping mall. Electronic banking has made banking easier and convenient. Customers can now transact banking business from the comfort of their homes and offices. Other benefits of electronic banking include; increased customer base, reduced cost in accessing and using the banking services, increased comfort and time saving-transactions can be made 24-hours a day, without requiring the physical interaction with the bank, quick and continuous access to information. Customers have easier access to information as they can check their accounts at the click of a button. Despite these benefits electronic banking also creates its own problems including; additional cost to acquire computer, internet connectivity and absence of human touch.

2.4.3 Online Banking and Financial Deepening

Ngungi (2013) researched the effect of internet depending on money related execution of business banks in Kenya. The study did an enumeration of the 43 business banks in Kenya and gathered essential information through surveys. The study reasoned that web saving money affected the monetary execution of business banks in Kenya. The study recommended that banks should rally more clients to use internet banking as based on the results of the study, internet banking services were very useful in addressing lowering costs to the bank and customers, security and accessibility by users.

Cheruiyot (2010) investigated the impact of internet banking on commercial bank performance in Kenya. Panel research design was adopted and secondary data for five years was collected. Panel regression and descriptive statistics were used to analyze the data. It was found that internet banking impacted positively on commercial banks performance. It was appropriate for the study to carry out panel data diagnostic tests prior to fitting regression model since it would have mitigated the possibilities of fitting spurious model. Moreover, examination of the single effect of internet banking may have led to biasness since there are alternative strategies adopted to enhance financial inclusion amongst commercial banks in Kenya.

Nasimiyu (2018) examined the effect of electronic banking on financial performance in Migori County. Devolution in Kenya has brought changes in many sectors of the economy. With the aim to attain the vision 2030 of industrialized nation and technological invention and innovation, many industries have embraced innovation in the field of information communication technology. ICT is seen as the main drive towards attainment of technological goals. Innovation in IT has been the force behind transformation of financial institutions in Migori County. Tremendous development in IT and the struggle to attain the vision's goals has made banking services more effective, accessible and cheaper. The study investigated the effects of E-banking on financial performance of commercial banks in Migori County. There are 4 variables used to investigate the main objective of the study. The study investigated 6 banks in five towns in Migori County. 56 respondents filled the questionnaires and emailed them back. Purposive sampling was used to select banks in the towns whereas stratified random sampling was used to cover the total population. The study adopted descriptive research design where qualitative and quantitative approaches were used. Primary data was collected through questionnaires developed and sent to respondents of commercial banks. The data was augmented with secondary data that was incorporated in the questionnaires and the central bank of Kenya supervisory reports. Regression analysis with aid of Statistical packages for social science and Microsoft Excel played a major role aid in data analysis and presentation. There was significant effect of electronic banking on financial performance of commercial banks in Migori County.

Tasmin, Alhaji, Norazlin and Josu (2013) investigated the effect of online banking on service delivery of commercial banks in Malaysia. Specifically, the study examined the effect of cost, security and convenience on access to banking services via online banking. Cross sectional research design was adopted and primary data gathered through questionnaires administration. Descriptive statistics, correlation and regression analysis analysed the data. It was found that there was positive and significant effect of online banking and service delivery of commercial banks. It was necessary to complement quantitative data with qualitative data.

Okoye, Omankhanlen, Okoh and Areghan (2018) investigated the effects of technology based financial services on customer satisfaction on Nigeria. This study was designed to identify the extent to which technology has impacted customer satisfaction in the Nigerian banking sector. Data analysis was based on responses obtained from 120 customers of three Deposit Money Banks within Ogun and Lagos States of Nigeria. Features of bank service evaluated in the study are time saving, convenience, crime reduction, reliability, risk reduction, and ease of use. The result showed significant positive impact of all the above service features on customer satisfaction, an indication that electronic-based banking has enhanced customer satisfaction in Nigeria. It is recommended that more service points and user-friendly customer-oriented financial products be provided to support this initiative.

Ogutu and Fatoki (2019) investigated the effect of E-banking on financial performance of listed commercial banks in Kenya. Specifically, the study investigated the effect of mobile banking, agency banking, ATM banking and online banking on financial performance. Causal research design was adopted and secondary data collected from annual financial statements. Univariate, bivariate and multivariate techniques were adopted for data analysis. The study found that there was positive and significant relationship between mobile banking, agency banking, ATM banking, online banking and financial performance of listed commercial banks. It was recommended that there is need for evaluation of alternative strategies that may be adopted so as to enhance performance of commercial banks and ease access of banking services among non-banked population.

Adewoye (2013) investigated the effect of electronic banking on efficiency of customer service in Nigeria commercial banks. Descriptive research design was adopted and primary data gathered through administration of questionnaires. Cluster sampling was applied to select employees hailing from four commercial banks and 140 questionnaires were issued to them. Descriptive statistics, correlation and multiple regression modelling analyzed the data. It was found that mobile banking improved quality of service delivery since it made transactions convenient, timely savings, quick transaction alerts,

savings on transaction costs and recuperation on customer's relationship and transaction. It was recommended that there was need for banking management to create awareness through public sensitization, creation of collaborative mechanisms and improvement of mobile based innovations graphical user interfaces. Further, measures should be adopted to minimize likelihood of hacking and fraudulent transactions which may precipitate manipulation of banking information and retrieval of data for malicious use. There was call for provision of reliable telecommunication network to enhance access of mobile banking services in regions which may have not been accessing network.

Simon and Thomas (2016) investigated the effect of online banking on customer satisfaction in Kenya. The study adopted a descriptive survey research design. The target population was 262511 customers drawn from 5 first tier banks within Nairobi CBD. Stratified sampling technique was used to select a sample size 225 respondents. Primary data was collected using structured questionnaires addressed to the participants. The researcher conducted initial data analysis using descriptive statistical measures. The study also conducted a regression analysis to establish the relationship between the study variables. From the findings, the study concluded that flexibility of internet banking influence customer satisfaction to a great extent. In addition, many customers use internet banking because it is easy to use while personalized internet banking also affects customer satisfaction to a great extent. The study further concludes that usefulness of internet banking and friendliness of internet banking has relatively low effect on customer satisfaction. The study also concludes that convenience of mobile banking affects customer satisfaction to a great. Further, the study concluded that user friendly ATMs, ease of access of ATMs and privacy of ATMs affects customer satisfaction to a great extent. In addition, using ATM cards in supermarket and affordability of ATM charges have moderate effect on customer satisfaction. In relation to point of sale system, the study concludes that, effectiveness of point of sale system affects customer satisfaction to a great extent. Finally, it was clear that mobile banking has the highest effect on Customer satisfaction followed by automated teller machines, then point of sale system while internet banking had the least effect on customer satisfaction. Banking

institutions should enhance their internet banking to make it flexible, fast and easy to use. Management of banking institutions should enhance application of mobile banking to increase satisfaction of their customers. Mobile service providers in conjunction with banks should develop more friendly and easy to use and efficient applications for bank customers. Finally, the banking institutions should work hand in hand with major retail outlets and other organizations that use point of sale systems so as to ensure the cards issued to customers and point of sale systems are useful, reliable and can work with speed.

Osa (2016) investigated the effect of electronic banking on efficient service delivery of customers in Nigeria. The advent of service areas like financial advisory services, funds transfers and international trade among others helps propel Nigeria banks into the development of new and improved service delivery channels. Information and communication technology rapidly emerged as the platform for building integrating and communicating effective service to customers. Today in Nigeria servers, personal computers and local / wide area networks have taken a firm foot as the minimum requirement for rendering credible and effective banking services. The recent trends in Information Technology are becoming central to the process of economic development. Information technology offers new ways of exchanging information, transacting business, changes the nature of the financial and other services sectors and provides efficient means of using the human and institutional capabilities of countries in both the public and private sectors. Information technology can be applied to every conceivable activity; from collecting taxes to bank management, complex scientific and technical problems.

Sathye (2015) investigated the impact of internet banking on performance and risk management of commercial banks and credit unions in Australia. Panel research design was adopted and secondary collected from annual financial statements of commercial banks and credit unions over 10-year period. Commercial banks and credit unions were judgementally selected. Panel regression and descriptive analysis were adopted to analyze the data. Classical modelling revealed positive significant impact of internet

banking on commercial bank performance and risk management. These findings cannot be generalized in Kenya owing to difference on business environment and stages of economic development which may have impact on financial inclusion and deepening.

Wabel (2011) studied the impact of e-banking on the performance of Jordanian banks. In their study, performance of banks was measured by return on equity and two sets of control variables were used. Using pooled ordinary least squares regression technique they found significant negative impact of e-banking on financial performance of banks. The major limitation of this study is that authors did not look at return on equity after a specific year of adoption of electronic banking. Since adoption of e-banking technology involves cost, this might take time to recover cost and experience profits.

Hammoud, Rima and Ibrahim (2018) investigated the impact of electronic banking on quality of customer service in Lebanese banking sector. The purpose of this study was to examine the relationship between the dimensions of E-Banking service quality and customer satisfaction to determine which dimension can potentially have the strongest influence on customer satisfaction. Data were gathered using a survey instrument, which was distributed among bank clients in the Lebanese banking sector. The data were statistically analyzed using structural equation modeling with SPSS and Amos (20). The findings show that reliability, efficiency, and ease of use; responsiveness and communication; and security and privacy all have a significant impact on customer satisfaction, with reliability being the dimension with the strongest impact. E-Banking has become one of the essential banking services that can, if properly implemented, increase customer satisfaction, and give banks a competitive advantage. Knowing the relative importance of service quality dimensions can help the banking industry focus on what satisfies customers the most.

Firdous and Farooqi (2017) investigated the effect of quality of internet banking on customer satisfaction in India. An exploratory survey with the help of a Likert based questionnaire was conducted to investigate the impact of Internet Banking service quality on customer satisfaction in New Delhi. Judgmental and convenience sampling

was used and various kinds of internet banking customers were approached in New Delhi. Data were collected from a sample of 194 internet banking customers. Findings: The result implicated that the internet banking service quality dimensions have a significant impact on the customer satisfaction of internet banking customers. Each of the dimension namely efficiency, system availability, fulfillment, privacy, contact, responsiveness and contact individually contribute 70% to the overall customer satisfaction in internet banking. Originality/value: The paper provides empirical evidence to show that the internet banking service quality dimensions' area an important factor to satisfy the customers since each of them is positively related to customer satisfaction. The research has contributed to an understanding of the importance of various dimensions that internet banking service quality comprises of and how the impact customer satisfaction. The paper lays a foundation to future research which must not be limited to one geographical area of India but should take into study the other areas where internet banking is widely being adopted given the new economy scenario of India. Practical implications: The research will help the managers of the banks and the policy makers to focus on these factors that tend to have a dominating impact on satisfying the customers. This will result in a better internet banking service quality provided by the banks and that in turn will help retain the existing customers and also gaining the new ones.

Udo, Kabir, Yussuf and Bukola (2017) investigated the effect of automated teller machines on customer satisfaction and profitability of Nigerian banks. Cross sectional research design was adopted and quantitative data gathered through issue of questionnaires. Univariate, bivariate and multivariate techniques were adopted for data analysis. It was found that adoption of automated teller machines enhanced customer satisfaction and improved profitability. These findings may not be localized in Kenya owing to differences in states of financial liberalization, regulation and technological development which may have impact on technological adoption. Further, the study should have considered both qualitative and quantitative data so as to complement data gathered through one approach.

Hasan et al. (2012) investigated the effect of internet banking on commercial banking in Italy. Correlation research design was adopted and panel secondary data collected from annual financial statements. Classical regression and descriptive statistics were used to analyze the data. The study revealed that there was positive and significant effect of internet banking on commercial banks performance in Italy. Further, internet banking impacted negatively on commercial banks risk levels.

Okibo and Wario (2014) investigated the effect of electronic banking on growth of customer base in Kenya commercial banks. Descriptive research design was adopted and primary data gathered through issue of questionnaires among 135 respondents who hailed from different banks. Descriptive statistics, correlation and regression analysis were applied for data analysis. Results of the study revealed that there was significant effect of electronic banking on growth of customer base. Secondly, there was increased accessibility of commercial banks in Kenyan courtesy of technological innovations. It was recommended that commercial banks ought to develop measures aimed at enhancing incorporation of electronic banking in their respective commercial banks so as to benefit from competitive advantage associated with technological innovations.

Chipeta and Muthinja (2018) investigated the effect of financial innovations on commercial banks performance in Kenya. Specifically, the study examined the effect of internet banking, mobile banking, agency banking and ATM banking on commercial banks performance. Secondary panel data was gathered from annual financial statements. Koyck dynamic distributed lag model was fitted. It was found that financial innovation had significant contribution on financial performance. Time specific characteristics had significant contribution on financial performance as compared to industry characteristics. Since there were only 42 commercial banks in Kenya it was appropriate to consider data for long periods of time to alleviate challenges associated with small sample while analyzing panel data.

Barasa, Obura and Anyira (2017) investigated the effect of internet banking on financial performance of commercial banks in Kisumu. Descriptive research design was adopted

and primary data gathered through administration of questionnaires. Purposive sampling was applied to select 11 commercial banks and 5 employees were selected from each bank. Document content analysis gathered secondary data. Univariate, bivariate and multivariate techniques were applied for data analysis. It was documented that there was positive and significant effect between internet banking and financial performance of commercial banks in Kenya. It was recommended that commercial banks should enhance quality of their internet banking to enhance performance.

Adeleye and Fadiya (2015) investigated the effect of automated teller machines on customer satisfaction in united bank of Africa. Survey research design was adopted and primary data gathered through questionnaires administration. Descriptive, correlation and regression analysis analyzed the data. It was found that there was positive and significant effect of automated teller machines and customer satisfaction. It was recommended that there is need for adoption of alternative evaluation for customer satisfaction and quality of service delivery due to adoption of ATM. These study findings may not be generalized to other banks since it drew its respondents from a single bank.

2.4.4 Agency Banking and Financial Deepening

Waiyenya (2012) studied the effects of agency banking on financial inclusion in Kenya. The examination inferred that agency banking has the impact of expanded money related incorporation in the country. Findings of the study indicated that the levels of budgetary incorporation are low and that there is eminent gap not filled by formal banking system. It additionally noticed that office managing an account is confronting a great deal of difficulties from the expanding portable infiltration in the nation and versatile cash exchanges expanding at a similar rate.

Mbugua and Omagwa (2017) investigated the effect of agency banking on financial performance of commercial banks in Embu County. Descriptive research design was adopted. Stratified sampling was adopted to select respondents from different levels of

banking management. Primary data was collected through use of semi structured questionnaires. Inferential and descriptive statistics were adopted to analyze quantitative data. Positive and significant effect of agency banking on financial performance was reported.

Gitonga and Kiraka (2019) investigated the effect of banking services on the business performance of bank agents in Kenya. Quantitative research design was adopted and primary data gathered through questionnaires administration among 384 respondents selected through simple random sampling. Descriptive and inferential statistics analyzed the data. Study findings revealed that there was growth in revenue amongst those who were recruited as bank agents. It was recommended that entrepreneurs should consider incorporation of agency banking in their models so as to enhance performance. The study should have drawn respondents from both business owners and bank customers and should have incorporated qualitative data.

Kingori and Gekara (2015) investigated the effect of agency banking on commercial bank performance in Thika municipality. Purposive sampling and cross-sectional research design were adopted. Primary data was collected using semi-structured questionnaires. Univariate and bivariate analysis was adopted. Regression analysis revealed positive and significant effect of agency banking on commercial banks performance. It was concluded that there was increased access to banking services especially amongst those working in the informal sector since they could easily access banking services within their areas of operations.

Tarazi (2010), observes that where damages are not easily quantified and agent behavior not easily monitored – resulting in an unknown risk that principal service providers are not well equipped to mitigate, for example, violations of data privacy. In this case, damages could be indirect and punitive – and therefore quite high. And yet, a principal service provider is ill equipped to stop such agent behavior. Some would argue that this problem is easily solved – keep the principal institution liable and it will take recourse against its own agent for any damages it is forced to pay as a result of such agent's

misconduct. That could work where agents are large well capitalized retail chains. But to reach the very poor, agents are often the simple, modest corner shops – the ones whose independent behavior is most difficult to control and whose ability to "pay back" a principal for paid damages is most limited. A principal is unlikely to take comfort that in the idea that it can sue the sole proprietor of a modest fruit stand to recover unknown liabilities.

Oranga and Tirimba (2018) investigated the effect of financial inclusion on financial performance of listed commercial banks in Kenya. The study adopted descriptive research design and census of 11 listed commercial banks from which management and operational employees were issued with questionnaires. Univariate, bivariate and multivariate techniques were adopted for data analysis. It was found that there was significant effect of financial literacy on financial performance of commercial banks. Secondly, ATMs and mobile banking services had positive and significant effect on financial performance. It was recommended that there was need for policy development among banking players so as to promote adoption and utilization of technologically enabled platforms. The study may have considered use of secondary data instead of primary data since it would have enabled examination of long and short run effect of financial inclusion on financial performance.

Emoru (2012) investigated factors determining the growth of agency banking in Mombasa County. Cross sectional research design was adopted. Purposive sampling was adopted to select respondents amongst Equity banks agents in Mombasa County. Primary data was collected using structured questionnaire. Inferential and descriptive statistics analyzed the data. It was found that competition from traditional and modern banking strategies have enhanced adoption of agency banking. Although, the study applied regression model it failed to test its classical assumptions prior to model fitting.

Tindi and Bogonko (2017) investigated the effect of agency banking on customer satisfaction in Kenya. The specific objectives of the study were to determine how convenience of agency banking affects customer satisfaction, to evaluate how agent

quality influences customer satisfaction and to establish the effect of reliability on customer satisfaction. Descriptive research design was adopted and primary data gathered through questionnaires administration. Qualitative and quantitative approaches were adopted for data analysis. The study revealed that convenience of agency banking affects customer satisfaction in commercial banks to a great extent, it was revealed that agent quality has a positive influence on customer satisfaction in commercial banks and reliability has a positive influence on customer satisfaction in commercial banks. Agent's prior experience with the bank customers is positively related to satisfaction and time spent in agency banking is low compared to the normal banking and also the cost involved in transacting in agency banking was low compared to the banking hall. Innovation affects customer satisfaction in commercial banks. Technology innovations, product innovations, market innovations as well as process innovations affect the financial performance of the Banks. Based on the above findings, the study therefore recommends provision of sufficient information to agency customers to make informed decisions regarding borrowings and investments.

Ndegwa (2017) analyzed the effectiveness of agency banking as a tool for financial inclusion. The study adopted a cross-sectional survey design. The study targeted 38 administration managers and supervisors of the commercial banks in Kiambu which had adopted the agency banking model. Census was adopted to include 38 managers and supervisors to participate in the study. The study used a self-administered questionnaire to collect data. Data analyzed using descriptive (frequency distribution and percentages) and inferential statistics (Regression). Geographical coverage and liquidity were found to be statistically significant at a 95% confidence level. The study concluded that geographical coverage is the most important benefit and therefore the most significant driver of financial inclusion. The study recommended that banks should seek to provide more services through agent banking to enhance financial inclusion especially in rural areas. Higher cash deposits and withdrawals should also be allowed since agents don't have problems with liquidity.

Ruyooka (2019) established the relationship between agency banking cost and financial performance of banks in Uganda. This study adopted a quantitative descriptive non-experimental case study design where data was collected from 52 bank officials by the use of Survey questionnaire checklists. Data was then analyzed using SPSS statistical package. Background characteristics of respondents was generated by the use of tables, frequencies and percentages. In order for the study to test the hypothesis, correlations and regression analysis was used to reach at the significance levels. The study revealed that agency banking costs is a significant determinant for the financial performance of commercial banks and useful financial services and products that can meet their needs in a responsible and sustainable manner.

Ekinabor, Basil and Sina (2019) investigated the effect of electronic banking on customer satisfaction. He objectives are to examine whether there is a significant relationship between poor interconnectivity and customers' patronage of e-banking services; to find out if there a significant relationship between service outages and customers' patronage of e-banking services; to identify how e-banking influences customers' satisfaction; and whether there is a significant relationship between e-banking and customers' satisfaction. To achieve these objectives, questionnaire was administered to collect primary data. Hypotheses were formulated, tested and analyzed using Chi-square test with the aid of SPSS package. The results reveal that there is a significant relationship between poor interconnectivity and customers' patronage of electronic banking services. In addition, there is a significant relationship between service outages and customers' patronage of electronic banking services. Lastly, the study finds a significant relationship between electronic banking and customers' satisfaction. The study recommended among others that much need to be done in the area of creating awareness about the availability of internet banking products and services, how they operate and their benefits. In addition, the Government should provide an adequate regulatory framework that will ensure customer protection and security of transaction.

Worku, Tilahun and Tafa (2016) investigated the impact of electronic banking has on customer satisfaction in comparing with traditional brick and mortar banking service, its

relationship with that of age, occupation and education, its impact on branch visits, the level of customer understanding about e-banking and the opportunities and challenges of e-banking. The paper tried to see all the above among 402 properly filled and returned questionnaires of e-banking customers and interview with four branches of the two commercial banks which have started e-banking service in Gondar city when this study was conducted. The study used tables, percentages, chi-square independency test to see the relationship between demographic characteristics and e-banking, independency t-test to see the visits of branches before and after e-banking by customers is significant or not and regression analysis test has been conducted to explain the variables which determine customers' satisfaction in e-banking. The results of the study implied t that majority of users of e-banking are the young, the educated, salaried and students, business men and women are not actively using the service of e-banking and there is also a relationship between e-banking and demographic characteristics, e-banking currently provided for saving and current accounts holders only, e-banking has improved customer satisfaction, reduced frequency of bank hall for banking service, reduced waiting time for customers, there are customers who don't know the fee charged for being e-banking users, the bank customers' satisfaction increased after being e-banking users, enabled customers to control their account movements and there is high opportunity to expand e-banking service in the city.

Kelly and Palaniappan (2019) the study investigated the effect of customer satisfaction and security of mobile phone banking. Meta-analysis of 68 articles satisfied the criteria for this review. The review has shown that security remains one of the principal constructs that hinder users in adopting and post-adoption of mobile banking. The research also showed that the most used model in mobile banking was TAM. Again, trust, perceived usefulness, perceived ease of use, perceived risk, compatible, and performance and effort expectation constructs remain the most studied variable in the mobile banking literature. This review captures and summarizes the huge knowledge of research work done on mobile banking, where security is one of the least discussed areas. However, most of the research reviewed did suggest that future work should

consider security, especially on the protection of users on this emerging technology in banking. This survey has also given researchers and academia to look for other areas besides security.

Wabwoba (2012) investigated challenges facing agency banking of equity bank in Pokot County Kenya. Cross sectional research design was adopted. Purposive sampling was used to select respondents amongst equity agents. Primary data was collected through use of structured questionnaire. Descriptive and chi square analysis were used to analyze the data. It was found that there was significant association between network coverage and agency banking. In addition, it was reported that there was poor communication network which was hindering coverage of agency banking. It would have been appropriate to collect quantitative and qualitative data. These findings in Pokot County cannot be generalized to be reflection of the whole county since there are possibilities of difference in agency supportive services differences which may affect its penetration effect.

Muoria and Moronge (2018) investigated the effect of agency banking on customer retention in Kenya Commercial Bank in Kiambu County. The specific objectives are; to look at how the cost of agency services, security of agency banking, customer awareness and availability of capital affect the adoption of agency banking by bank customers in KCB in Kiambu County. The dependent variables were the level of the client of awareness, increase uptake of agency banking indicated by the amount of cash deposit, the volume of withdrawal by customers, and overall commission earned by the agent and the total number of agents. The research embraced a descriptive study design. Stratified random sampling was used to select a random sample of 120 agents of KCB. The research used questionnaires to obtain data which was analyzed by use of inferential and descriptive statistics. The study found and concluded that cost of agency services, security of agency service, customer awareness and capital availability significantly influenced the Adoption of agency banking by bank customers at KCB in Kiambu County. The findings revealed that there was a negative and significant association between agency cost and agency banking adoption. The findings also revealed that there

was a positive and significant association between agency security and agency banking adoption. The findings also revealed that there was a positive and significant association between customer awareness and agency banking adoption. Lastly, the findings revealed that there was a positive and significant association between capital availability and agency banking adoption. The study recommended that enough security measures should be put in place as a result of the rampant cybercrimes and studies to be done in other areas of Kenya to establish whether the findings can be generalized.

Muluka, Kidombo, Munyolo and Oteki (2015) investigated accessibility of digital banking services and customer satisfaction in National bank of Kenya. The objective that guided the study: To establish effect of accessibility of digital banking on Customer Satisfaction case of National Bank of Kenya, Bungoma County. The target population for the study was bank customers and banking staff from National Bank in Bungoma County and a sample size of 417. Descriptive survey design was undertaken. Data was collected using questionnaires, interview schedules and document reviews. Analysis was done with the aid of Statistical Package for Social Sciences where both descriptive and correlation analysis were performed. The findings of the study established there was a significant relationship between accessibility of digital banking and customer's satisfaction. The study recommends that Mobile banking and POS terminals, need to come up with an application that can be used to enhance digital banking.

Ndungu and Njeru (2014) assessed factors affecting adoption of agency banking in Kajiado County. This study was intended to asses some of the factors that contribute to the adoption of agency banking in Kenya. Three independent variables were assessed namely Customer Service, Convenience and quality of agents. The dependent variable was the total commissions earned by agents from time to time at intervals of six months. The results indicate that system availability contributes to service reliability. High reliability increases the adoption of agency banking. Complaints resolution time does not affect the adoption of agency banking. Agency banking is delivering convenience in form of extended hours of banking and by bringing the banking service closer to the customers leading to increased adoption of agency banking. High quality of agents

increases the adoption of agency banking while poor quality agents inhibit the adoption of agency banking. Commissions earned by agents grew from one period to the other signifying adoption and growth of agency banking.

Nyota and Muturi (2019) investigated the effect of agency banking features on performance of Equity bank in western region of Kenya. Cross sectional research design was applied and primary data gathered through questionnaires administration. Descriptive statistics and regression analysis were used for data analysis. Results of the study revealed strong association between agency banking and financial performance. It was concluded that agency banking had capacity to enhance penetration of commercial banks especially in regions which were branchless due to geographical coverage.

Kitali, Chepkuli and Shibairo (2017) investigated the effect of agency banking on customer satisfaction in Kenya. Specific objectives of the study will be to find out the relationship between agency banking on time delivery of customer banking services, find out the extent to which customers utilizing agency banking services, to find out the relationship between agency banking and customer service quality assurance, to find out the relationship between agency banking and cost reduction on customer service delivery and to find out whether banks fulfil customer expectation and reliability of agent and reliability of agent banking services. Descriptive research design was adopted and primary data gathered through questionnaires administration. Stratified and convenient sampling were adopted in selection of respondents. Descriptive statistics and multiple regression analysis analyzed the data. Study findings revealed that customers were satisfied with quality of services accorded to them through agency banking. They perceived those in charge of customer service in respective agents as competent.

2.4.5 Bank Size and Financial Innovation

Arif, Khan and Iqbal (2013) investigated the effect of bank size on commercial banks performance in Pakistan. Panel research design was adopted and quarterly secondary data collected for period 2005 to 2009. Univariate and bivariate data were used to

analyze the data. It was found that bank size had positive and significant effect on profitability of commercial banks. These findings cannot be generalized in Kenya owing to different state of business environment and economic development. Further, failure to report panel diagnostic tests increased likelihood of reporting biased findings.

Muhindi and Ngaba (2018) examined the effect of bank size on commercial banks performance in Kenya. Panel research design was adopted. Secondary data was collected from annual financial statements. Ordinary least squares model was fitted. Study findings revealed positive and significant effect of bank size on commercial banks performance.

Sreesha (2014) examined the effect of firm size, operational efficiency and financial performance in India. Panel research design was adopted and secondary data for 2009 to 2013. Classical regression modelling was applied to analyze the data. It was found that there was positive and significant effect of firm size on financial performance of commercial banks.

Terrazza (2017) examined the effect of bank size on financial performance of commercial banks in Europe. Secondary of 1270 commercial banks between 2005 to 2012 was collected. Fixed effects regression model was fitted in addition to descriptive statistics. It was found that bank size had significant effect on commercial bank financial performance.

Mwangi (2018) investigated the effect of bank size on financial performance of commercial in Kenya. Expo facto research design was adopted and panel data collected over ten-year period from 2007 to 2016. Univariate, bivariate and multivariate techniques were applied for data analysis. There was positive and significant effect of bank size on financial performance. The effect was stronger among large commercial banks. The study recommended that policies to be developed and be aimed at increasing sizes of commercial banks. This may be achieved through adoption of growth and development strategies.

Maina. Kiragu and Kamau (2019) investigated the effect of firm size on profitability of commercial banks in Kenya. Descriptive research design was adopted and secondary data retrieved from annual financial statements from 2012 to 2016. Univariate and bivariate techniques were adopted for data analysis. It was found that there was positive and significant effect of profitability on financial performance of commercial banks. Since the data was panel it was necessary to carry out panel diagnostic tests prior to fitting the model. Furthermore, the study should have considered long panels so as to examine long run effect of firm size on bank profitability.

Eyigege (2018) investigated the effect of firm size on financial performance of deposit taking quoted banks in Nigeria. Expo facto research design was adopted and secondary data was collected from five commercial banks. Descriptive statistics and regression modelling were adopted for data analysis. Results of the study revealed positive and significant effect of firm size on financial performance of commercial banks in Kenya. The study should have carried out system generalized methods moments to examine the short run effect of firm size on commercial banks performance.

Muinamia and Atheru (2018) investigated the effect of leverage, firm size, liquidity and financial performance of tier one commercial banks in Kenya. Expo facto research design was adopted and multiple regression model fitted on secondary data collected from annual financial statements. Results of the study revealed that firm size and leverage had positive and significant effect on financial performance or tier one commercial banks. Liquidity had negative and significant effect on financial performance of tier one commercial banks. It was recommended that there was need for restructuring commercial banks so as to allow small banks to benefits from economics of scale associated with larger banks. To enhance performance there was need for commercial banks to embrace alternative financing strategies that are aimed at promoting financial sustainability and performance. Liquidity requirements among commercial banks should be evaluated so as to align policies with financial targets for respective commercial banks.

Musah and Kong (2019) investigated the relationship between size and financial performance of listed companies in Ghana securities exchange. Correlation research design was adopted and secondary data collected from annual financial statements of listed companies. Univariate, bivariate and multivariate techniques were adopted for data analysis. Strong positive and significant association between firm size and financial performance was reported. These results may not be generalized in banking sector since there are governed by different regulatory guidelines in relation to other listed firms. Further, there are industry specific risks which differs from every sector to another and they ought to have been factored in during modelling.

Abeyrathna and Priyadarshana (2019) investigated the impact of firm size on profitability of listed manufacturing companies in Sri Lanka. Correlation research design was adopted and purposive sampling applied to select 20 listed companies. Panel data was gathered from 2014 to 2017. Univariate, bivariate and multivariate techniques were adopted for data processing and analysis. Positive and significant impact of total assets on financial performance was reported. Total sales impacted financial performance positively. Prior to classical modelling it was appropriate to carry out diagnostic tests so as to examine robustness of regression model and minimize likelihood of fitting spurious model.

Masika and Simiyu (2019) investigated the effect of firm characteristics on financial performance of deposit taking savings and credit cooperative societies in Kenya. Specifically, the study examined the effect of firm size, leverage, growth, liquidity on financial performance. Expo facto research design was adopted and secondary data gathered from 2012 to 2016 among SACCOs hailing from Nairobi County. Descriptive statistics, correlation and ordinary least squares regression model analysed the data. Results of the study revealed positive and significant effect of firm size on financial performance of SACCOs. This study examined direct effect of firm size and currently moderating effect of firm size on financial performance commercial banks will be examined. Unlike deposit taking SACCOs commercial banks are more empowered hence they may have larger firm size.

Birru (2016) investigated the impact of capital structure on financial performance of commercial banks in Ethiopia. Expo facto research design was adopted and secondary data gathered over five-year period. Descriptive statistics, correlation and regression analysis analysed the data. Results of the study revealed positive and significant effect of capital structure on financial performance of commercial banks in Ethiopia. The study should have considered adoption of dynamic panel modelling instead of static so as to examine short run effect of capital structure on financial performance.

2.5 Summary of Literature Review

The foregoing chapter has discussed empirical and theoretical review. Theoretical contribution and justification have been presented. Empirical argument showing nexus between study variables have been presented.

Earlier studies have been conducted on financial innovations and differ on the extent of relationship on performance and financial deepening of commercial banks. The studies also were done in different context ranging from global to local context with varying methodologies and also considering different financial innovations and the extent each significantly influenced financial performance and financial deepening. Mixed findings have been reported.

From the foregoing, the studies reviewed present conceptual, empirical, theoretical, methodological and contextual gaps. Studies which include Rayhan,Sohel and Mahjabin, 2012; Huwa,Shagida and Abdul,2017; Suaiman,Jabbar , Mujahhid and Lakhan, 2013; Kingori and Gekara, 2015 and Muturi, 2019 reported positive significant effect of financial innovations and financial deepening of banks. Other studies which include; Ching et al, 2011; Kenyoru, 2013; Jegede, 2014 and Emeka, Abba and Fatokum, 2013presented insignificant effect of financial innovations on financial deepening of commercial banks. This presents empirical gap since some studies reported significant positive effect while others negative effect.

In reference to contextual gaps, Abeyrathna and Priyadarshana, 2019; Musah and Kong 2019, Sreesha, 2014, Masika and Simiyu 2019, all present contextual gaps in that some were done in different countries and others in different industries apart from the banking sector. Examination of direct link between financial innovations and financial deepening of commercial banks as presented by Kenyoru 2013 did not utilise moderating variable. In other studies the used moderating effect of firm size deducing the effect of financial performance which presents conceptual gaps. In other studies, diagnostic tests were not conducted, small sample size, primary data was used and no classical modelling was used to analyse the results of the findings

2.6 Critique of Existing Literature

The above reviewed studies therefore present conceptual, contextual and methodological gaps to be filled by the current study. At contextual level, most of these researches have been carried out in developed countries. This study therefore extends the previous studies by scrutinizing financial innovations adoption and financial deepening of commercial banks in Kenya.

Empirical studies have reported evidence which calls for subsequent enquiry. The different views from different authors have therefore necessitated the intervention of this study in order to fill the gap by conceptualizing the independent variables and determine the overall influence it has on the dependent variable by determining the relationship between bank financial innovations and financial deepening of commercial banks as moderated by bank size on banks innovation.

Researchers such as Gennaioli, Shleifer and Vishny, (2012); Lerner and Tufano (2011); Ngumi (2014); Mwangi (2013) were conducted on financial innovations and performance. Gennaioli, Shleifer and Vishny, (2012); Lerner and Tufano (2011); Ngumi (2014) provided mixed and inconclusive results and also failed to document evident of the likelihood that further innovation will be necessary to generate a level of access and transactions costs that make services affordable for the customers. The different views

from different authors have therefore necessitated the intervention of this study in order to fill the gap by conceptualizing the independent variables and determine the overall influence it has on the dependent variable by determining the relationship between bank financial innovations and financial deepening of commercial banks as moderated by bank size on banks innovation.

Morever, others studies which include; Abeyrathna and Priyadarshana (2019; Musah and Kong (2019) Sreesha (2014) and Masika were conducted in different countries Nigeria, Pakistan and India which may have different frameworks and the levels of economic development may not be the same.

2.7 Research Gaps

Previous studies have produced mixed and inconclusive results regarding the impact of financial innovations on banking sector with most being carried out in other countries that are governed by different policy frameworks and regulations. Further, global views cannot be generalized in local market prior to empirical examination.

From the empirical review of existing literature that is relevant to the study, it has been shown that there are few studies specifically in Kenyan context on the linkage between Bank financial innovations and financial deepening of commercial banks in Kenya. There was the omission of important variable bank size as a moderator. Most of the studies do not take into consideration a moderating variable at all.

Accordingly, studies like Lerner and Tufano (2011) studied on consequences of financial innovations on financial deepening in India using empirical review which may have not considered the views of the respondents at the time and also not the same context as the current study which is set to be carried in Kenya. Gennaioli, Shleifer and Vishny (2012) on their study on Neglected Risks, Financial Innovation and Financial Fragility found a conceptualized influence of the two variables on financial fragility which is different from the current study which considers financial innovations aspects

as the independent variables and financial deepening as the dependent variable. Mwangi (2013) focused on the effects of bank innovations on financial performance of commercial banks in Kenya. The current study focuses on financial innovations and financial deepening which is expected to yield different results.

Heterogeneity of methodological approaches by empirical scholars may have contributed to inconclusively of empirical findings. This calls for customized examination of empirical amongst Kenyan commercial banks upon promulgation of new constitution and focus on achievement of Vision 2030.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The definite reason for this chapter is aiding justification for the research methodology to be positioned to answer the major question on the effect of financial innovations on financial deepening of commercial banks in Kenya. The chapter discusses the research philosophy, research design, target population, data collection procedures and instruments and data processing and analysis.

3.2 Research Philosophy

At the heart of research philosophies lies a positivist and phenomenology philosophy. It is anchored on exploration of empirical relationship on social variables under investigation (Ravitch & Riggan, 2012). Phenomenology on the other hand holds that meanings on reality and phenomena are constructed and reconstructed through qualitative approaches.

The study at hand was based on a positivist philosophy. According to Saunders, Lewis and Thornhill, (2014) this kind of philosophy is quantitative as opposed to phenomenology which is basically a qualitative approach and also the positivist orientation is guided on the philosophy of one realism existing limitations of humanity it may be known imperfectly and the realism within the context of probability can be discovered by researchers (Ravitch & Riggan, 2012). It allows researchers to ask more diverse and meaningful questions about entities, events, phenomena, processes and people. The study deployed positivism since it was conceptualized from theoretical and empirical basis.

In the Kenyan context, there are studies that have adopted the positivism philosophy view including Mureithi (2016) which was to determine the effects of financial risks on

the performance of banking institutions in Kenya; Muiruri (2015) determined CBK regulatory requirement effect on banking performance in Kenya. This study objectively was focused on testing the theory wherein the theory was at first be taken as the building framework for hypotheses development and testing thereby emphasizing the adoption of deductive orientation by the study.

3.3 Research Design

Research design is perceived as the logical flow of how the study will be executed (Nachmias & Nachmias, 2004). Descriptive correlational research design fits those studies which endeavor to find causality between independent and dependent variables. It was adopted to describe financial innovations carried out by commercial banks and show how they influence financial deepening in Kenya. This design also helps to collecting and analyzing study units data at a point in time in order to determine the strength of relationship among variables (Saunders et al., 2007; Mulwa 2013).

The study used data that is descriptive Cross-Sectional (TSCS) research design and can be described as a research design that is quasi-experimental and according to Lempert (1966), TSCS designs have for a period been earmarked amongst finest designs for studies relating to causation, next to a purely random experiment. Published work done by Lempert (1966) stated designs that are TSCS are termed as 'par excellence' due to their advantages. Adding to their unrivalled ability to detect causal relationships, TSCS designs presents as well a handful of distinct advantages. Analysis using the Panel data technique had an upper hand as compared to cross-section or time series individually because it permits accounting for any unobservable heterogeneity.

3.4 Target Population

Target population for a study emanates from consolidation of all elements under consideration (Kothari & Garg, 2014). Currently, the target population comprised of 43 commercial banks licensed and operating in Kenya as at 31/12/2018. Amongst 43

commercial banks, one was mortgage based, 30 locally owned, three publicly owned, 26 were private and 13 foreign based. Further, classification showed that 11 were listed in Nairobi securities exchange and the rest none listed. Moreover, eight banks were in tier one, 20 in tier two and 15 in tier three.

3.5 Data Collection Instruments

Data collection is a simply a systematized assembling of relevant information to the sub-problems of a research area, with aid of defined measures namely interviews, observations of participants, discussion amongst focus group, case histories and narratives. (Burns & Grove 2010).

Secondary data was used in the study. Annual banking report by CBK was the main source document for secondary data. Data collection was applied for data collections and this was in line with past studies such as Githira and Nasieku (2015), Ndili and Muturi (2015); Tarus and Omandi (2013) who adopted similar approach to consolidate secondary data for their analysis.

3.6 Data Collection Procedure

The researcher obtained a letter from the Department of Economics, Commerce and Accounting, JKUAT to enable the researcher to seek a research permit from the National Council for Science, Technology and Innovations. Secondary data was gathered from annual banking reports prepared by central bank of Kenya and where information was missing respective annual statements of banks was considered as data source document.

3.7 Data Processing and Analysis

Data gathered was cleaned, coded, entered into computer and analyzed. Descriptive statistics included mean, standard deviation, minimum, maximum, kurtosis and skewness. Inferential statistics had Pearson correlation and regression analysis. Stepwise regression analysis examines the moderating effect of bank size on the relationship

between financial innovation and financial deepening. Study findings were presented in tables and graphs.

3.8 Statistical Modelling

The multiple regression model for the study were:

$$Y_{it} = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \varepsilon_{it}$$ ……. Equation 3.1

$$Y_{it} = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \beta_5 Z_{it} + \beta_6 X_{1it} Z_{it} + \beta_7 X_{2it} Z_{it} + \beta_8 X_{3it} Z_{it} + \beta_9 X_{4it} Z_{it} + \varepsilon_{it}$$
……..... Equation 3.2

Where; Y_{it} represent Financial Deepening of Commercial banks

X_{1it} represent Mobile phone banking (MB) for bank i in period t;

X_{2it} represent ATM banking (ATMB) for bank i in period t;

X_{3it} represent Online banking for bank i in period t;

X_{4it} represent Agency banking for bank i in period t;

Z_{it} represent Bank size for bank i in period t

X_{it}*Z_{it} represent interaction between respective independent variable with bank size for bank i in period t.

3.9 Variable Measurement

Publication by Creswell (2014) highlighted that there occurs a necessity for the variables to be specific in researches that are in form quantitative to guarantee clarity to readers what groups are in the receiving end of the experimental treatment and what are the outcomes to be measured. The study, therefore, adopted financial deepening as the only

dependent variable. Mobile phone banking, ATM banking, online banking and agency banking comprised the explanatory variables. The researcher introduced bank size as the moderating variable.

3.9.1 Financial deepening

Financial deepening is the capacity of financial institution to allow access of financial services efficiently (Ndege, 2012 It can be evaluated through alternative measures such as changes in money supply to gross domestic product, money supply to price index, proportion of commercial banks assets to central bank assets, number of bank branches, and proportion of commercial banks assets to its income. The current study utilised the ratio of credit extended to private sector to gross domestic product as the measure of financial deepening.

3.9.2 Financial Innovations Composite Index (FICI)

Composite index methodologies have evolved to meet a wide range of purposes and to inform particular decisions or decision-making processes (Kaufmann et al. 2010). In order to ascertain the summarized value for each of the innovations a composite index was computed to enable plot and regress the independent variable against dependent.

3.9.3 Mobile Phone banking

Mobile phone banking was classified into three components; investment in mobile phone banking, number of subscribers and number of transactions. An index was computed to enable plot and regress the independent variable against dependent.

$$FIII_{MB} = \left[\frac{\left(\frac{Invest.in\ Mobile\ phone\ banking}{\sum (Mobile\ phone\ components)}\right)^2 + \left(\frac{Number\ of\ subscribers}{\sum (Mobile\ phone\ components)}\right)^2 + \left(\frac{Number\ of\ transactions}{\sum (Mobile\ phone\ components)}\right)^2}{}\right] \quad \text{…..…….3.3}$$

3.9.4 ATM Banking

ATM banking was classified into three components namely; number of ATM cards issued, number of ATM machines and distribution criteria. An index was computed to enable plot and regress the independent variable against dependent.

$$FIII_{ATM} = \left| \frac{\left(\text{Number of ATM cards issued} \right)}{\sum (\text{ATM components})} \right|^2 + \left| \frac{\left(\text{Number of ATM machines} \right)}{\sum (\text{ATM components})} \right|^2 + \left| \frac{\left(\text{Distribution criteria} \right)}{\sum (\text{ATM components})} \right|^2 \quad \text{……..…….3.4}$$

3.9.5 Online Banking

Online banking was classified into three components namely; number of online subscribers, number of online transaction and amount of transaction. An index was computed to enable plot and regress the independent variable against dependent.

$$FII_{OB} = \left| \frac{\left(\text{Number of online subscribers} \right)}{\sum (\text{Online components})} \right|^2 + \left| \frac{\left(\text{Number of Online transactions} \right)}{\sum ((\text{Online components})} \right|^2 + \left| \frac{\left(\text{Amount of transaction} \right)}{\sum ((\text{Online components})} \right|^2 \quad \text{……3.5}$$

3.9.6 Agency Banking

Agency banking was classified into three components namely; number of operational agents, number of transactions and amount of transactions.

$$FII_{AB} = \left| \frac{\left(\frac{Number\ of\ agents}{\sum (Agency\ components)}\right)^2}{} + \left| \frac{\left(\frac{Number\ of\ transactions}{\sum ((Agency\ components)}\right)}{} \right|^2 + \left| \frac{\left(\frac{Amount\ of\ transactions}{\sum ((Agency\ components)}\right)^2}{} \right| \quad \text{…….....3.6}$$

3.10 Diagnostic Tests

Classical regression modelling is based on assumptions which are normality, multicollinearity, heteroscedasticity, autocorrelation.

3.10.1 Tests of Normality

Normality test can be tested graphically or statistically. Graphical methods include use of box plot, stem and leaf, QQ plots and PP plots. Statistical tests include Kolmogorov Smirnov, Jarque Berra amongst others. Normality assumes data is normal against non-normality. If p value is greater than 0.05, then we conclude that there is normality and no need for data transformation (Woodridge, 2012).

3.10.2 Stationarity Test

Panel data depicts both cross sectional and time series characteristics. Classical modelling assumes that the data is stationary and failure to fit regression on stationary data increases likelihood of fitting spurious model (Baltagi, 2005). Stationarity was tested using inverse chi squared, inverse normal, inverse logit and modified inverse chi-

squared. The null hypothesis for stationary tests assumed that the data was not stationary against an alternative that the data was stationary. It was rejected if p value was less than 0.05; in case it was accepted then lagging of non-stationary variable was appropriate prior to fitting the model.

3.10.3 Multicollinearity Tests

In regression analysis independent variables are assumed to be non-related. If independent variables are correlated, then there is need for model re-specification. Multicollinearity was tested through variance inflation factors and tolerance limits. If tolerance limits exceed 10 then there is multicollinearity and one of highly related variables ought to be dropped (Baltagi, 2005).

3.10.4 Test for Homoscedasticity

Regression analysis assumes that the error term has equal variation. The situation is examined through graphical methods and statistical tests. Breusch-Pagan test was applied to test for heteroscedasticity amongst error terms. Presence of non-uniform variance was indicated by p value less than 0.05. It may be corrected through use of robust standard errors or FGLS (Woodridge, 2012).

3.10.5 Auto-correlation Test

Classical regression modelling assumes that the error term is not correlated. Serial autocorrelation is mostly tested using Durbin Watson for time series data and likelihood ratio for panel data. Presence of serial correlation can be mitigated by fitting feasible generalized least squares (FGLS) (Woodridge, 2012).

3.10.6 Panel Granger Causality

Granger causality is adopted to evaluate interrelationship between independent and dependent variables (Baltagi, 2005). This study assumed that financial innovations had

causality with financial deepening of commercial banks in Kenya. Null hypothesis was rejected incase p value for respective variable was greater than 0.05.

3.10.7 Fixed Effects or Random Effects

Fixed effects model explain that the unobserved variables are allowed to have any associations whatsoever with the observed variables." Fixed effects models control for, or partial out, the effects of time-invariant variables with time-invariant effects. This is true whether the variable is explicitly measured or not. Exactly how they do so vary by the statistical technique being used. The optional appendix discusses these methods further. Unfortunately, the effects of time-invariant variables that are measured cannot be estimated.

Random Effects Models explain that the unobserved variables are assumed to be uncorrelated with (or, more strongly, statistically independent of) all the observed variables. RE models can be estimated via Generalized Least Squares (GLS). Here is an example of a random effects logistic regression model.

The choice of the exclusive model to fit is guided by Hausman test (Baltagi, 2005). The test assumes that the most appropriate model to fit is random effects as compared to fixed effects. Whenever the p value is less than 0.05, then there is enough evidence to warrant rejection of the null hypothesis and fitting of fixed effects otherwise fit random effects model.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

In this chapter findings and discussions of the study will be presented as per study objectives. The main objective of the study examined the relationship between financial innovations and financial deepening of commercial banks in Kenya. Secondary data for 36 commercial banks was gathered from annual banking supervision report for seven years. Natural logarithms of mobile, automated teller machine, online banking and agency banking were adopted as measures of banking financial innovations. Financial deepening was calculated as ratio of credit extended to private sector to GDP. Descriptive and inferential statistics were adopted for data analysis.

4.2 Descriptive Statistics

4.2.1 Descriptive Statistics for Commercial Banks in Kenya

Descriptive statistics adopted in the study included measures of central tendency and dispersion. Study findings in Table 4.1 revealed that average financial deepening was 13.39, with an average deviation of 13.72. There was wider variation in average financial deepening amongst banks as accounted by minimum of -28.58 and maximum of 60. It was not normally distributed since p value for Jarque Berra test was less than 0.05, which presented enough evidence to warrant rejection of the null hypothesis at 5 percent which indicated that data was normally distributed.

The average FICI Mobile banking innovation was 13.89 with minimum of 1.24 and maximum of 30.30, there was minimal variations on FICI Mobile banking innovations across banks as accounted for 5.07, this may be attributed by increased penetration of mobile telecommunication hence it can be easily incorporated as tool for provision of banking services. On average FICI ATM banking innovation was 16.26, there was

skewed adoption of FICI ATM banking innovation across banks with large banks executing their banking services through FICI ATM as compared to small ones. This was confirmed by non-normality of its adoption. The average online banking innovation was 17.87, with minimum of 1.54 and maximum of 34.45, further, it was not normally distributed as depicted by Jarque Berra p value less than 0.05. On average FICI Agency banking was 17.17 with maximum of 40.58 and minimum of 1.17. Amongst banking FICI Agency banking innovation had the highest standard deviation of 7.11, which manifested non-uniformity of agency banking transactions amongst commercial banks in Kenya.

These results concurred with Adreniran and Junaidu (2014), Adetoi (2011), Akram and Allam (2010), Hamilton et al. (2007) and Kinyanjui (2011) who reported commercial banks had incorporated financial innovations to aid in provision of banking services, minimize operational costs and diversify their portfolio of banking services. This is in line with Vision 2030 which calls for provision of the highest portion of non-banked population. Commendable development is notable through decline in non-banked over the last ten years though telecommunication is credited to it (FSD, 2013).

Table 4.1: Overall Descriptive Statistics for Commercial Banks in Kenya

	Financial Deepening	**FICI Mobile Banking**	**FICI ATM Banking**	**FICI Online Banking**	**FICI Agency Banking**	**Bank Size**
Mean	13.39	13.89	16.26	17.87	17.17	17.61
Median	12.25	13.04	17.35	21.24	19.35	17.37
Maximum	60.00	30.30	30.68	34.45	40.58	36.96
Minimum	-28.58	1.24	1.05	1.54	1.17	9.77
Std. Dev.	13.72	5.07	5.82	6.66	7.11	3.81
Skewness	0.52	0.51	-0.52	-0.83	-0.19	1.94
Kurtosis	4.77	4.27	3.87	2.98	3.95	10.61
Jarque-Bera	38.08	23.82	16.39	24.52	9.28	657.34
Probability	0.00	0.00	0.00	0.00	0.01	0.00
Sum	2891.74	2999.34	3512.49	3860.71	3707.64	3803.17
Sum Sq. Dev.	40479.39	5536.97	7270.09	9529.78	10874.15	3121.51
Observations	252	252	252	252	252	252

4.2.2 Descriptive Statistics for Mobile Phone Banking

Firstly, the study looked at the effects of mobile phone banking on financial deepening of commercial banks in Kenya. Mobile phone banking was classified into investment in mobile phone banking, number of subscribers and number of transaction. Investment in mobile phone banking comprised the total amount invested, number of subscribers comprised of total customers who have subscribed and number of transaction comprised of total transactions undertaken as a result of mobile phone use. As shown in Table 4.2, the mean investment in mobile phone was 5.07, with maximum of 30.91 and minimum of 1.01

Kenya National Bureau of Statistics, World Bank website, Central Bank of Kenya, published financial accounts statements of all the 43 commercial banking institutions in Kenya, and the Banking survey publications for a time scope ranging between 2013 to 2018

Number of subscribers had an average of 6.12 with maximum of 31.00 and standard deviation of 1.03. Number of transactions had an average of 4.13with a maximum of 31.39 and a minimum of 1.07. None of mobile phone banking attributes was normally distributed amongst commercial banks. There were wide variations of mobile phone adoption across commercial banks as to the observed by minimum, maximum and standard deviations.

For normal distribution with symmetrical distribution the study used skewness of zero and a typical value indicates values between -3 and +3 (Muigai & Muriithi, 2017). A negative value shows skewness to the left while the positive values show skewness to the right. Kurtosis is a measurement of the heaviness of the tails of a distribution. If kurtosis is equal to three and skewness is equal to zero, then distribution is normal. When kurtosis exceeds three then the distribution is thicker or heavier tails than the normal (Curran, West & Finch, 1996). As shown in the table, all the variables exhibited kurtosis of leptokurtic nature because all indexes of kurtosis coefficient were all

positive. The values of probability was 0.000 amongst all the components in the series showing model made use of in the study was good fit and there was expectation that every variable measured was anticipated to significantly have an impact on financial deepening of commercial banks in Kenyan. The researcher used large samples and transformed the variables to natural logarithm. These findings also supported Kefela (2011), Mwangi (2013), Adreniran (2014), Ngumi (2014) and Sathye (2015) who reported that financial innovations were adopted by commercial banks in Kenya to aid in provision of banking services. Increased access of banking is possible through technological innovation if alternative banking services are easier to use and are more secure as advocated for by technology advancement model.

Table 4.2: Descriptive Statistics for Mobile Phone Banking

	Investment in Mobile Phone banking	**Number of Subscribers**	**Number of Transactions**
Mean	5.07	6.12	4.13
Median	4.06	4.97	4.22
Maximum	30.91	31.00	31.39
Minimum	1.01	1.03	1.07
Std. Dev.	4.05	4.74	3.76
Skewness	1.05	0.76	2.56
Kurtosis	4.50	2.69	20.71
Jarque-Bera	176.76	42.32	3410.10
Probability	0.00	0.00	0.00
Sum	2563.10	3019.65	2113.46
Sum Sq. Dev.	9218.52	11425.11	2349.76
Observations	252	252	252

4.2.3 Descriptive Statistics for ATM banking

Secondly, the study analyzed effects of ATM banking on financial deepening of commercial banks in Kenya. ATM banking was operationalized as number of ATM cards issued, Number of ATM machines and distribution criteria nationwide. As shown in Table 4.3, number of ATM cards issued was 6.27, with a minimum of 1.64 and a maximum of 28.85. The average of the number of ATM machines was 4.12, with minimum of 1.01 and maximum of 25.31. distribution criteria nationwide averaged at 4.16, with standard deviation of 3.76 and a minimum of 1.05 and maximum of 27.69. Due to obtainability of information sought, 252 observations were generated for ATM variable. None of ATM variables had Jarque-Berra coefficient greater than 0.05, hence all were not normally distributed hence justifying use of either FGLS or robust standard errors. Moreover, elements of error term were either more or less peaked than that exhibited by a normal distribution.

As depicted in the table, all the variables exhibited kurtosis of leptokurtic nature in nature for the reason being all the indexes of kurtosis coefficient were all positive. The values of probability was 0.000 amongst all the components in the series showing model made use of in the study was good fit and there was expectation that every variable concerning ATM measured was anticipated to significantly have an impact on financial deepening of commercial banks in Kenya.

Table 4.3: Descriptive Statistics for ATM Banking

	Number of ATM cards issued	Number of ATM machines	Distribution criteria nationwide
Mean	6.27	4.12	4.16
Median	5.86	3.47	3.12
Maximum	28.85	25.31	27.69
Minimum	1.64	1.01	1.05
Std. Dev.	3.75	2.74	3.76
Skewness	0.84	0.76	0.56
Kurtosis	4.57	3.64	3.91
Jarque-Bera	283.16	73.62	137.15
Probability	0.00	0.00	0.00
Sum	1954.17	2121.25	1949.56
Sum Sq. Dev.	2894.42	8443.17	6346.15
Observations	252	252	252

4.2.4 Descriptive Statistics for Online Banking

Thirdly, the study determined effects of online banking on commercial banking financial deepening in Kenya. Online banking was operationalized as number of online subscribers, number of online transaction and call and amount of transactions. As shown in Table 4.4, average number of online subscribers was 8.34, followed by 8.22 number of online transaction and 7.96 for amount of transactions. None of online banking components was normally distributed as indicated by p value < 0.05 for Jarque-Berra coefficients. Number of online subscribers across banks differed most since it had the highest standard deviations and the least variation was in amount of transactions.

As it was highlighted by Muigai and Muriithi, (2017), for normal distribution with symmetrical distribution the study applied skewness of zero (0) and a typical value indicates values between -3 and +3. A negative value shows skewness to the left while the positive values show skewness to the right. Kurtosis is a measurement of the heaviness of the tails of a distribution. If kurtosis is equal to three and skewness is equal to zero, then distribution is normal. When kurtosis exceeds three then the distribution is thicker or heavier tails than the normal (Curran, West & Finch, 1996).

As presented in the table, all the variables except saving deposits exhibited kurtosis of leptokurtic nature all the indexes of kurtosis coefficient were all positive and above positive three. The values of probability were 0.000 amongst all the components in the series showing model made use of the study was good fit and there was expectation that every attribute to online banking was anticipated to significantly have an impact on financial deepening of commercial banks in Kenya.

Table 4.4: Descriptive Statistics for Online Banking

	Number of Online Subscribers	Number of Online Transactions	Amount of Transactions
Mean	8.34	8.22	7.96
Median	6.46	7.35	6.91
Maximum	30.79	31.51	29.85
Minimum	1.89	1.76	1.38
Std. Dev.	5.23	4.29	4.44
Skewness	0.12	0.35	0.24
Kurtosis	3.25	3.14	3.54
Jarque-Bera	28.75	141.32	249.85
Probability	0.00	0.00	0.00
Sum	2328.41	2250.14	2273.32
Sum Sq. Dev.	6946.62	2877.48	4842.34
Observations	252	252	252

4.2.5 Descriptive Statistics for Agency Banking

The fourth objective examined effects of agency banking on financial deepening of commercial banks in Kenya. Agency banking was operationalized as number of agents, number of transactions through agents and amount of transactions. As shown in Table 4.5 number of transactions through agents average of 7.83, followed by placed 7.25 average on number of agents and 6.94 on amount of transactions. The widest variation in agency banking was in number of transactions which had standard deviation of 4.83 meaning banks varied in a number of transactions as a result of using online banking and other None of these components types was normally distributed amongst banks as indicated Jarque-Berra coefficients with p values greater than 0.05.

The probability value was 0.000 amongst all the components in the series showing model made use of in the study was good fit and there was expectation that every variable pertaining investment avenue measured was anticipated to significantly have an impact on financial deepening of commercial banks in Kenyan. Since only 18 commercial banks had operational agents, the study used point of sale in order for the analysis to be conclusive. As depicted in the table, Kurtosis for all investment agency banking variables was exhibited kurtosis of leptokurtic nature in nature for the reason being al the indexes of kurtosis coefficient were above three. These findings supported Chipeta and Muthinja (2018) and agency theory which minimized agency and monitoring costs since auditing time and costs may be minimized through use of search engines instead of manual process.

Table 4.5: Descriptive Statistics for Agency Banking

	Number of Agents	Number of transactions	Amount of Transactions
Mean	7.25	7.83	6.94
Median	5.87	6.05	5.19
Maximum	31.27	30.46	31.07
Minimum	1.17	1.21	2.39
Std. Dev.	4.76	4.83	4.73
Skewness	0.02	0.18	0.64
Kurtosis	3.86	6.23	3.04
Jarque-Bera	33.91	1137.23	124.67
Probability	0.00	0.00	0.00
Sum	2162.31	2050.34	2077.58
Sum Sq. Dev.	1666.43	2432.26	6223.15
Observations	252	252	252

4.3 Panel Data Diagnostic Tests

Before fitting regression model, it was necessary to carry out diagnostic tests to minimize likelihood of fitting spurious regression model. Unit root was tested using inverse chi squared, inverse normal, inverse logit and modified inverse chi-squared. Multicollinearity was tested using variance inflation factors and tolerance limits, heteroskedasticty was tested through use of Breusch-Pagan test, serial correlation was tested using Woodridge test and Hausman test was applied to ease choice between random and fixed effects model.

4.3.1 Panel Unit Root for Commercial Banks in Kenya

The null hypothesis for unit roots stated that there was unit root (the data was not stationary). Financial deepening, FII Mobile banking, FII ATM banking, FII Online banking, FII Agency banking and bank size were stationary since all p values were less than 0.05.

Study findings in Table 4.6 revealed that there was enough evidence to warrant rejection of the null hypothesis at 5 percent level of significance since all p values were less than 0.05. Thus, we conclude that financial deepening; mobile banking, ATM banking, online banking, agency banking and bank size of commercial banks in Kenya were stationary at levels. Consequently, regression modelling without lagging was fitted with no likelihood of fitting spurious model. These findings are in tandem with Githira, Muturi and Nasieku, (2019b); Muchiri, (2016) who found stationarity at levels while examining influence of firm financial characteristics and financial structure in EASE respectively. The findings refuted Ochieng, Olweny, Oluoch and Ochere (2019a) who found non stationarity of study variables.

Table 4.6: Panel Unit Root for Commercial Banks in Kenya

Variable	Test	Statistic	P value
Financial deepening	Inverse Chi-squared	256.487	0.0000
	Inverse Normal	-7.9537	0.0000
	Inverse logit	-10.058	0.0000
	Modified Inverse chi-squared	15.3739	0.0000
FICI Mobile banking	Inverse Chi-squared	345.0278	0.0000
	Inverse Normal	-6.6734	0.0000
	Inverse logit	-12.9071	0.0000
	Modified Inverse chi-squared	22.7523	0.0000
FICI ATM banking	Inverse Chi-squared	343.7775	0.0000
	Inverse Normal	-7.9477	0.0000
	Inverse logit	-14.2693	0.0000
	Modified Inverse chi-squared	22.6481	0.0000
FICI Online banking	Inverse Chi-squared	409.3941	0.0000
	Inverse Normal	-8.112	0.0000
	Inverse logit	-16.3711	0.0000
	Modified Inverse chi-squared	28.1162	0.0000
FICI Agency banking	Inverse Chi-squared	373.6859	0.0000
	Inverse Normal	-7.6865	0.0000
	Inverse logit	-14.6215	0.0000
	Modified Inverse chi-squared	25.1405	0.0000
Bank size	Inverse Chi-squared	403.088	0.0000
	Inverse Normal	-8.1924	0.0000
	Inverse logit	-16.1729	0.0000
	Modified Inverse chi-squared	27.5907	0.0000

4.3.2 Panel Unit Root for Mobile Phone Banking

The null hypothesis for unit roots stated that there was unit root (the data was not stationary). Study findings in Table 4.7 revealed that there was enough evidence to warrant rejection of the null hypothesis at 5 percent level of significance since all p values were less than 0.05. Thus, we conclude that investment in mobile phone banking, number of subscribers and number of transactions were stationary at levels. Consequently, regression modelling without lagging was fitted with no likelihood of fitting spurious model. There was no need for lagging prior to fitting regression model since the findings concurred with Tarus and Omandi (2013) and Githira et al., (2019b) who found panel data of listed companies to be stationary at levels.

Table 4.7: Panel Unit Root for Mobile Phone Banking

Variable	Test	Statistic	P value
Investment in Mobile phone banking			
	Inverse Chi-squared	64.0374	0.0000
	Inverse Normal	-4.8448	0.0000
	Inverse logit	-5.3217	0.0000
	Modified Inverse chi-squared	6.9629	0.0000
Number of Subscribers	Inverse Chi-squared	107.0105	0.0000
	Inverse Normal	-3.5206	0.0000
	Inverse logit	-7.7561	0.0000
	Modified Inverse chi-squared	13.7576	0.0000
Number of Transacttions	Inverse Chi-squared	106.3522	0.0000
	Inverse Normal	-4.1693	0.0000

4.3.3 Panel Unit Root for ATM Banking

The null hypothesis for unit roots stated that there was unit root (the data was not stationary). Study findings in Table 4.8 revealed that there was enough evidence to warrant rejection of the null hypothesis at 5 percent level of significance since all p values were less than 0.05. Thus, we conclude that number of ATM cards issued, number of ATM machines and Distribution criteria nationwide were stationary at levels. Consequently, regression modelling without lagging was fitted with no likelihood of fitting spurious model. These results agreed with Wanjau, Muturi and Wanjau (2018) who found panel data from listed companies in East Africa securities exchanges to be stationary at level.

Table 4.8: Panel Unit Root for ATM Banking

Variable	Test	Statistic	P value
Number of ATM Cards Issued	Inverse Chi-squared	192.4497	0.0000
	Inverse Normal	-6.3483	0.0000
	Inverse logit	-8.5659	0.0000
	Modified Inverse chi-squared	13.7722	0.0000
Number of ATM Machines	Inverse Chi-squared	238.0173	0.0000
	Inverse Normal	-5.6692	0.0000
	Inverse logit	-10.4210	0.0000
	Modified Inverse chi-squared	18.2405	0.0000
Distribution Criteria Nationwide	Inverse Chi-squared	237.4253	0.0000
	Inverse Normal	-6.4872	0.0000
	Inverse logit	-11.4934	0.0000
	Modified Inverse chi-squared	18.1824	0.0000

4.3.4 Panel Unit Root for Online Banking

The null hypothesis for unit roots stated that there was unit root (the data was not stationary). Study findings in Table 4.9 revealed that there was enough evidence to warrant rejection of the null hypothesis at 5 percent level of significance since all p values were less than 0.05. Thus, we conclude that number of online subscribers, number of online transactions and amount of transactions were stationary at levels. Consequently, regression modelling without lagging was fitted with no likelihood of fitting spurious model.

Table 4.9: Panel Unit Root for Online Banking

Variable	Test	Statistic	P value
Number of online subscribers	Inverse Chi-squared	74.2421	0.0000
	Inverse Normal	-6.5959	0.0000
	Inverse logit	-8.4575	0.0000
	Modified Inverse chi-squared	12.7051	0.0000
Number of online transactions	Inverse Chi-squared	63.0369	0.0000
	Inverse Normal	-5.8388	0.0000
	Inverse logit	-7.1434	0.0000
	Modified Inverse chi-squared	10.4179	0.0000
Amount of Transaction	Inverse Chi-squared	71.5415	0.0000
	Inverse Normal	-6.6518	0.0000
	Inverse logit	-8.1557	0.0000
	Modified Inverse chi-squared	12.1538	0.0000

4.3.5 Panel Unit Root for Agency Banking

The null hypothesis for unit roots stated that there was unit root (the data was not stationary). Study findings in Table 4.10 revealed that there was enough evidence to warrant rejection of the null hypothesis at 5 percent level of significance since all p values were less than 0.05. Thus, we conclude that number of agents, number of transactions and amount of transactions were stationary at levels. Consequently, regression modelling without lagging was fitted with no likelihood of fitting spurious model.

Table 4.10: Panel Root for Agency Banking

Variable	Test	Statistic	P value
Number of Agents	Inverse Chi-squared	59.4853	0.0000
	Inverse Normal	-5.1963	0.0000
	Inverse logit	-6.6686	0.0000
	Modified Inverse chi-squared	9.9629	0.0000
Number of Transactions	Inverse Chi-squared	117.909	0.0000
	Inverse Normal	-6.4885	0.0000
	Inverse logit	-12.808	0.0000
	Modified Inverse chi-squared	21.6186	0.0000
Amount of Transactions	Inverse Chi-squared	80.985	0.0000
	Inverse Normal	-5.3816	0.0000
	Inverse logit	-8.8809	0.0000
	Modified Inverse chi-squared	14.0815	0.0000
	Modified Inverse chi-squared	4.3327	0.0000

4.4 Multi-Collinearity Test

Classical regression modeling is anchored on assumption that there is no collinearity amongst independent variables. Multi-collinearity was examined through use of variance inflation factors and tolerance limits. The cut off rule was that there is no collinearity if VIF was under 10 or tolerance limits were above 0.1. This was in line with Baltagi (2005) recommendations.

4.4.1 Multicollinearity Test for Commercial Banks in Kenya

Classical modelling assumes none of independent variable is highly correlated with each other. Variance inflation factors (VIFs) and tolerance were adopted to test for multicollinearity

According to Woodridge (2012) independent variables are not collinear if none of its tolerance exceed 10 or tolerance limit is less than 0.1. As shown in Table 4.11, none of VIFs exceeded 10 or tolerance limits was less than 0.1. Consequently, there was no collinearity amongst independent variables and FICI Mobile banking, FICI ATM banking, FICI Online banking and FICI agency banking were jointly fitted to examine their relationship with financial deepening of commercial banks in Kenya.

Table 4.11: Multicollinearity Test for Commercial Banks in Kenya

Dependent Variable	Collinearity Statistics	Tolerance	VIF
Financial Deepening	FICI Mobile Banking	0.415	2.410
	FICI ATM Banking	0.247	4.050
	FICI Online banking	0.213	4.697
	FICI Agency Banking	0.133	7.533

4.4.2 Multicollinearity Test for Mobile Phone Banking

As shown in Table 4.12, it supported that no collinearity amongst investment in mobile phone banking, number of subscribers and number of transactions when they were predicting financial deepening was observed. Additionally, they were jointly fitted in the model to pursue effects of mobile phone banking on financial deepening of commercial banks in Kenya. These findings concurred with Mulwa (2018) who investigated sectoral credit and financial performance of commercial banks in East Africa and found absence of multicollinearity amongst independent variables. The conclusion can also be achieved by applying the findings by Sporta (2018) that a VIF with a value of 1 imply that there existed low level of collinearity between the independent variables, whereas a result of between 1 and 5 imply existence of moderate collinearity while a value in excess of 5 imply that independent variables were highly multi-correlated. Therefor e we conclude that there is moderate multi-collinearity among the variables since the mean VIF for the model was close to 1.

Table 4.12: Multicollinearity Test for Mobile Phone Banking

Dependent Variable	Collinearity Statistics	VIF	Tolerance
Financial Deepening	Investment in Mobile Phone banking	1.59	0.63
	Number of subscribers	2.77	0.71
	Number of Transactions	2.09	0.48

4.4.3 Multicollinearity Test for ATM Banking

Table 4.13 shows no collinearity amongst number of ATM cards issued, number of ATM machines and distribution criteria nationwide when they were predicting financial deepening. All the tolerance limits were above 0.1 and VIF was observed to be less than 10. However, using VIF it was concluded that there is moderate multi-collinearity among the variables since the mean VIF for the model was close to 1. This

depicted absence of multi-collinearity and consequently, they were jointly fitted in the model to scrutinize the effect of ATM banking on financial deepening of commercial banks in Kenya. These findings also agreed with Sporta (2018) and Muriithi (2016).

Table 4.13: Multicollinearity Test for ATM Banking

Dependent Variable	Collinearity Statistics	VIF	Tolerance
Financial Deepening	Number of ATM cards issued	2.79	0.7579
	Number of ATM machines	4.34	0.6306
	Distribution criteria nationwide	6.23	0.4606

4.4.5 Multicollinearity Test for Online Banking

Table 4.14 shows no collinearity amongst number of online subscribers, number of online transactions and amount of transactions when they were predicting financial deepening. All the tolerance limits were above 0.1 and VIF was observed to be less than 10. The tolerance limit was observed to be less than 1. This depicted absence of multi-collinearity and consequently, they were jointly fitted in the model to scrutinize the effect of Online banking on financial deepening of commercial banks in Kenya.

Table 4.14: Multicollinearity Test for Online Banking

Dependent Variable	Collinearity Statistics	VIF	Tolerance
Financial Deepening	Number of Online Subscribers	8.87	0.1127
	Number of Online transactions	5.44	0.1837
	Amount of Transaction	4.61	0.2168

4.4.6 Multicollinearity Test for Agency Banking

Table 4.15 shows no collinearity amongst number of agents, number of transactions and amount of transactions when they were predicting financial deepening. All the tolerance limits were above 0.1 and VIF was observed to be less than 10. The tolerance limit was observed to be less than 1. This depicted absence of multi-collinearity and consequently, they were jointly fitted in the model to scrutinize the effect of agency banking on financial deepening of commercial banks in Kenya.

Table 4.15: Multicollinearity Test for Agency Banking

Dependent Vriable	Collinearity Statistics	VIF	Tolerance
Financial Deepening	Number of Agents	8.61	0.1161
	Number of Transactions	4.70	0.2127
	Amount of Transaction	3.75	0.2664

4.5 Correlation Analysis

Coefficient of Pearson correlation was adopted to evaluate strength of the effect of financial innovation and financial deepening of commercial banks in Kenya. It was selected since all variables were in the same scale. This was in concurrence with Wanjau et al. (2018), Githira et al. (2019), Ochieng et al. (2019) who adopted it to evaluate nexus of financial transparency and financial performance, influence of firm financial characteristics and stock return and effects of equity portfolio flows on stock market volatility respectively.

4.5.1 Correlation Analysis for Commercial Banks in Kenya

Product moment Pearson correlation coefficient was fitted to examine the strength of relationship between financial innovations and financial deepening of commercial banks in Kenya. Results shown in Table 4.16, depicted strong positive significant relationship between financial deepening and mobile banking in Kenya (rho = 0.7871, p value <0.05). Secondly, there was strong positive significant relationship between ATM banking and financial deepening of commercial banks in Kenya (rho = 0.8002, p value <0.05). Thirdly, there was strong positive significant relationship between online banking and financial deepening (rho = 0.7795, p value <0.05). Fourthly, there was strong positive significant relationship between agency banking and financial deepening (rho = 0.8506, p value <0.05). Fifthly, there was strong positive significant relationship between bank size and financial deepening (rho = 0.7772, p value <0.05).

These findings agreed with Ching et al. (2013) who reported strong positive relationship between mobile banking and financial inclusion in Malaysia. Also, they agreed with Too et al., (2016) who reported positive effect of financial innovation on financial access in Kapsabet. Moreover, the study concurred with Sathye (2015) and Hasan et al., (2012) reported positive contribution of internet banking on banking market penetration in Italy.

Table 4.16: Correlation Analysis for Commercial Banks in Kenya

	Financial Deepening	FICI Mobile Banking	FICI ATM Banking	FICI Online Banking	FICI Agency Banking	Bank size
Financial Deepening	1					
FICI Mobile Banking	0.7871	1				
	0.0000	-----				
FICI ATM Banking	0.8002	0.2058	1			
	0.0000	0.0000	-----			
FICI Online Banking	0.7795	0.2643	0.3787	1		
	0.0000	0.0000	0.0000	-----		
FICI Agency Banking	0.8506	0.3784	0.5389	0.4882	1	
	0.0000	0.0000	0.0000	0.0000	-----	
Bank Size	0.7772	0.0726	0.4630	0.5975	0.3732	1
	0.0000	0.0000	0.0000	0.0000	0.0000	-----

4.5.2 Correlation Analysis for Mobile Phone Banking

Correlation analysis on the effect of mobile phone banking and financial deepening of commercial banks in Kenya are presented in Table 4.17. It was found that Investment in mobile phone banking had strong positive relationship with financial deepening (rho = 0.7632, p value <0.05). Secondly, number of subscribers had strong positive relationship with financial deepening amongst commercial banks (rho = 0.7260, p value <0.05). Thirdly, there was strong positive and significant relationship between number of

transactions and financial deepening of commercial banks (rho = 0.6985, p value <0.05). These findings disagreed with Hasan et al., (2012) who reported inverse effect of internet banking on banking penetration.

Table 4.17: Correlation Analysis for Mobile Phone Banking

	Financial Deepening	Investment in Mobile Phone banking	Number of Subscribers	Number of transactions
Financial Deepening	1			
Investment in Mobile Phone banking	0.7632	1		
	0.0000	-----		
Number of Subscribers	0.7260	0.5500	1	
	0.0000	0.0000	-----	
Number of transactions	0.6985	0.4575	0.5684	1
	0.0000	0.0002	0.0000	-----

4.5.3 Correlation Analysis for ATM Banking

Correlation analysis on the effect between ATM banking and financial deepening of commercial banks in Kenya are presented in Table 4.18. It was found that number of ATM cards issued had strong positive relationship with financial deepening of commercial banks (rho = 0.799, p value <0.05). Secondly, number of ATM machines had strong positive relationship with financial deepening amongst commercial banks (rho = 0.813, p value <0.05). Thirdly, there was strong positive and significant relationship between distribution criteria nationwide and financial deepening of commercial banks (rho = 0.792, p value <0.05). They concurred with Sreesha (2014)

who argued that operating efficiency is achieved through financial innovation and firm size. These results supported innovations diffusion theory since technological adoption had necessitated commercial banks capacity to serve non-banked population.

Table 4.18: Correlation Analysis for ATM Banking

	Financial Deepening	Number of ATM cards issued	Number of ATM Machines	Distribution criteria nationwide
Financial Deepening	1			
Number of ATM cards issued	0.799	1		
	0.000	-----		
Number of ATM Machines	0.813	0.282	1	
	0.000	0.000	-----	
Distribution criteria nationwide	0.792	0.568	0.112	1
	0.000	0.000	0.000	-----

4.5.4 Correlation Analysis for Online Banking

Results shown in Table 4.19 revealed that online banking had positive and significant relationship with financial deepening of commercial banks in Kenya (rho = 0.7846, p value <0.05). Secondly, there was positive and significant relationship between number of online subscribers and financial deepening of commercial banks in Kenya (rho =

0.8122, p value <0.05). Thirdly, there was positive and significant relationship between number of online transaction and financial deepening of commercial banks (rho = 0.7845, p value <0.05). Fourthly, amount of transaction had positive and significant relationship with financial deepening of commercial banks in Kenya (rho = 0.8142, p value <0.05). These findings disagreed with Hasan et al., (2012) who reported inverse effect of internet banking on banking penetration.

Table 4.19: Correlation Analysis for Online Banking

	Financial Deepening	**Number of subscribers**	**Number of online transaction**	**Amount of transactions**
Financial Deepening	1			
Number of subscribers	0.7846	1		
	0.0000	-----		
Number of online transaction	0.8122	0.4559	1	
	0.0000	0.0000	-----	
Amount of transactions	0.7845	0.6154	0.5010	1
	0.0000	0.0000	0.0000	-----

4.5.5 Correlation Analysis for Agency Banking

Results shown in Table 4.20 revealed that there was positive and significant relationship between agency banking and financial deepening of commercial banks in Kenya (rho = 0.7966, p value <0.05). Secondly, there was positive and significant relationship between number of agents and financial deepening of commercial banks in Kenya (rho =

0.7855, p value <0.05). Thirdly, number of transactions had positive and significant relationship with financial deepening of commercial banks in Kenya (rho = 0.7743, p value <0.05). Fourthly, amount of transactions had positive and significant effect with financial deepening of commercial banks in Kenya (rho = 0.8892, p value <0.05). The study concurred with Kingori and Gekara (2015) and Mbugua and Omagwa (2017) who reported positive and significant relationship between agency banking and market penetration of commercial banks. These results supported innovations diffusion theory since adoption of technology has trickling down effect on financial deepening.

Table 4.20: Correlation Analysis for Agency Banking

	Financial Deepening	**Number of agents**	**Number of transactions**	**Amount of transaction s**
Financial Deepening	1			
Number of agents	0.7966	1		
	0.0000	-----		
Number of transactions	0.7855	0.3350	1	
	0.0000	0.0000	-----	
Amount of transactions	0.7743	0.3633	0.3779	1
	0.0000	0.0000	0.0000	-----

4.6 Panel Heteroskedasticity Test

Regression analysis assumes that there is uniform variance of the error terms. This was tested using likelihood ratio test proposed by Poi and Wiggins (2001). Its null

hypothesis stated that the data was homoskedastic against an alternative that the data was heteroskedastic.

4.6.1 Panel Heteroskedasticity for Commercial Banks in Kenya

Classical modelling assumes uniformity of error terms amongst variables under examination (Baltagi, 2005). Even if failure to meet this condition has no likelihood of yielding biased findings, they have tendency to increase likelihood of rejecting null hypothesis due to decreased t statistics and increased standard errors. Breusch Pagan was applied to test for heteroskedasticty. In this test, null hypothesis stated that there is uniform variance across error term. Results in Table 4.21 had p value < 0.05, for non-moderated and moderated models respectively revealed that there was enough evidence to warrant rejection of the null hypothesis and conclusion that the data was not homoscedastic. This was solved through use of robust standard errors (Githira, Muturi & Nasieku, 2019a).

Table 4.21: Panel Heteroskedasticty for Commercial Banks in Kenya

	Dependent Variable	Model	χ^2–Value	P value
F	Financial Deepening	Without Moderation	313.71	0.0000
		With Moderation	1117.91	0.0000

4.6.2 Panel Heteroskedasticity for Mobile Phone Banking

Results in Table 4.22 show existence of adequate confirmation to support non-acceptance confirmation to support non-acceptance of H_0 and infer nonexistence of uniformity of variance across the error terms and the most proper model to be fitted was fixed generalized least squares model or fit regression model having robust standard errors. Hence, regression models with robust standard errors were adopted by the

researcher to look into the effect of mobile phone banking and financial deepening of commercial banks in Kenya. These findings were also in conformity with Muigai, (2016) who stated that heteroscedasticity existed when the null hypothesis of constant variance was rejected. Heteroscedasticity exists when 'prop>chi2' is less than 5 percent significance level else homoscedasticity. The violations of the fundamental regression assumptions had to be corrected by applying robust standard errors instead of the least ordinary square method or generalized least squares (GLS) estimation method.

Table 4.22: Panel Heteroskedasticty for Mobile Phone Banking

	Dependent Variable	χ^2–Value	P value
F	Financial Deepening	100.58	0.0000

4.6.3 Panel Heteroskedasticity for ATM banking

Results in Table 4.23 show existence of adequate confirmation to support non-acceptance confirmation to support non-acceptance of H_0 and infer nonexistence of uniformity of variance across the error terms and the most proper model to be fitted was fixed generalized least squares model or fit regression model having robust standard errors. Hence, regression models with robust standard errors were adopted by the researcher to look into the effect of ATM banking and financial deepening of commercial banks in Kenya. These findings were also in conformity with Muigai, (2016) who stated that heteroscedasticity existed when the null hypothesis of constant variance was rejected. Heteroscedasticity exists when 'prop>chi2' is less than 5 percent significance level else homoscedasticity. The violations of the fundamental regression assumptions had to be corrected by applying robust standard errors instead of the least ordinary square method or generalized least squares (GLS) estimation method.

Table 4.23: Panel Heteroskedasticty for ATM Banking

Dependent Variable	χ^2–Value	P value
FFinancial Deepening	1111.24	0.00

4.6.4 Panel Heteroskedasticity for Online banking

Results in Table 4.24 show existence of adequate confirmation to support non-acceptance confirmation to support non-acceptance of H_0 and infer nonexistence of uniformity of variance across the error terms and the most proper model to be fitted was fixed generalized least squares model or fit regression model having robust standard errors. Hence, regression models with robust standard errors were adopted by the researcher to look into the effect of ATM banking and financial deepening of commercial banks in Kenya. These findings were also in conformity with Muigai, (2016) who stated that heteroscedasticity existed when the null hypothesis of constant variance was rejected. Heteroscedasticity exists when 'prop>chi2' is less than 5 percent significance level else homoscedasticity. The violations of the fundamental regression assumptions had to be corrected by applying robust standard errors instead of the least ordinary square method or generalized least squares (GLS) estimation method.

Table 4.24: Panel Heteroskedasticty for Online Banking

Dependent Variable	χ^2–Value	P value
F Financial Deepening	1.04	0.00

4.6.5 Panel Heteroskedasticity for Agency Banking

Results in Table 4.25 show existence of adequate confirmation to support non-acceptance confirmation to support non-acceptance of H_0 and infer nonexistence of uniformity of variance across the error terms and the most proper model to be fitted was fixed generalized least squares model or fit regression model having robust standard errors. Hence, regression models with robust standard errors were adopted by the researcher to look into the effect of agency banking and financial deepening of commercial banks in Kenya. These findings were also in conformity with Muigai, (2016) who stated that heteroscedasticity existed when the null hypothesis of constant variance was rejected. Heteroscedasticity exists when 'prop>chi2' is less than 5 percent significance level else homoscedasticity. The violations of the fundamental regression assumptions had to be corrected by applying robust standard errors instead of the least ordinary square method or generalized least squares (GLS) estimation method.

Table 4.25: Panel Heteroskedasticty for Agency Banking

Dependent Variable	χ^2–Value	P value
FFinancial Deepening	11.99	0.00

4.7 Panel Serial Autocorrelation Test

Classical regression analysis undertakes that there is nonexistence of serial autocorrelation amongst the error terms. This was tested using Woodridge serial correlation tests which hypothesis that there is no serial correlation as opposed to an alternative of serial correlation. If p-value > 0.05, then, there is no presence of serial correlation otherwise serial correlation present. Presence of serial correlation is alleviated by use of fixed generalized least squares model or regressions with robust standard errors.

4.7.1 Panel Serial Correlation for Commercial Banks in Kenya

Classical modelling also assumes that error terms are not serially correlated. This was examined through Woodridge test. The null hypothesis is depicted through high coefficient of determinations and small standard errors. According to Woodridge (2012) presence of first order serial correlation is managed through use of fixed generalized least squares. As shown in Table 4.26, p values for moderated and non-moderated models were greater than 0.05, which depicted first order serial correlation was absent.

Table 4.26: Panel Serial Correlation for Commercial Banks in Kenya

Model	F–Value	P value
Without Moderation	0.312	0.562
With Moderation	0.526	0.239

4.7.2 Panel Serial Correlation for Mobile Phone Banking

As presented in Table 4.27, p value is greater than 0.05 which indicates absence of first order serial correlation, thus no need to fit FGLS. These results agreed with (Wanjau, Muturi & Ngumi, 2018) who reported absence of first order serial correlation amongst listed companies in East Africa securities exchange. They contrasted (Muchiri, Muturi & Ngumi, 2016) who reported presence of first order correlation on their examination on the effect of financial structure on financial performance of listed companies in East Africa Securities Exchanges.

Table 4.27: Panel Serial Correlation for Mobile Phone Banking

Dependent Variable	F–Value	P value
Financial Deepening	0.868	0.756

4.7.3 Panel Serial Correlation for ATM Banking

As presented in Table 4.28, p value is greater than 0.05 which indicates absence of first order serial correlation, thus no need to fit FGLS. These results agreed with (Wanjau, Muturi & Ngumi, 2018) who reported absence of first order serial correlation amongst listed companies in East Africa securities exchange. They contrasted (Muchiri, Muturi & Ngumi, 2016) who reported presence of first order correlation on their examination on the effect of financial structure on financial performance of listed companies in East Africa Securities Exchanges.

Table 4.28: Panel Serial Correlation for ATM Banking

Dependent Variable	F–Value	P value
Financial deepening	0.723	0.653

4.7.4 Panel Serial Correlation for Online Banking

As shown in Table 4.29, p value is greater than 0.05 which indicates absence of first order serial correlation, thus no need to fit FGLS. These results agreed with (Wanjau, Muturi & Ngumi, 2018) who reported absence of first order serial correlation amongst listed companies in East Africa securities exchange.

Table 4.29: Panel Serial Correlation for Online Banking

Dependent Variable	F–Value	P value
Financial deepening	0.712	0.4373

4.7.5 Panel Serial Correlation for Agency Banking

First order serial correlation test as shown in Table 4.29, had p value greater than 0.05 which indicated absence of first order serial correlation, thus no need to fit FGLS. These results agreed with (Wanjau, Muturi & Ngumi, 2018) who reported absence of first order serial correlation amongst listed companies in East Africa securities exchange. They contrasted (Muchiri, Muturi & Ngumi, 2016) who reported presence of first order correlation on their examination on the effect of financial structure on financial performance of listed companies in East Africa Securities Exchanges.

Table 4.30: Panel Serial Correlation for Agency Banking

Dependent Variable	F–Value	P value
Financial Deepening	10.737	0.0220

4.8 Panel Granger Causality Test

Granger causality was adopted to evaluate causality between independent and dependent variables in the study. The H_0 highlighted absence of causality against an alternative of presence of causality. The H_0 was rejected if p value was less than 0.05 and it was deducted that there is causality which was bidirectional or unidirectional.

4.8.1 Panel Granger Causality Test for Commercial Banks in Kenya

Granger causality was applied to evaluate causality between financial innovations and financial deepening of commercial banks in Kenya. Results shown in Table 4.31, indicated that there was no causality between FICI Mobile banking and financial deepening, FICI ATM banking and financial deepening, FICI Online banking and financial deepening, FICI Agency banking and financial deepening. Further there was no causality between FICI Mobile banking, FICI ATM banking, FICI Online banking and

FICI Agency banking respectively. Moreover, bank size had no causality with financial deepening. These findings concurred with Muchiri et al. (2016) who reported no causality between financial structure and financial performance. They refuted Githira et al., (2019b) who reported causality between some firm financial characteristics and stock return of listed companies in Nairobi securities exchange.

Table 4.31: Panel Granger Causality Test for Commercial Banks in Kenya

Null Hypothesis:	F-Statistic	Prob.
FICI Mobile banking does not Granger Cause financial deepening	0.24215	0.7853
Financial deepening does not Granger Cause FICI mobile banking	1.09972	0.3358
FICI ATM banking does not Granger Cause financial deepening	0.34995	0.7053
Financial deepening does not Granger Cause FICI ATM banking	0.69474	0.5009
FICI Online banking does not Granger Cause financial deepening	1.02138	0.3628
Financial Deepening does not Granger Cause FICI online banking	0.00183	0.9982
FICI Agency banking does not Granger cause financial deepening	0.00741	0.9926
Financial deepening does not Granger Cause FICI agency banking	0.39346	0.6755
Bank size does not Granger Cause financial deepening	1.94023	0.1475
Financial deepening does not Granger Cause bank size	1.11063	0.3323
FICI ATM banking does not Granger Cause FICI mobile banking	0.99986	0.3706
FICI Mobile banking does not Granger Cause FICI ATM banking	0.27055	0.7634
FICI Online banking does not Granger Cause FICI mobile banking	3.08106	0.0491
FICI Mobile banking does not Granger Cause FICI online banking	0.09863	0.9061
FICI Agency banking does not Granger Cause FICI mobile banking	1.9578	0.145
FICI Mobile banking does not Granger Cause FICI agency banking	0.22402	0.7996
Bank size does not Granger Cause mobile banking	5.95866	0.0033
FICI Mobile banking does not Granger Cause bank size	0.36554	0.6945
FICI Online banking does not Granger Cause FICI ATM banking	1.77281	0.1737
FICI ATM banking does not Granger Cause FICI online banking	1.20486	0.3028
FICI Agency banking does not Granger Cause FICI ATM banking	1.81136	0.1673
FICI ATM banking does not Granger Cause FICI agency banking	2.14022	0.1215
Bank size does not Granger Cause FICI ATM banking	1.71425	0.1839
FICI ATM banking does not Granger Cause bank size	0.09546	0.909
FICI Agency banking does not Granger Cause FICI online banking	0.50507	0.6046
FICI Online banking does not Granger Cause FICI agency banking	3.211	0.0433
Bank size does not Granger Cause FICI online banking	0.78817	0.4567
FICI Online banking does not Granger Cause bank size	0.68042	0.5081
FICI Bank size does not Granger Cause FICI agency banking	2.21932	0.1125
FICI Agency banking does not Granger Cause bank size	0.20013	0.8189

4.8.2 Panel Granger Causality Test for Mobile Phone Banking

As presented in Table 4.32, there was no causality between the various components of mobile phone banking and financial deepening. There was no causality between investment in mobile phone banking and financial deepening running from investment in mobile phone banking to financial deepening meaning there were no casualty between investment in mobile phone banking and financial deepening of commercial banks in Kenya. There was no causality between number of subscribers and financial deepening there was no causality between number of transaction and financial deepening as evidenced by the robust results.

These results contradicted findings by Olarewaju and Adeyemi (2015) who found contradictory findings that there was no casual association both unidirectional and bidirectional relationship between liquidity and profitability of some banks in Nigeria.

Table 4.32: Panel Granger Causality Test for Mobile Phone Banking

Null Hypothesis:	F-Statistic	Prob.
Investment in Mobile phone does not Granger Cause financial deepening	1.8550	0.1715
Financial deepening does not Granger Cause Investment in mobile banking	2.4337	0.1024
Number of subscribers does not Granger Cause financial deepening	0.2340	0.7926
Financial deepening does not Granger Cause number of subscribers	0.9681	0.3898
Number of transaction does not Granger Cause financial deepening	0.1163	0.8906
Financial deepening does not Granger Cause number of transaction	1.5476	0.2270
Invest. in mobile phone does not Granger Cause number of subscribers	0.3345	0.7180
Number of subscribers does not Granger Cause Invest. in mobile phone	0.1166	0.8903
Invest. in mobile phone does not Granger Cause number of transaction	1.2710	0.2932
Number of transaction does not Granger Cause Invest. in mobile phone	0.0103	0.9898
Number of subscribers does not Granger Cause number of transactions	0.8355	0.4421
Number of transactions does not Granger Cause number of subscribers	0.8095	0.4532

4.8.3 Panel Granger Causality for ATM Banking

As presented in Table 4.33, there was no causality between the various components of ATM banking and financial deepening. There was no causality between number of ATM cards issued and financial deepening. There was no causality between number of ATM machines and financial deepening there was no causality between distribution criteria nationwide and financial deepening as evidenced by the robust results.

Table 4.33: Panel Granger Causality of ATM Banking

Null Hypothesis:	**F-Statistic**	**Prob.**
Number of ATM cards issued does not Granger Cause financial deepening	1.2475	0.2917
Financial deepening does not Granger Cause Number of ATM cards issued	2.4419	0.0922
Number of ATM machines does not Granger Cause financial deepening	0.4534	0.6368
Financial deepening does not Granger Cause number of ATM machines	1.3592	0.2616
Financial deepening does not Granger Cause Distr. Criteria nationwide	0.9238	0.4004
Distr. Criteria nationwide does not Granger Cause Financial deepening	0.1406	0.8690
Number of ATM machines does not Granger Cause number of ATM cards	0.3604	0.6983
Number of ATM cards issued does not Granger Cause distr. criteria nationwide	0.7096	0.4943
Distr. criteria nationwide does not Granger Cause number of ATM cards	0.7145	0.4919
Number of ATM machines does not Granger Cause Distr. criteria nationwide	0.4182	0.6594
Distr. criteria nationwide does not Granger Cause Number of ATM machines	0.8423	0.4338
Number of ATM cards issued does not Granger Cause number of ATM machines	0.3762	0.6874

4.8.4 Panel Granger Causality of Online Banking

As presented in Table 4.34, there was no causality between the various components of mobile online banking and financial deepening. There was no causality between number of online subscribers and financial deepening. There was no causality between number of online transaction and financial deepening there was no causality between amount of transaction and financial deepening as evidenced by the robust results.

Table 4.34: Panel Granger Causality of Online Banking

Null Hypothesis:	**F-Statistic**	**Prob.**
Number of online subscribers does not Granger Cause financial deepening	0.0961	0.9084
Financial deepening does not Granger Cause number of online subscribers	2.1355	0.1250
Number of online transaction does not Granger Cause financial deepening	0.3248	0.7237
Financial deepening does not Granger Cause number of online transaction	1.8116	0.1701
Financial deepening does not Granger Cause amount of transaction	0.1118	0.8944
Amount of transaction does not Granger Cause Financial deepening	1.2130	0.3028
Number of online subscribers does not Granger Cause no. of online transaction	0.0993	0.9056
No. of online transaction does not Granger Cause number of online subscribers	0.9095	0.4069
Number of online subscribers does not Granger Cause amount of transaction	1.4255	0.2465
Amount of transaction does not Granger Cause number of online subscribers	0.4139	0.6625
No. of online transaction does not Granger Cause amount of transaction	0.5744	0.5654
Amount of transaction does not Granger Cause no. of online transaction	0.3605	0.6985

4.8.5 Panel Granger Causality of Agency Banking

As presented in Table 4.35, there was no causality between the various components of agency banking and financial deepening. There was no causality between number of agents and financial deepening. There was no causality between number of transactions and financial deepening there was no causality between amount of transaction and financial deepening as evidenced by the robust results.

Table 4.35: Panel Granger Causality of Agency Banking

Null Hypothesis:	F-Statistic	Prob.
Number of agents does not Granger Cause financial deepening	0.1954	0.8231
Financial deepening does not Granger Cause number of agents	0.1407	0.8691
Number of transactions does not Granger Cause financial deepening	0.0605	0.9414
Financial deepening does not Granger Cause number of transactions	1.1681	0.3185
Amount of transaction does not Granger Cause financial deepening	0.9809	0.3814
Financial deepening does not Granger Cause amount of transaction	1.2951	0.2821
Number of agents does not Granger Cause number of transactions	0.5682	0.5698
Number of transactions does not Granger Cause number of agents	0.7274	0.4878
Number of agents does not Granger Cause amount of transaction	1.7858	0.1773
Amount of transaction does not Granger Cause number of agents	1.6123	0.2087
Number of transactions does not Granger Cause amount of transaction	0.5998	0.5525
Amount of transaction does not Granger Cause number of transactions	0.3944	0.6760

4.9 Panel Hausman Test

Hausman test was utilised to help in choosing between FEM and REM models. The H_0 stated REM model should be fitted to examine the effects financial innovations on financial deepening of commercial banks in Kenya against an alternative that FEM

model should be adopted. If the p value would be less than 0.05, then the most appropriate model to fit should be FEM model otherwise fit REM Model. Hausman test basically tests whether the unique errors are correlated with the regressors; the null hypothesis is they are not. In this case since the sample size was almost equal to the population size, then fixed effects model appeared more prudent in the study.

However, the study was careful that the use of the random effects model assumes exogeneity of all regressors with the random individual effects. Opposing to this, the fixed model allows for endogeneity of all the regressors with the case of individual effects (Baltagi, 2005). Therefore, to guarantee the validity and reliability of the estimated model parameters, the study applied the Hausman test in choosing the appropriate model between the fixed effects or the random effects model for study variables.

4.9.1 Panel Hausman Test for Model without Moderation

Fixed effects and random effects modelling choice is guided by findings of Hausman test. This test assumes that the most appropriate model to fit is fixed effects against an alternative use of random effects. As shown in Table 4.36, Chi square statistics was 2.25 and p value of 0.694 which was greater than 0.05. Consequently, there was enough evidence to warrant rejection of the null hypothesis and conclusion that the most appropriate model to examine relationship between banking financial innovations and financial deepening of banks in Kenya was random effects. These findings differed with Githira and Nasieku (2015) who fitted fixed effects on firms listed in East Africa securities exchanges and they concurred with Ndili and Muturi (2015) who fitted fixed effects on their examination on role of financing decision on financial performance of listed companies in NSE.

Table 4.36: Panel Hausman Test for Commercial Banks in Kenya

Dependent Variable	Test Summary		Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
			2.225	4	0.694
Financial deepening	**Variable**	**Fixed**	**Random**	**Var (Diff.)**	**Prob.**
	FICI Mobile Banking	0.895	0.890	0.005	0.953
	FICI ATM Banking	0.392	0.345	0.005	0.488
	FICI Online Banking	0.223	0.306	0.008	0.353
	FICI Agency Banking	0.728	0.679	0.010	0.620

4.9.2 Panel Hausman Test for Moderated Model of Commercial Banks in Kenya

As shown in Table 4.41, Chi square statistics was 17.88578 and p value of 0.0365 which was greater less 0.05. Consequently, there was no enough evidence to warrant rejection of the null hypothesis and conclusion that the most appropriate model to examine moderating effect of bank size on relationship between banking financial innovations and financial deepening of banks in Kenya was fixed effects. These findings agreed Tarus and Omandi (2013) who adopted fixed effects model to examine effects of corporate governance transparency on performance of listed companies in Kenya.

Table 4.37: Panel Hausman Test for Moderated Model of Commercial Banks in Kenya

Dependent Variable	Test Summary		Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
			17.88578	9	0.0365
	Variable	**Fixed**	**Random**	**Var (Diff.)**	**Prob.**
Financial deepening	FICI Mobile Banking	0.160157	0.039898	0.002183	0.0101
	FICI ATM Banking	0.089961	0.116953	0.002573	0.5946
	FICI Online Banking	0.28426	0.223868	0.003276	0.2914
	FICI Agency Banking	-0.0688	0.017586	0.004932	0.2187
	Bank Size	0.508078	0.27847	0.006372	0.004
	FICI MB*BS	0.011512	0.012746	0.000004	0.5183
	FICI ATMB*BS	0.016036	0.011781	0.000007	0.1167
	FICI OB*BS	0.005924	0.011214	0.000007	0.0525
	FICI AB*BS	0.012391	0.011485	0.000006	0.7215

4.9.3 Panel Hausman Test for Mobile Phone Banking

As shown in Table 4.37, Chi square statistics was 4.9439 and p value of 0.2931 which was greater than 0.05. Consequently, there was enough evidence to warrant rejection of the null hypothesis and conclusion that the most appropriate model to examine effect between mobile phone banking and financial deepening of commercial banks in Kenya was random effects. These findings agreed with Muchiri et al. (2016) who adopted random effects model and they concurred with Kariuki (2017) on examination on effect of firm characteristics on efficiency of savings and credit cooperative societies of Kenya.

Table 4.38: Panel Hausman Test for Mobile Phone Banking

Dependent	Test Summary		Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
			4.9439	4	0.2931
Financial deepening	**Variable**	**Fixed**	**Random**	**Var (Diff.)**	**Prob.**
	Invest. In Mobile phone	1.2427	1.0280	0.0219	0.1472
	No. of subscribers	0.6631	0.5904	0.0133	0.5283
	No. of transaction	0.5699	0.6050	0.0265	0.8291

4.9.4 Panel Hausman Test for ATM Banking

As shown in Table 4.38, Chi square statistics was 5.0761and p value of 0.276 which was greater than 0.05. Consequently, there was enough evidence to warrant rejection of the null hypothesis and conclusion that the most appropriate model to examine the effect between ATM banking and financial deepening of commercial banks in Kenya was random effects. These findings contrasted Tarus and Omandi (2013) who adopted fixed effects model to examine effects of corporate governance transparency on performance of listed companies in Kenya.

Table 4.39: Panel Hausman Test for ATM Banking

Dependent	Test Summary		Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Financial deepening	Cross-section random		5.0761	4	0.2796
	Variable	Fixed	Random	Var (Diff.)	Prob.
	No. of ATM cards issued	0.7161	0.8545	0.0044	0.0367
	No. of ATM machines	0.3378	0.3419	0.0065	0.9589
	Distribution criteria	0.0207	0.1203	0.0108	0.3376

4.9.5 Panel Hausman Test for Online Banking

As shown in Table 4.39, Chi square statistics was 2.1009 and p value of 0.7172 which was greater than 0.05. Consequently, there was enough evidence to warrant rejection of the null hypothesis and conclusion that the most appropriate model to examine the effect between online banking and financial deepening of commercial banks in Kenya was random effects.

Table 4.40: Panel Hausman Test for Online Banking

Dependent	Test Summary		Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
			2.1009	4	0.7172
Financial deepening	**Variable**	**Fixed**	**Random**	**Var (Diff.)**	**Prob.**
	No. of online subscribers	1.0441	0.9275	0.0151	0.3424
	No. of online transaction	0.4109	0.5492	0.0116	0.1999
	Amount of transactions	0.5539	0.6651	0.0312	0.5289

4.9.6 Panel Hausman Test for Agency Banking

As shown in Table 4.40, Chi square statistics was 3.3298 and p value of 0.5042 which was greater than 0.05. Consequently, there was enough evidence to warrant rejection of the null hypothesis and conclusion that the most appropriate model to examine the effect between agency banking and financial deepening of commercial banks in Kenya was random effects.

Table 4.41: Panel Hausman Test for Agency banking

Dependent	**Test Summary**		**Chi-Sq. Statistic**	**Chi-Sq. d.f.**	**Prob.**
					0.5042
			3.3298	4	
	Variable	**Fixed**	**Random**	**Var (Diff.)**	**Prob.**
Financial deepening	No. of agents	0.7443	0.7690	0.0027	0.6331
	No. of transactions	0.3996	0.2506	0.0071	0.0769
	Amount of transactions	0.0843	0.0277	0.0071	0.5031

4.10 Hypothesis Testing

4.10.1 Effect of Mobile Phone Banking on Financial Deepening of Commercial Banks in Kenya

The first study hypothesis stated that mobile phone banking had no significant effect on financial deepening of commercial banks in Kenya. Panel regression analysis was adopted to test the hypothesis and study findings are tabulated in Table 4.42. The study

outlined that mobile phone banking had significant effect on financial deepening of commercial banks in Kenya (F= 40.6321, p value <0.05). Coefficient of determination (R squared) of 0.7724, depicted that 77.24 percent of adjustments in financial deepening was accounted for by investment in mobile phone, number of subscribers and number of transactions while the remaining percentage was explained for by other elements not factored in the derived model.

Investment in mobile phone had positive significant effect on financial deepening (β = 0.3321, p value <0.05). This stipulates that unit increment in investment in mobile phone banking increases financial deepening by 0.3321 units while holding constant number of subscribers and number of transactions. Secondly, number of subscribers had positive significant effect on financial deepening (β = 0.2813, p value <0.05). This suggested that unit adjustment in number of subscribers increases financial deepening by 0.2813 units while holding constant investment in mobile phones and number of transactions. Thirdly, number of transactions had positive effect on financial deepening (β = 0.5698, p value <0.05). This stipulates that unit increment in number of transactions increases financial deepening by 0.5698 while holding constant investment in mobile phones and number of subscribers.

Financial Deepening = -1.24101 + 0.3321*Investment in Mobile Phone + 0.2813*Number of Subscribers + 0.5698*Number of Transaction…….……4.1

Table 4.42: Random Effect Model on Effect of Mobile Banking on Financial Deepening of Commercial Banks in Kenya

Variable	Coefficient	Robust Std. Error	t-Statistic	Prob.
C	-1.24101	1.3487	-0.8719	0.3745
Investment in mobile phone	0.3321	0.0736	5.3964	0.0000
Number of subscribers	0.2813	0.0894	3.1145	0.0010
Number of transactions	0.5698	0.1367	4.3427	0.0000
R-squared	0.7724	Mean dependent var		16.2531
Adjusted R-squared	0.7538	S.D. dependent var		14.6892
S.E. of regression	7.5125	Akaike info criterion		6.9322
Sum squared residuals	29357.3200	Schwarz criterion		7.2437
Log likelihood	-1897.1440	Hannan-Quinn criterion.		7.1567
F-statistic	40.6321	Durbin-Watson stat		2.3318
Prob(F-statistic)	0.0000			

4.10.2 Effect of ATM-Banking on Financial Deepening of Commercial Banks in Kenya

The second study hypothesis stated that ATM banking had no significant effect on financial deepening of commercial banks in Kenya. Panel regression analysis was adopted to test the hypothesis and study findings are tabulated in Table 4.43. The study outlined that ATM banking had significant effect on financial deepening of commercial banks in Kenya (F= 54.6792, p value <0.05). Coefficient of determination (R squared) of 0.7468, depicted that 74.68 percent of adjustments in financial deepening was accounted for by number of ATM cards, number of ATM machines and distribution

criteria nationwide while the remaining percentage was explained for by other elements not factored in the derived model.

Number of ATM cards had positive significant effect on financial deepening (β = 0.6285, p value <0.05). This stipulates that unit increment in number of ATM cards increases financial deepening by 0.6285 units while holding constant number of ATM machines and distribution criteria nationwide. Secondly, number of ATM machines had positive significant effect on financial deepening (β = 0.5143, p value <0.05). This suggested that unit adjustment in number ATM machines increases financial deepening by 0.5143 units while holding constant number of ATM cards and distribution criteria nationwide. Thirdly, distribution criteria nationwide had positive effect on financial deepening (β = 0.5934, p value <0.05). This stipulates that unit increment in distribution criteria nationwide increases financial deepening by 0.5934 while holding constant number of ATM cards and number of ATM machines. These findings agreed with Adewoye (2013) who found that ATM banking had significant contribution on quality of services provided by commercial banks in Nigeria. Mwatsika (2016) argued that ATM banking amplified customers satisfaction and ultimately improved access of banking services through customer referrals.

Financial Deepening = -2.0312 + 0..6285* Number Of Atm Cards + 0.5143*Number Of Atm Machines + 0.5934* Distribution Criteria Nationwide …….4.2

Table 4.43: Random Effect Model on Effect of ATM Banking on Financial Deepening of Commercial Banks in Kenya

Variable	Coefficient	Robust Std. Error	t-Statistic	Prob.
C	-2.0312	1.3781	-1.6892	0.0003
No.of ATM cards issued	0.6285	0.0980	5.6798	0.0000
No. of ATM machines	0.5143	0.0825	5.5896	0.0010
Distribution criteria nationwide	0.5934	0.0779	4.4623	0.0000
R-squared	0.7468	Mean dependent var		16.2284
Adjusted R-squared	0.7257	S.D. dependent var		14.2917
S.E. of regression	6.6872	Akaike info criterion		6.6638
Sum squared residuals	23843.6400	Schwarz criterion		7.0458
Log likelihood	-1876.5120	Hannan-Quinn criterion.		6.8796
F-statistic	54.6792	Durbin-Watson stat		1.4283
Prob(F-statistic)	0.0000			

4.10.3 Effect of Online Banking on Financial Deepening of Commercial Banks in Kenya

The third study hypothesis stated that online banking had no significant effect on financial deepening of commercial banks in Kenya. Panel regression analysis was adopted to test the hypothesis and study findings are tabulated in Table 4.44. The study outlined that online banking had significant effect on financial deepening of commercial

banks in Kenya (F= 48.7412, p value <0.05). Coefficient of determination (R squared) of 0.7675, depicted that 76.75 percent of adjustments in financial deepening was accounted for by number of online subscribers, number of online transaction and amount of transactions while the remaining percentage was explained for by other elements not factored in the derived model.

Number of online subscribers, had positive significant effect on financial deepening (β = 0.5272, p value <0.05). This stipulates that unit increment in number of online subscribers increases financial deepening by 0.5272 units while holding constant number of online transaction and amount of transactions. Secondly, number of number of online transaction had positive significant effect on financial deepening (β = 0.9846, p value <0.05). This suggested that unit adjustment in number of online transaction increases financial deepening by 0.9846 units while holding constant number of online subscribers and amount of transactions. Thirdly, amount of transactions had positive effect on financial deepening (β = 0.4761, p value <0.05). This stipulates that unit increment in amount of transactions increases financial deepening by 0.4761 while holding constant number of online subscribers and number of online transaction. These findings concurred with Sathye (2015) who found that internet banking had significant effect on performance of credit unions and commercial banks in Australia. This was also in line with Hasan et al., (2012) who reported significant contribution of internet banking in Italy though their nature of relationship differed amongst banks.

Financial Deepening = -4.5432 + 0.5272* Number of Online Subscribers + 0.9846* Number of Online Transaction + 0.4761*Amount of Transactions …….4.3

Table 4.44: Random Effect Model on Effect of Online Banking on Financial Deepening of Commercial Banks in Kenya

Variable	Coefficient	Robust Std. Error	t-Statistic	Prob.
C	-4.5432	1.3536	-4.6543	0.0000
No.of online subscribers	0.5272	0.0826	6.1739	0.0000
No. of online transaction	0.9846	0.1327	6.7645	0.0010
Amount of transaction	0.4761	0.0887	5.3851	0.0112
R-squared	0.7675	Mean dependent var		16.3156
Adjusted R-squared	0.7522	S.D. dependent var		14.8426
S.E. of regression	7.0142	Akaike info criterion		6.8113
Sum squared residuals	26932.1700	Schwarz criterion		7.1824
Log likelihood	-1913.3740	Hannan-Quinn criterion.		6.9012
F-statistic	48.7412	Durbin-Watson stat		2.1532
Prob(F-statistic)	0.0000			

4.10.4 Effect of Agency Banking on Financial Deepening of Commercial Banks in Kenya

The fourth study hypothesis stated that agency banking had no significant effect on financial deepening of commercial banks in Kenya. Panel regression analysis was adopted to test the hypothesis and study findings are tabulated in Table 4.45. The study outlined that agency banking had significant effect on financial deepening of commercial banks in Kenya (F= 43.7887, p value <0.05). Coefficient of determination

(R squared) of 0.7452, depicted that 74.52 percent of adjustments in financial deepening was accounted for by number of agents, number of transactions and amount of transactions while the remaining percentage was explained for by other elements not factored in the derived model.

Number of agents, had positive significant effect on financial deepening ($\beta = 0.3264$, p value <0.05). This stipulates that unit increment in number of agents increases financial deepening by 0.3264 units while holding constant number of transactions and amount of transactions. Secondly, number of transactions had positive significant effect on financial deepening ($\beta = 0.5704$, p value <0.05). This suggested that unit adjustment in number of number of transactions increases financial deepening by 0.5704 units while holding constant number of agents and amount of transactions. Thirdly, amount of transactions had positive effect on financial deepening ($\beta = 0.5216$, p value <0.05). This stipulates that unit increment in amount of transactions increases financial deepening by 0.5216 while holding constant number of agents and number of transactions. These findings concurred with Mbugua and Omagwa (2017) who supported use of agency banking as means of providing banking services in rural set ups. Alos, they concurred with Kingori and Gekara (2015) revealed positive significant of agency banking on financial performance of commercial banks in Kenya. Successful use of agency banking is dependent on acceptability of financial innovations as discussed by technology acceptance model. Moreover, there is need for banking agents to be adequately trained so as to maintain provision of quality banking services.

Financial deepening = -1.135 + 0.3264* Number of agents + 0.5704* Number of transactions + 0.5216*Amount of transactions …….…….4.4

Table 4.45: Random Effect Model on Effect of Agency Banking on Financial Deepening of Commercial Banks in Kenya

Variable	Coefficient	Robust Std. Error	t-Statistic	Prob.
C	-1.1351	1.4063	-0.7648	0.0557
No.of agents	0.3264	0.1300	2.4576	0.0000
No. of transactions	0.5704	0.1468	4.1432	0.0010
Amount of transactions	0.5216	0.0993	4.4719	0.0112
R-squared	0.7452	Mean dependent var		16.2213
Adjusted R-squared	0.7247	S.D. dependent var		14.4688
S.E. of regression	7.5384	Akaike info criterion		6.8358
Sum squared residuals	29683.7800	Schwarz criterion		7.3326
Log likelihood	-1926.2310	Hannan-Quinn criterion.		7.3754
F-statistic	43.7887	Durbin-Watson stat		1.5729
Prob(F-statistic)	0.0000			

4.11 Moderating Effect of Bank Size on the Effect of Financial Innovations and Financial Deepening on Commercial Banks in Kenya

The fifth objective of the study examined moderating effect of bank size on the effect of financial innovations on financial deepening of commercial banks in Kenya. Multiple regression analysis was applied to examine direct effect of financial innovations on financial deepening. Further, stepwise regression and marginal differentiation were adopted to examine bank size moderating effect on the effects of financial innovations on financial deepening of commercial banks in Kenya. As depicted in Table 4.46, financial innovations had significant effect on financial deepening of commercial banks in Kenya ($F= 195.2354$, p value <0.05). Coefficient of determination of 0.7873, explained that 78.73 percent of changes in financial deepening of commercial banks in Kenya was accounted for by mobile phone banking, income ATM banking, online

banking and agency banking while the remaining percentage was accounted for by other aspects not in the model.

There was positively significant effect of mobile phone banking and financial deepening ($\beta = 0.8903$, p value <0.05). This deduced that unit increment in FICI mobile phone banking increased financial deepening by 0.8903 units while holding FICI ATM, HHI online and FICI agency banking constant. Secondly, ATM banking had positively significant effect on financial deepening ($\beta = 0.3453$, p value <0.05). This pointed out that unit increment in ATM banking increases financial deepening by 0.3453while holding FICI mobile banking, FICI online banking and HHI agency banking constant. Thirdly, there was positively and significant effect of online banking on financial deepening ($\beta = 0.3058$, p value <0.05). This insinuated that unit increment in online banking increases financial deepening by 0.3058 while holding HHI mobile, FICI ATM and FICI agency banking constant. Fourthly, there was positively significant effect of agency banking on financial deepening ($\beta = 0.6794$, p value <0.05). This suggested that unit increment in agency banking increases financial deepening by 0.6794 while holding FICI mobile banking, FICI ATM banking and FICI online banking constant. From the findings, mobile phone banking had the highest effect on financial deepening, followed by agency banking, ATM banking and online banking had the lowest effect.

Table 4.46: Random Effect on Effect of Financial Innovations on Financial Deepening of Commercial Banks in Kenya

Variable	Coefficient	Robust Std. Error	t-Statistic	Prob.
C	-21.7198	1.4882	-14.5949	0.0000
FICI Mobile banking	0.8903	0.1334	6.6765	0.0000
FICI ATM banking	0.3453	0.1502	2.2986	0.0225
FICI Online banking	0.3058	0.1425	2.1460	0.0330
FICI Agency banking	0.6794	0.1686	4.0288	0.0001
R-squared	0.7873	Mean dependent var		12.4543
Adjusted R-squared	0.7833	S.D. dependent var		13.4484
S.E. of regression	6.2610	Sum squared residuals		8271.3380
F-statistic	195.2354	Durbin-Watson stat		2.1739
Prob(F-statistic)	0.0000			

Financial deepening = -21.7198 + 0.8903* FICI Mobile phone banking + 0.3453*FICI ATM banking + 0.3058*FICI Online banking + 0.6794*FICI Agency banking …….4.4

Regression results in Table 4.47, revealed that 93.10 percent of changes in financial deepening was accounted for by FICI Mobile, FICI ATM, FICI Online, FICI Agency banking and Bank size, moderated financial innovations while the remaining percentage was accounted for by other factors excluded in the model. R squared increased by 14.37 percent (0.9310-0.7873) after moderation which indicated bank size had moderating effect on the effect of financial innovations and financial deepening of commercial banks in Kenya. Further, bank size had positive significant effect on financial deepening of commercial banks in Kenya ($\beta = 0.5081$, p value <0.05).

After bank size moderation on FICI mobile banking, FICI MB*BS there was positive significant relationship with financial deepening ($\beta = 0.0115$, p value <0.05). Secondly,

bank size had positive moderating effect on FICI ATM banking, FICI ATMB*BS (β = 0.0160, p value <0.05). Thirdly, FICI online banking, FICI OB*BS had positive and non-significant moderation on bank size (β = 0.0059, p value >0.05). Finally, bank size had positive significant moderating effect on FICI agency bank, FICI AB*BS (β = 0.0124, p value <0.05).

Financial Deepening = -18.9276 + 0.1602 * FICI Mobile banking + 0.0900 * FICI ATM banking+ 0.2843* FICI Online banking + 0.0688* FICI Agency banking + 0.5081 * Bank size + 0.0115* FICI MB*BS + 0.0160 * FICI ATMB*BS+0.0059* FICI OB*BS+0.0124* FICI AB*BS……..……. ..…4.5

Bank size moderating effect was confirmed through comparison of moderated and non-moderated coefficients with marginal change of financial innovations on financial deepening of commercial banks in Kenya. Bank size moderating effect will be present if marginalized coefficients will differ from non-moderated banking financial innovations coefficients. The following equations were adopted:

$\frac{\delta FDi,t}{\delta MBi,t} = \beta_1 + \beta_6 BS = 0.1602 + 0.0115 * 17.61 = 0.3627$

$\frac{\delta FDi,t}{\delta ATMBi,t} = \beta_2 + \beta_7 BS = 0.0900 + 0.0160 * 17.61 = 0.3718$

$\frac{\delta FDi,t}{\delta OBi,t} = \beta_3 + \beta_8 BS = 0.2843 + 0.0059 * 17.61 = 0.3882$

$\frac{\delta FDi,t}{\delta ABi,t} = \beta_4 + \beta_9 BS = 0.0688 + 0.0124 * 17.61 = 0.2872$

Comparison between marginalized coefficients and those in equation 4.4 (Financial Deepening = -21.7198 + 0.8903* FICI Mobile Banking + 0.3453 * FICI ATM banking + 0.3058* FICI Online banking + 0.6794* FICI Agency banking), these coefficients differed. Consequently, it can be concluded that bank size had moderating effect on the effect of financial innovations on financial deepening of commercial banks in Kenya.

These results supported Hasan et al., (2012), Chipeta and Muthinja (2018), Mbugua and Omagwa (2017), Wabwoba (2012), Arif et al. (2013), Muhindi and Ngaba (2018) and Sreesha (2018) who reported significant relationship between financial innovation, bank size and financial access. Bank size contribution on banking performance and provision of services have significant effect amongst past scholars. Furthermore, moderating effect of bank size is in line with innovation diffusion theory which argues that to fully benefit from technology then institutions ought to have enough financial resources to acquire assets. This will be in line with Ndili and Muturi (2015) who argued that performance of listed companies is anchored on their ability to acquire and invest their finances.

Table 4.47: Moderating Effect of Bank Size on the Effect of Financial Innovations and Financial Deepening Commercial Banks in Kenya

Variable	Coefficient	Robust Std. Error	t-Statistic	Prob.
C	-18.9276	2.3631	-8.0096	0.0000
FICI Mobile banking	0.1602	0.1109	1.4437	0.1507
FICI ATM banking	0.0900	0.1159	0.7759	0.4389
FICI Online banking	0.2843	0.1200	2.3694	0.0189
FICI Agency banking	0.0688	0.1392	0.4941	0.6219
Banking size	0.5081	0.1504	3.3784	0.0009
FICI MB*BS	0.0115	0.0045	2.5615	0.0113
FICI ATMB*BS	0.0160	0.0063	2.5628	0.0112
FICI OB*BS	0.0059	0.0062	0.9515	0.3427
FICI AB*BS	0.0124	0.0053	2.3218	0.0214
R-squared	0.9310	Mean dependent var		13.3877
Adjusted R-squared	0.9132	S.D. dependent var		13.7214
S.E. of regression	4.0422	Akaike info criterion		5.8145
Sum squared residuals	2793.9760	Schwarz criterion		6.5177
Log likelihood	-582.9645	Hannan-Quinn criterion.		6.0986
F-statistic	52.4197	Durbin-Watson stat		2.0663
Prob(F-statistic)	0.0000			

Table 4.48: Summary of Statistical Hypotheses Testing Results

Null Hypothesis	Rule	P-value	Statistical Significance	Decision	Relationship
Mobile phone banking has no significant effect on financial deepening of Commercial banks in Kenya	Reject H0 if P-Value < 0.05	P < 0.05	Yes	Reject	Positive
ATM banking has no significant effect on financial deepening of Commercial banks in Kenya	Reject H0 if P-Value < 0.05	P < 0.05	Yes	Reject	Positive
Online banking has no significant effect on financial deepening of Commercial banks in Kenya	Reject H0 if P-Value < 0.05	P < 0.05	Yes	Reject	Positive
Agency banking has no significant effect on financial deepening of Commercial banks in Kenya	Reject H0 if P-Value < 0.05	P < 0.05	Yes	Reject	Positive
Bank size has no moderating effect on the relationship between Financial Innovations and Financial deepening of Commercial banks in Kenya	Reject H0 if P-Value < 0.05	P < 0.05	Yes	Reject	Positive

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

In this section major findings will be presented, conclusion drawn and recommendations will be presented as well as suggestions for further studies.

5.2 Summary of Findings

The study endeavored to examine the effect of financial innovations on financial deepening amongst commercial banks in Kenya. Financial innovations were operationalized as mobile, ATM, online and agency banking. Moreover, moderating effect of bank size was examined. To achieve the main objective secondary data was gathered amongst 36 commercial banks for seven consecutive years commencing 2012. Univariate, bivariate and multivariate approaches were applied for data analysis. Prior to classical modelling diagnostic tests were carried out to evaluate its robustness.

5.2.1 Mobile Banking and Financial Deepening of Commercial Banks in Kenya

The first objective of the study determined the effect of mobile banking on financial deepening of commercial banks in Kenya. This was achieved through simple and multiple regression analysis. Mobile phone banking was classified into investment in mobile phone banking, number of subscribers and number of transaction. Number of transaction had the highest mean followed by investment in mobile and lastly number of subscribers. It was found that there was positive and significant relationship between mobile banking and financial deepening of commercial banks in Kenya. It was implied that increase in mobile banking increased financial deepening of commercial banks in Kenya.

5.2.2 ATM Banking and Financial Deepening of Commercial Banks in Kenya

The second objective of the study examined relationship between ATM banking and financial deepening of commercial banks in Kenya. This was achieved through simple and multiple regression analysis. ATM banking was classified into number of ATM cards issued, number of ATM machines and distribution criteria nationwide. Number of ATM cards recorded the highest mean followed by distribution criteria and lastly number of ATM machines. It was found that there was positive and significant relationship between ATM banking and financial deepening of commercial banks in Kenya. It was implied that increase in ATM banking increased financial deepening of commercial banks in Kenya.

5.2.3 Online Banking and Financial Deepening of Commercial Banks in Kenya

The third objective of the study examined relationship between online banking and financial deepening of commercial banks in Kenya. This was achieved through simple and multiple regression analysis. Online banking was classified into number of transactions, number of subscribers and amount of transaction. Number of online transaction recorded the highest mean followed by number of subscribers and finally amount of transaction. It was found that there was positive and significant relationship between online banking and financial deepening of commercial banks in Kenya. It was implied that increase in online banking increased financial deepening of commercial banks in Kenya.

5.2.4 Agency Banking and Financial Deepening of Commercial Banks in Kenya

The fourth objective of the study evaluated relationship between agency banking and financial deepening of commercial banks in Kenya. This was achieved through simple and multiple regression analysis. Agency banking was classified into number of agents, number of transactions and amount of transaction. Number of transactions recorded the highest mean followed by amount of transactions and finally number of agents. It was

found that there was positive and significant relationship between agency banking and financial deepening of commercial banks in Kenya It was implied that increase in mobile banking increased financial deepening of commercial banks in Kenya.

5.2.5 Bank Size Moderating Effect on Relationship between Financial Innovations and Financial Deepening of Commercial banks in Kenya

The fifth objective examined moderating effect of bank size on the relationship between banking financial innovations and financial deepening of commercial banks in Kenya. It was found that banks size had positive moderating effect on mobile banking, ATM banking, online banking and agency banking. The results in this study show that the average total asset base of the commercial banks increased progressively along the six performance cycles. It is argued that large banks have all the options of small banks, and, in addition, the capability of harnessing economies of scales and access to capital markets from which small banks are excluded, thus leading to higher profit rates and increased penetration of their services.

5.3 Conclusions

From the foregoing findings it can be concluded that there is need for commercial banks to take advantage of mobile phone uptake to advent their products and services. There is need to increase mobile banking products to have alternative services accessed in favour of current lending, withdrawals, deposits. Mobile phone banking diversification would minimize cases of financial exclusion especially amongst unbanked population in Kenya.

Commercial banks should integrate their ATM banking so as to intensify access of banking services. Commendable use of ATM services was noted in listed and non-listed banks. Commercial banks ought to encourage of ATM plastic money to minimize cases associated with theft and loss of cash during transit.

Thirdly, online banking services had strong significant relationship with financial deepening of commercial banks in Kenya. There is provision of online banking supportive services in different parts of the country. Provision of internet connection in geographically dispersed locations would aid in eradicating distances covered to access banking services. Banking online services ought to be blended to be easily accessible in those remote regions with limited internet access.

Further, it was found that agency banking service impacted positively on financial deepening. This calls for creative and diversified provision of financial services through agents. Beyond normal banking transactions such as opening of accounts there is need for provision of services such as financial advisory and recruitment of mortgage clients which will be in line achievement of big four agendas in Kenya.

Finally, increased bank size improved financial deepening of commercial banks in Kenya. Bank size had positive moderating effect on financial deepening, mobile banking, ATM banking, online banking and agency banking. Hence, there is need for commercial banks to invest in tangible and intangible assets which would aid in adoption of banking financial innovation.

5.4 Recommendations

The mobile banking concept is in positive trend towards full realization of financial deepening in its full impact hence the Government must develop better policies to manage this subsector which has potential to be a very high-volume financial transaction platform. Since mobile banking may over step and overtake some commercial banking functions, there is need to regulate and rehabilitate it to its main objective of remittances. The Government should also make it compulsory for every mobile network companies to participate in this product to reduce costs for consumers though there is need for its independent regulation.

There is need for banking companies to improve securities on use of debit and credit cards to execute online purchases and payments. This would minimize financial fraud associated with unauthorized access personal credit cards information. Alternative security approaches beyond use of personal identification numbers, biometric identification should be incorporated during ATM banking transactions.

Although, online banking services have received positive reception, it is faced by several security threats. Customer's sensitization against use of public internet services, this would minimize possibilities of financial losses. Banking institutions should develop financial services which can be easily accessed through use internet instead of traditional approaches. This would save on environmental degradation and eliminate wastages.

From the findings, over the period agency banking has been in operation, the kind of service offered by the agents has been limited to simple transactions and supportive functions like deposits and withdrawals. A more interesting perspective will be when banks allow agents to perform core activities like vetting loan applications and collecting loan repayment, it is recommended that the banks transfer the basic knowledge to the agents to enable them perform these extra activities. The banks also need to advertise the other kinds of service that can be done via agency banking to ensure an uptake of all services offered by agents who will be more efficient and cost effective.

5.5 Areas of Further Research

This study used bank size as moderating variable, financial innovations adoption as independent variable and financial deepening as dependent variable. Long term study should be carried out and use of dynamic panel modelling to explore long run and short effect of financial innovations on banking performance.

There is need to carry out comparative analysis with consideration of changes in regulatory framework as per BASEL accords, one, two and three. It could further reveal how financial innovations adoption affects financial deepening, other factors like an increasing regulatory framework, varying economic set ups of customers, or changing income levels should be considered for future researches. The other suggestion for further research is examining the direct role of bank size on financial deepening in the commercial banks of Kenya.

Future research efforts should also broaden the scope of this study by including important contextual variables such as, competition, bank portfolio diversification, to the research framework, which may help explain some of the insignificant findings in this study. One direction for future research is to investigate the hindrances that block commercial banks' commitment to financing the economy like resource constraint as to deficiency of human, financial and technological resources.

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APPENDICES

Appendix I: Introduction Letter

Anthony Maina Mwai

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7/6/2018

DIRECTOR, BANK SUPERVISION

CENTRAL BANK OF KENYA

P.O BOX 60000-00200

NAIROBI

Dear Sir/Madam,

RE: Letter of Request for Permission to Collect Data

I am a student pursuing a Doctorate Degree in Business Administration- Finance Option at Jomo Kenyatta University of Agriculture and Technology. I'm requesting for secondary data to complete my research titled 'Effect of Financial Innovations on Financial Deepening of Commercial Banks in Kenya. This is purely an academic exercise conducted under the department of Commerce and Economics Studies, JKUAT Nairobi CBD campus towards meeting the requirements for my award of the degree of Doctor of Philosophy in Business Administration.

This study intends to examine Mobile phone banking, ATM banking, Online banking, Agency banking and Total Assets of commercial banks. The information you provide will be treated with utmost confidentiality.

Yours Sincerely

Anthony Maina Mwai

Student Reg No. HD433/5059/2014

Appendix II: Secondary Data Collection Instrument

Secondary data from all the registered commercial banks in Kenya as at the end of 2018 will be collected as follows:

Name of the Bank …….

Financial Year		2012	2013	2014	2015	2016	2017	2018
Financial	Credit Penetration							
Mobile Phone Banking	Investment in Mobile Phone banking							
	Number of Subscribers							
	Number of Transactions							
ATM Banking	Number of ATM cards issued							
	Number of ATM machines							
	Distribution criteria nationwide							
Online Banking	Number of Online subscribers							
	Number of Online Transactions							
	Amount of Transactions							
	Number of Agents							
	Number of transactions							
	Amount of Transactions							
Banks' Size	Total Assets							

Source: Central Bank of Kenya, Various Annual Reports, Author's estimates.

Appendix III: Study Population: List of Commercial Banks in Kenya

NAME OF THE BANK	YEAR LICENSED
1. ABC Bank (Kenya)	1984
2. Bank of Africa	1980
3. Bank of Baroda	1953
4. Bank of India	1953
5. Barclays Bank Kenya	1953
6. CfC Stanbic Holdings	1955
7. Chase Bank Kenya	1991 Acquired by SBM
8. Citibank	1974
9. Commercial Bank of Africa	1967
10. Consolidated Bank of Kenya	1989
11. Cooperative Bank of Kenya	1965
12. Credit Bank	1986
13. Development Bank of Kenya	1973
14. Diamond Trust Bank	1946
15. Dubai Bank Kenya	1982
16. Eco-bank Kenya	2005
17. Equatorial Commercial Bank/Spire Bank	1995
18. Equity Bank	2004
19. Family Bank	1984
20. Fidelity Commercial Bank Limited	1992
21. First Community Bank	2008
22. Giro Commercial Bank	1992 Acquired by I&M in 2017
23. Guaranty Trust Bank Kenya	1986
24. Guardian Bank	1992
25. Gulf African Bank	2007
26. Habib Bank	1978 Acquired by Diamond Trust bank
27. Habib Bank AG Zurich	1956
28. Housing Finance Company of Kenya	2010
29. I&M Bank	1974
30. Imperial Bank Kenya	1992
31. Jamii Bora Bank	1999
32. Kenya Commercial Bank	1896
33. K-Rep Bank/Sidian Bank	1999
34. Middle East Bank Kenya	1980
35. National Bank of Kenya	1968
36. NIC Bank	1959
37. Oriental Commercial Bank	1991
38. Paramount Universal Bank	1993
39. Prime Bank (Kenya)	1992
40. Standard Chartered Kenya	1910
41. Trans National Bank Kenya	1985
42. United Bank for Africa	2009
43. Victoria Commercial Bank	1987

(Source: Central Bank of Kenya, 2018)