# EFFECT OF FINANCIAL INNOVATIONS ON FINANCIAL PERFORMANCE OF COMMERCIAL BANKS IN KENYA

BY

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## DEDICATION

This thesis is dedicated to; God Almighty, my parents George and Rose Malit, lastly to my wife

Irene and children Winters, Rose and Eve.

# ACKNOWLEDGEMENT

# ABSTRACT

Commercial banking industry in all economies have been facing increased performance fluctuations due to high competition, interest rate changes, high credit risk, exchange rate fluctuations and liquidity problems. To overcome these challenges, commercial banking is evolving globally from conventional banking through financial innovations. A lot of innovations have been undertaken in banking sector that have led to proliferation of financial products, activities and organizational forms that have improved the efficiency of the financial system. Financial innovations such as branch networking, agency banking, mobile banking, electronic funds transfer are currently perceived to enable cost effective service delivery in the banking sector. In spite of uptake of these cutting edge innovations by the banking sector, return on assets and return on equity still remain low and unpredictable. Furthermore, loans uptake in terms of volume and quality remain low in relation to banked and general population. Despite its importance and the presence of extensive literature on financial innovations, a number of past studies have largely focused on process innovation as opposed to product and financial services innovation. Secondly, most past studies on Kenya have covered relatively shorter study periods which may not reliably capture the financial trends, more so given the short shelf life of financial studies caused by rapid changes in the financial sector. This study therefore examined the effect of financial innovation on the financial performance of commercial banks in Kenya between the year 2007 and 2017. The choice of research area was the need for justification of finnovs for better banking and financial sector performance due to its vital role in economic development. The specific objectives of the study were to; determine the effect of financial innovation on banks' return on assets; to establish the effect of financial innovation on loan portfolio and to examine the effect of financial innovation on banks' return on equity. This study was modeled on Constraint–induced and Schumpeter's financial innovation theories and applied correlation research design. The target population was 42 Central Bank of Kenya registered commercial banks. The 12 Nairobi Securities Exchange listed commercial banks were purposively sampled. Secondary data for the study period was obtained from the Central Bank for Stata 15 panel data diagnostics and regression analytics. Results indicated that financial innovations had mixed effects on commercial banks. For return on assets; finnovs accounted for 51.34% of all variations as denoted by overall $R^2 = 0.5134$. Mobile banking, branch networking and total assets had positive effects on financial performance with coefficients of 0.052, 0.373 and 0.130 respectively with corresponding p-values of 0.050, 0.000 and 0.014. ROE and LA as regressors had negative impact on ROA. Finnovs accounted for 59.28% variations in loan portfolio as denoted by overall $R^2 = 0.5928$. Branch networking and total assets had positive effects with coefficients of 0.382 (p-value = 0.000) and 0.015 (p-value = 0.017) respectively. Both enhanced bank productivity from loans. However, ROA and ROE had -0.278 (p-value = 0.020) and -0.291 (p-value = 0.001) coefficients respectively. Both were significant but negative on loans, meaning they led to financial losses. For return on equity, finnovs accounted for 20.77% of all variations as depicted by overall $R^2 = 0.2077$. Mobile banking services, branch networking and total assets had positive effect denoted by coefficients 0.046 (p-value = 0.016), 0.307 (p-value = 0.000) and 0.130 (p-value = 0.050) respectively. The study concluded that use of some financial innovations improved financial performance; some innovations were however loss prone while a few had insignificant effect. In this view, the study recommends that banks and stakeholders should research, innovate and employ effective financial innovations to improve performance. This study may be useful to private and public sector financial policy makers as well as a source of information to academicians and investors. Further research should focus on; role of finnovs on performance of non-banking financial sub-sector as well as a study on challenges facing market available finnovs in Kenya.

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## LIST OF ACRONYMS AND ABBREVIATIONS

| | | |
|---|---|---|
| **ACH** | : | Automated Clearing House |
| **ATM** | : | Automated Teller Machine |
| **BN** | : | Branch Networking |
| **CBK** | : | Central Bank of Kenya |
| **CBS** | : | Commercial Banks |
| **CMA** | : | Capital Markets Authority |
| **CDS** | : | Central Securities Depository |
| **CRB** | : | Credit Reference Bureau |
| **D/A** | : | Document against Acceptance |
| **D/P** | : | Document against Payment |
| **DV** | : | Dependent Variable |
| **ECC** | : | Electronic Cheques Clearing |
| **EFTPoS** | : | Electronic Funds Transfer at Point of Sale |
| **ERP** | : | Economic Recovery Programme |
| **FE** | : | Fixed Effects Regression |
| **FINNOV** | : | Financial Innovation |
| **IB** | **:** | Internet Banking |
| **IMF** | : | International Monetary Fund |
| **IT** | : | Information Technology |
| **IV** | : | Independent Variable |
| **JB** | : | Jarque - Bera test |
| **KENSWITCH**: | | Kenya Switch |
| **KEPSS** | : | Kenya Electronic Payments and Settlement System |
| **M/Ts** | : | Mail Transfers |
| **MBS** | **:** | Mobile Banking Service |
| **NSE** | : | Nairobi Securities Exchange |
| **PS** | : | Payment System |
| **PSDP** | : | Payment System Development Programme |
| **RE** | : | Random Effects regression |
| **R&D** | : | Research and Development |

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| **RTGSS** | : | Real Time Gross Settlement System |
| **ROA** | : | Return on Assets |
| **ROE** | : | Return on Equity |
| **SAP** | : | Structural Adjustment Programme |
| **TA** | : | Total Assets |
| **T/Ts** | : | Telegraphic Transfers |

## OPERATIONAL DEFINITION OF TERMS

**Financial innovation**;   the act of creating / new financial instruments as well as new financial technologies, institutions, and markets. They reduce costs, risks, or provide better satisfaction to participants' demands. For example, Internet banking, branch networking, agency banking and electronic funds transfer.

**Performance measurement**; a process of assessing progress toward achieving predetermined goals including information on the efficiency with which resources achieve desired outcomes.

**Financial performance**; a subjective measure of how well a bank can use assets from its primary mode of business to generate revenues. Its measures include indicators such as earning per share, increase in loan base, increase in asset base, increase in profits, and decrease in costs, among others.

**Automated Teller Machine (ATMs);** the combination of computer terminal, record keeping system and cash vault in one unit permitting plastic carding. Customers can enter the bank's book keeping system with a plastic card containing a personal identification number (PIN) or by punching a special code number into the computer terminal linked to the bank's computerized records 24 hours a day.

**Telebanking;**   a form of remote or virtual banking, a delivery of branch financial services via telecommunication devices connected to an automated system of the bank by utilizing Automated Voice Response (AVR) technology.

**Internet banking**;   (online or web banking) is an electronic payment system that enables customers to conduct a range of financial transactions through the bank's website.

**Agency banking**;   an arrangement by a commercial bank (as regulated by the central bank) to contract third party retail networks as banking agents offering selected products and services on behalf of and to the standards set by the bank.

**Electronic Funds Transfer at Point of sale (POS) terminal;** a retail payment device which; reads a customer's bank's name and account number when a bankcard or

credit card is swiped (passed through a magnetic stripe reader). It contacts the bank and (if funds are available) transfers or withdraws the customer approved amount and prints a receipt (Business Dictionary, 2011)

**Profit:** the (instantaneous) difference between total revenue and total costs of a firm or business entity.

**ROA:** return on non-loan bank assets including physical assets, cash and government securities.

**Bank Profitability**: a (lagged) measure of a bank's performance over a given period. It is mainly measured through Return on assets, Return on equity, risk-adjusted returns and the price to book ratio. This study used Return on assets and Return on equity.

**Branch Networking**: increase in bank branches and the attendant computerization and inter-connecting of the geographically scattered stand-alone newly formed and old bank branches into one unified system in the form of a Wide Area Network or Enterprise Network as an innovative means of performance enhancement.

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# CHAPTER ONE

# INTRODUCTION

## 1.1 Background of the Study

In order to overcome numerous operations and financial performance challenges facing the financial sector, commercial banking has evolved globally from conventional banking to high technology systems (Prager, 2001). The changing needs of clients and the move towards a global economy and associated demands has led to the development of automatic teller machines (ATM), cellular banking, wireless banking platforms, smart card technologies, debit and credit card and agency banking platforms (Shirley & Shushanta, 2006). Financial innovation (finnov) is becoming essential in the provision of new processes and products to, in a better way, suit the changing circumstances of time, market and technology in order to meet varied requirements of consumers and other stakeholders in commercial banking. The main motivations for financial innovations has been universal proliferation of financial systems, great advances in technologies and deregulations  in addition to achieving the banks' set financial performance goals.

In Kenya, stiff global competition exposes commercial banks to operational challenges and inefficiencies in the intermediation process thereby rendering the sector comparatively passive and uncompetitive. Private saving and investments are low at 27.8 % of GDP and people prefer less risky, low-rate of return non-banking sector investments (CBK, 2017). It is therefore important to understand the determinants of the banks' comparative financial performance attributed to innovations (e-banking, ATMs, M-banking, branch networking, agency banking, internet banking, asset base augmentation, online account opening and unsecured lending) as indicated by  their  profitability and loan portfolios (Ngumi, 2013).  It is also important to know what this poses to Kenya's economic growth and development, and most importantly how the banks can be innovatively reinvigorated to meet the prevailing national and international demands and challenges (ibid, 2013).

In the view of Nyangosi (2008), financial innovation holds the key to a tremendous capacity for growth through saving and investment. It can be used for improving intermediation and building confidence in the formal financial system for macro-economic stability. Many changes have taken place in the banking sector that have led to widespread infiltration of financial activities, products and organizational forms that have improved the competency and efficiency of the

financial system. Technological developments and the ever dynamic economic conditions have necessitated this change. These advances coupled with changes in the global financial policies and the rising globalization of international financial markets has resulted in heightened financial innovation.

Banking sector is one of the most compelling economic sectors in contemporary societies. It is essential to an economy and a very crucial element in savings mobilization and investments drive (Pringle et al, 2011). Long-term sustainability of an economy calls for a strong banking sector, which also helps forestall financial crises which would otherwise cause economic instability (Valverde et al, 2007). In the view of Nofie (2011), a financial sector innovation is the advent of a new process and / or better financial cost saving product. According to Paulson & Mc Andrew (1998), banks have been forced to rationalize prices and automate in order to improve efficiency and to lower costs in order to meet competitive market demands. On the other hand, there is also an increasing socio- political as well as internal pressure on financial intermediaries to on-load the under-banked and unbanked (Bitner et al, 2000). All these demands on the banks necessitate research, development and adoption of innovations to enhance their performance**.**

Financial intermediaries play a role of risk reduction through sharing, pooling and diversification of risks. They transform the maturity of the portfolios of savers and investors, while providing sufficient liquidity to the system as the need arises (Nissanke & Stein, 2003). Through this avenue, a modern and effective financial system spurs economic growth. Commercial banks are principal players in economic growth and development. They are storehouses of the country's financial resources and a vital spring of capital for trade and industry. Financial services offered by banks are an important influence on real economic activities (Keynes, 1930). Levine (1997) found that economic growth and development springs from financial sector's productivity. Similarly Umoh (1995) avers that capital formation occurs within the financial system where banks intermediate and further calls for more efficient market-based financial resource allocation.

The catalyst effect of the financial sector based on technological innovation and capital accumulation can be used to influence economic growth. According to Valderrama (2003), there exists a positive relationship between financial development and economic growth. Banks muster

savings and allocate credit to different ventures over varied time periods. Banks help households, firms and industry to surmount devastating economic inconstancies by mediating the flow of financial resources from savers to investors. Banks also help in improving the quantity and quality of real investments, which leads to rise in per capita incomes and standards of living. Herring and Santomero (1991) gives an exhaustive contemporary treatise on the impact of financial sector in the state of the economy. On economic grounds and prospect, as part of banking activities, savings is vital owing to its direct link to growth and development of an economy. A vector error-correction modeling technique (VECM) inquiry by Anoruo and Ahmad (2001) in selected African countries established that there is a long-run relationship between economic and savings growth rates. Moreover, Guiso et al (2003) established that private capital flows to emerging market economies have grown to US$1.3 trillion by the late 1990s from close to zero in 1970s. This underscores the critical role of financial flows in development.

Kenya's is a diversified financial system supervised and regulated by the Central Bank of Kenya. According to GOK (2017), the Company Act, the Banking Act and the Central Bank of Kenya Act are the regulatory frameworks of financial sector in Kenya. It has 44 commercial banks. The repeal of Foreign Exchange Act 1992 and the deregulation of interest rate control (1995) liberated the banking industry. Kathanje (2000) noted that the liberalization process resulted in massive failures with 4 banks failing in the year 1993 alone, and 14 by the year 2002. Mugo (2003) notes that by the end of December 2002, owing to mergers, the banking sector consisted of 44 commercial banks, which was a decline from 47 that were there in December 2001.

According to GOK (2017), as at November 2017, the Kenyan financial sector comprised of the Central Bank of Kenya, 14 foreign and 28 domestic commercial banks, one mortgage finance company, 11 licensed deposit taking microfinance institutions, 8 representative offices of foreign banks, the Post Office Savings Bank , 49 insurance  companies, 79 foreign exchange bureaus, 14 money remittance providers, 3 licensed credit reference bureaus and 200 deposit taking licensed savings and credit cooperative organizations (SACCOs) all with a collective membership of more than 3 million Kenyans.

The following table summarizes the major products offered by most of the Kenyan commercial banks.

**Table 1.1: Products offered by Commercial Banks in Kenya**

| | |
|---|---|
| Interbank transfer via KENSWITCH system | Collection of government revenues, utility bills and other recurrent payments |
| Debit Card (e.g. E-card) | |
| Stored value cards (e.g. Mondex) | Inward Remittance via Western Union and other service providers |
| Maintaining various bank accounts | |
| Forex service | Inter bank Credit Clearing |
| Agency functions | Cheques |
| Credit services and CRB | ATMSWIFTED transfer or wire transfer (for international payments) |
| Trustee/ Standing order/Referee services | |
| CDS accounts/ purchase of securities | Internet banking (Limited to inquiry and statement request only) |
| Safe locks | |
| Export promotion cells | Telephone banking (customer inquiry and own account transfer) |
| Trade/ financial information | |
| Payroll service | Electronic banking |

**Source: CBK, 2017.**

The records of Bankelele (2016) shows that in terms of customer deposits, total assets, net loans and profit before tax, the Kenyan banking sector is dominated by six commercial banks namely; KCB Bank, Equity Bank Ltd, Cooperative Bank of Kenya, Standard Chartered Bank, Barclays Bank of Kenya (changed to ABSA from May, 2018) and Diamond Trust Bank. Out of the 1,910,000 total banking accounts, the six dominant banks owned 73 per cent. This is illustrated in Table 1.2 below.

Mugwanga, (1999) also noted industry dominance by these six banks. He noted that they held about 60 per cent of total deposits and an equal percentage of total loans and advances. Kenya Commercial Bank was as at December 2017, the market leader with customer deposits of Kshs 372 billion, a total asset of Kshs 480 billion and net loans to customers of Kshs 332 billion (ibid, 2016)

**Table 1.2: Performance of the Main Commercial Banks, 2017 (Ksh. Billion)**

| Basis of comparison | KCB | EQUITY | Co-Op Bank | SCBK | BBK | DTB | TOTAL |
|---|---|---|---|---|---|---|---|
| Total Assets | 480 (24.4%) | 380(19.3%) | 352 (17.9%) | 264(13.4%) | 264 (13.4%) | 230(11.7%) | 1970 |
| Customer Deposits | 372(24.7%) | 271.3(18%) | 260(7.2%) | 199(13.2%) | 178.2(11.9%) | 227.4(15%) | 1507.9 |
| Net loans To Customers | 332(24%) | 206.2(15%) | 208.6(15.1%) | 285.5(20.7%) | 163.7(11.8%) | 186.3(13.5% | 1382.3 |
| Profits Before Tax | 21.7 (26.5%) | 19.5(24%) | 15(18.4%) | 10.7(13.1%) | 8.7(10.7%) | 6.2 (7.6%) | 81.8 |

**Source: Bank Website and via www.bankelele.bogshot.com/2017 03 08**

### 1.1.1 The Financial Innovations and financial performance of Commercial Banks

Financial innovation constitutes a new product or service that induces cost and risk reduction and provides an improved service/ product /instrument which satisfy users' demands better (Frame & White, 2002). It includes proliferation of diversified financial institutions which revolutionize financial service delivery. Financial innovations can be categorized as new services, new production processes, new products, or new organizational forms. Frame & White (2002) further points out that this new range of finnovs is influenced by enterprise size; market power of an enterprise; the technology's appropriateness, product market conditions and technological opportunity.

Firstly, a bank's profitability indicates its potential to handle risks and to broaden its activities. The main indices used in appreciating bank profitability are Return on equity (ROE), Return on Assets (ROA) and financial leverage (Durdac & Barbu, 2005; Ceylan et al, 2008). These indicators, including profits, are captured by banks' financial and income statements. Profitability is used as a parameter for measuring financial performance which is the main objective of both public and private sector profit driven organizations.

Secondly, loan portfolios stand out as a crucial asset of finance houses, thrifts, banks and other lending establishments. According to Zarutskie (2013), the loan portfolio's value depends on the interest rates earned on the loans and the degree of likelihood that interest and principal amount shall be paid. Lending being the principal business activity and the principal source of earnings for most banking institutions, calls for enhanced volumes in lending as well as fortified loan portfolio management (LPM) anchored on innovation to increase volume of uptake at the same time reduce inherent risks in the credit process (ibid, 2013).

Thirdly, in the view of Martanovic (2023), in commercial banking the return on equity is a measure of business profitability in relation to its equity. It is an indicator of a company's astuteness in investment and allied growth. It is arrived at by dividing annual return by shareholders' equity. It is largely dependent on costs and profits against the volume of equity invested. It is therefore majorly affected by financial innovations. A correlation of online banking in emerging and developed economies indicated that as opposed to emerging markets, in the developed markets lower costs and higher revenues are more evident, leading to higher

ROEs. Sullivan (2000) found no evidence of benefit of internet banking to ROE in US click and mortar banks. Comparatively Furst et al (2002) found higher Return on Equity (ROE) by using the click and mortar business model by Federal chartered US banks. They also examined the factors influencing internet banking adoption and observed that more profitable banks with higher ROEs adopted internet banking after the year 1998 yet they were not the first movers.

From their study, Jayawardhena and Foley (2000) show that internet banking results in cost and efficiency gains for banks yet very few banks were using it and only a little more than half a million customers were online in U.K. In the last two decades (1997-2017), a lot of reforms have been undertaken in Kenya's financial sector that have led to proliferation of financial products, activities and organizational forms that have improved and increased the efficiency of the financial system. Advances in technology and changing economic conditions have created impetus for this change (Roseline, 2010). The financial liberalization process had also brought out a competitive environment in the banking industry which forces commercial banks to aggressively compete in different ways for deposits (Aiana, 2002).

Mannah-Blankson (2004) observes that significant improvements and developments have been registered in the banking sector, for example expanded use of branches by existing and new banks as well as entry of more private banks into the market. With the development of new technologies, branch banking in Kenya has come about to deliver financial services, such as M-PESA, Automated Teller Machines (ATMs), and other stored value cards. These available cost-effective innovations and products reduce pressure on over-the-counter services to bank customers. Tufano (2003) also specified financial innovation as the act of creating or popularizing new financial instruments, technologies, institutions and markets. He summarized functions of innovations to comprise; minimizing search, transaction, or marketing costs; completing inherently incomplete markets; addressing inherent agency concerns and information asymmetries; responding to taxes and regulations; responding to changes in economic conditions such as increased risk; and capitalizing on technological developments for example use of information and communications technology.

Many empirical studies however hold the opposite view on innovation. In the findings of Ho (2006), evolution of electronic means of payment (e-money) to the extreme, may undermine the

functioning of monetary transmission mechanism by replacing bank demand and liquid deposits thereby weakening the link between change in bank deposits and change in real sector activities. In conclusion, the rising economic importance of the financial sector in developing countries, as well as the rapid rate of innovation in this sector have generated a growing research interest in financial innovation (Mannah-Blankson & Belyne, 2004; Bylik, 2006; Tufano & Schneider, 2008). Objectives for further studies should be to find out more benefits that can be generated from financial innovations. There is need to map control measures on their impact on the economy as well as to innovate and put in place fail-safe mechanisms in order to avoid negative impacts of finnovs to all stakeholders.

From studies done in Kenya, we have for example Wafubwa (2013) whose study was on factors influencing performance of commercial banks in Bungoma. The study had no findings on influence of financial innovation though he acknowledged presence of innovations. It was therefore inadequate in revealing relevance of finnovs to relevant users; bank customers, the bankers, shareholders, researchers and state financial control systems. Ngumi (2013) found various (all) positive effects of financial innovations on bank performance. The study used lump sum innovations and limited intervening variables. It's notable that this could have led to failure to reveal specific effects of individual finnovs. There is also a possibility that it could have led to inaccurate generalizations on a factor specific industry which may mislead bank decisions and customer perceptions. Nyaga (2014) from a study on effect of financial innovation on financial performance of commercial banks in Kenya- has findings showing a positive effect of his only two financial innovations ATM and KEPSS on solo performance indicator- Profitability. His study is therefore limited in depth and scope for general reliability by banks. However, his positive finding is a pointer to the need for use of more finnovs and further research and innovation in the field of finance. Cheruiyot (2010) had his study on impact of internet banking on financial performance of commercial banks in Kenya. He found that internet has a small positive influence on Return on Equity (ROE) and Return on Assets (ROA). This study was limited because it used a single finnov's effect on only two measures of performance ROE and ROA and completely ignored the effect of intervening variables. Its lack of depth scientifically limits reliability of its findings for projection purposes by prospective users of the study.

## 1.2 Statement of the Problem

Financial intermediaries were at the center of the world's financial crises of 2007-2009, 2010 and 2015. One of the major structural sources of the crises was asset value deterioration largely attributed to distorted credit management. Rapid globalization, economic changes, regulation, privatization, the changing competitive environment among others demand efficient and effective running of commercial banks through continuous use of innovations. In Kenya, commercial banks have exponentially embraced the use of finnovs including information and communication technologies in their service provision. They have invested huge amounts of money and other resources in implementing the self and virtual banking services with the objective of improving the quality of customer service, investor returns and operational efficiencies (Roseline, 2010). However despite this expensive drive, still stiff competition, emergence of new products, technologies, processes and more demanding markets exerts more pressure on the commercial banks to engage necessary skills and resources to keep afloat and attain market advantage. This rapidly changing market demand exposes commercial banks to operational challenges and exposes inefficiencies in their financial intermediation duties and achievement of corporate goals. It is noted that without prompt uptake of new technology, the sector remains comparatively passive. Private saving and investments in Kenya are low at 27.8 % of GDP and people prefer less risky, low-rate returns from non-bank investments (GoK,2017). It is therefore very necessary to understand the determinants of the banks' comparative financial performance attributed to innovations which they have considerably subscribed to in order to discover how this impacts on economic growth and development, and most importantly how the banks can be innovatively reinvigorated to meet the prevailing national and international demands and challenges. Financial innovation holds the key to a tremendous capacity for growth through saving and investment. It can be used to improve intermediation and confidence building in the formal financial system for macro-economic stability.

First, it is noted that many studies focused on process innovation as opposed to product and financial services innovation. In terms of methodology, a number of the past studies took innovation-performance relationship approach, ignoring the effect of both external and internal intervening factors that definitely affect these relationships. Secondly, number of studies especially on the Kenyan market for example Nyaga,2014; Cheruiyot, 2010 focused on effect of ATM on financial performance of commercial banks. These studies are mostly in the category

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which establish positive impact of finnovs on bank performance. Thirdly, a number of the studies (Jayawardhena& Foley, 2000; Sullivan,2000; Frame & White, 2000; Bylik, 2006) were based on Europe and other developed economies therefore leaving gaps on Africa and other LDCs. Notably there is marked fluctuations in financial performance of commercial banks despite their adoption of modern financial innovations. These leave gaps for further studies in order to discover what, for example, these innovations have on banks based in developing economies like Kenya. Although new technologies in finance industry arise, it is still apparent that a number of studies on financial innovation have been done based on few variables, with little done on how various innovations impact on banks' returns on equity, assets and loans especially as confounding variables based on multilevel regression method. This gives room for further inquiries in this field, a challenge this study purposed to undertake.

## 1.3 Objectives of the Study

### 1.3.1 Main Objective

The main objective of this study was to determine the effect of financial innovations on the financial performance of commercial banks in Kenya in the 2007 to 2017 period.

### 1.3.2 Specific Objectives

The specific objectives include;

i. To determine the effect of financial innovation on banks' return on assets.
ii. To establish the effect of financial innovation on the banks' loan portfolio.
iii. To examine the effect of financial innovation on the banks' return on equity.

## 1.4 Study Hypotheses

This study's hypotheses include;

i. $H_o$: Financial innovations have no significant effect on the return on assets of commercial banks.
ii. $H_o$: Financial innovations have no significant effect on commercial banks' loan portfolio base.
iii. $H_o$: Financial innovations have no significant effect on commercial banks' return on equity.

## 1.5  Justification of the Study

Ncube (2007) postulated that the banking sub-sector dominates Africa's financial sector. Among other factors, this led to concentration of this work on the banking sector. Commercial banking contributes more than 54% of Kenya's finance sector GDP input (CBK, 2017). Given Kenya's quest to develop this sector, a study on the association and inter-relations between financial innovation and bank performance is of utmost importance because it shall offer a significant indicator for economic prosperity and development. The findings are of importance to the commercial banks on policy and regulatory framework designs and can be useful to central bank on policy and governance. The findings serve as a point of reference for banking industry policy making especially in initiating policies that lay foundation for financial innovation. This study is of practical importance to stakeholders in the banking industry and shall specifically; help commercial banks (CBS) to determine the effect of financial innovation on their profit levels by providing statistical evidence on financial impacts of innovations. Product, market planning and development can also find a basis in these findings. Indeed it shall help commercial banks to evaluate how financial innovation influences their loaning system especially on their loan bases. This will underscore the key objective of financial inter-mediation and help increase their income levels. The findings will serve as an investment reference tool to investors and financial institutions on which type of financial innovation to adopt in order to improve their profits and performance respectively. It is as well expected help innovators with reviews and directions on appropriate financial technology. At oversight level, it shall guide the CBK, CMA, NBA and other regulators on the adoption, monitoring and streamlining of finnovs as a safeguard to financial sector and the economy.

Lastly, the study contributes to the body of knowledge and theory of banking and finance. It fortifies the existing literature on the correlation between commercial banks' financial innovations and financial performance. It thus benefits academia as a reference for general knowledge and for research on the same, similar or related areas.

## 1.6 Scope of the Study

The study targeted 42 licensed and functioning commercial banks in Kenya as at fourth quarter of the financial year, 2017. The study covered a period of 11 years (2007-2017). This period was covered by this study because, from the literature review; the last related study (but not similar in

objective and methodology) done in Kenya, in this area was carried out in 2014. Others are Ngigi (2012) and Ngumi (2012). The current study's period not only witnessed the highest level of innovations in the banking industry but also saw the sector undergo regulation and deregulation of interest rates; it witnessed a boom in the growth of SACCOs which pose threats to bank markets. All these necessitated current/contemporary knowledge for stakeholders, hence the need for this study. This study considered audited financial reports of only the 11 NSE listed commercial banks. It focused only on M-banking, EFTPoS, Assets base, Bank networking and internet/Agency banking among other innovations identified by Bylik (2006). The current study investigated the effects of the listed innovations on financial performance commercial banks as measured by three parameters namely; return on assets, loan portfolio base and return on equity.

## 1.7 Theoretical Background

This section gives an overview of the theories anchoring this study. A detailed treatise of these theories is done at the theoretical review section of literature review. This study was based on Constraint – induced financial innovation theory by American, Silber. According to this theory, profit maximization by a financial institution is the key reason for financial innovation in the process of pursuing profit maximization (Silber, 1983). In pursuit of profit maximization, there are some restrictions (external and internal handicaps) which reduces efficiency guarantees management stability, therefore shaking them off is a priority of the financial institutions .The internal and external handicaps in this study are the intervening variables namely; technological advances and industry dynamics (environmental and organizational context factors- operational and legal frameworks). This theory interrogates financial innovation from microeconomic view, it is economy derived and representative hence appropriate for bank units. According to this theory, the challenges and constraints trigger innovations aimed at gaining degrees of freedom to better the banks' financial performance (ibid, 1983). According to Silber (1975), the objective for regulation by monetary authorities is the inspiration for financial innovation.

Commercial banks in Kenya are constrained by; rise of labor unions, higher intermediation costs, non- performing loans, loss of initiative and entrepreneurship, privatization and deregulation among others, all with impact on performance. These aspects of challenges and constraints facing the Kenyan commercial banks in their efforts to gain financial freedoms and more, lends credence and the rationale for adoption of this theory to guide the study.

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## 1.8 Capital Asset Pricing Model

The study is annexed to Capital Asset Pricing Model (CAPM) for ROA and ROE by virtue of both falling under its sphere in terms of investment. This model was developed in 1960s by William Sharpe, Jack Treynor, John Lintner and Jan Mossin.  This model states the relationship between a security (investment) and its expected return. It indicates that the expected return is equal to the risk-free return plus a risk premium based on the beta of that security. In this study CAPM's expected return on security is representative of  ROA and ROE.

The CAPM formula is;

$$R_a = R_{rf} + [B_a \quad x\,(R_m - R_{rf})]$$

Where  $R_a$  = Expected return on a security

$R_{rf}$ = Risk- free rate

$B_a$ = Beta for the Security (stock/equity's market risk)

$R_m$ = Expected return of the market

$R_m - R_{rf}$ = Risk premium

The CAPM equation is used to compute the expected ROA/ROE. It's anchored on the idea of a non-diversifiable (systematic) risk that an investor is compensated for through a premium. The study adopted this model because it is vital in calculating the weighted average cost of capital (WACC) just as it computes the cost of equity. It is used in financial modeling and can be used to find the net present value (NPV) of the future cash flows of an investment and to further calculate its enterprise value and finally its equity value. CAPM helps in understanding the dynamics of capital asset acquisition and the subsequent calculations and rating of returns on both assets and equity and determination of adoption of appropriate innovations to improve general returns in the two critical areas.

CAPM formula helps investor banks (and this study) to understand the dynamics of asset acquisition which is essential in ultimate evaluation or appreciation of returns on corporate investments which this study measured through ROA and ROE. It theoretically outlines the backgrounds of the derivatives from which the two study variables emanate.(More on this theory is explored in chapter two under theoretical literature review).

## 1.9 The Loanable Funds Model

The LFM doctrine is a theory of the market interest rates. It was developed in 1930s by Dennis Robertson of Britain and Bertil Ohlin of Sweden. The theory assumes a fully integrated market with perfect mobility of funds, perfect competition and one interest rate prevailing in the market at any time. This approach determines interest rate through the demand for and supply of loanable funds (loans, bonds or savings deposits). The funds market being a variation of market model, illustrates the interaction of borrowers and savers. What is on sale or purchase is money that has been saved. The current study evaluated how financial innovations influence uptake and volume of loans and whether this affects the financial position of the banks. This theory and its relationship with the current study is explored further under theoretical literature review in chapter two.

CHAPTER TWO

LITERATURE REVIEW

## 2.1 Introduction

An overview of financial sector development in the context of financial performance is presented in this chapter. This is done in order to provide the setting for the study. The chapter entails a brief historical overview of banking industry in Kenya, the theoretical and empirical review of financial innovation - its inhibitors and drivers; bank performance - its measurements and impact.

## 2.2 Theoretical Literature Review

A theory is a reasoned statement or group of statements, which are supported by evidence meant to explain some phenomena. A theory is a systematic explanation of the relationship among phenomena. Theories provide a generalized explanation to an occurrence. Therefore a researcher should be conversant with those theories applicable to his area of research (Kombo and Tromp, 2009, Smyth, 2004). According to Trochim (2006) Aguilar (2009), and Tormo (2006), a theoretical framework guides research, determining what variables to measure, and what statistical relationships to look for in the context of the problems under study. Thus, the theoretical literature helps the researcher see clearly the variables of the study; provides a general framework for data analysis; and helps in the selection of applicable research design.

Financial innovation is explained by various scholars through different theories. Theories reviewed and which are relevant to and/or inform this study are; Capital Asset Pricing Theory, Loanable Funds Theory, Schumpeter theory of innovation, Financial Intermediation Theory and Assets /Entity theory. The theories reviewed inform the source of the variables of the study and the interactions between the dependent and independent variables.

### 2.2.1 Capital Asset Pricing Theory

The Capital Asset Pricing Model describes the relationships between the expected return on a security (investment) and risk. This model was developed in 1960s by William Sharpe, Jack Treynor, John Lintner and Jan Mossin. CAPM indicates that the expected return on a security is equal to the risk-free return plus a risk premium, which is subject to the beta of that security. In the current study CAPM's expected return on security is representative of ROA and ROE. This is

based on the idea that not all risk should affect asset prices. It thus gives an insight into the kind of risks related to return. CAPM is an essential tool for estimating the cost of capital for firms and the returns that investors require prior to investing in a company's assets. According to Rossi (2016), CAPM explains the trade-off between assets' returns and their risks, measuring the risk of an asset as the covariance of its returns with returns on the overall market. The major prediction of the model is a linear relationship between expected return on any two assets and the covariance of the return on these assets with the return on the market portfolio.

Assets have two types of risks; diversifiable and non-diversifiable (market) risk. The advantage of CAPM is that it offers powerful, intuitively appealing predictions regarding risk measurement and of the relationship between expected returns and risk. The model is an ideal depiction of financial markets securities pricing and determination of expected returns on capital investments. The CAPM provides a methodology for risk quantification and its translation into estimate of expected return on equity (ROE). The objective nature of estimated costs of equity calculations is an advantage of CAPM. In spite of a persisting debate on use of CAPM, modern financial theory is currently inherent to investment management. Issues in corporate finance are equally benefiting from same techniques. The empirical record of CAPM is poor. Its empirical problems may be attributed to difficulties in implementing valid tests of the model or simplifying assumptions.

The CAPM formula is; $R_a = R_{rf} + [B_a \quad x \ (R_m - R_{rf})]$

Where $R_a$ = Expected return on a security; $R_{rf}$ = Risk- free rate; $B_a$ = Beta for the Security (stock/equity's market risk); $R_m$ = Expected return of the market; $R_m - R_{rf}$ = Risk premium.

This formula is applicable in calculating the expected ROA/ROE. CAPM is anchored on a systematic (non-diversifiable) risk for which investors need to be compensated in the form of a premium.

CAPM formula helps investor banks (and this study) to understand the dynamics of asset acquisition which is essential in ultimate evaluation or appreciation of returns on corporate investments which this study measured through ROA and ROE. It theoretically outlines the backgrounds of the derivatives from which the two study variables emanate.

The current study adopted this model because it is important in calculating the weighted average cost of capital (WACC) just as it computes equity costs. Financial modeling employs it to ascertain net present values (NPV) of future cash flows of an investment as well as to calculate its  equity and enterprise value.

**2.2.2 Loanable Funds Theory**

The loanable funds doctrine (LFD), a product of the Stockholm school, is a theory of the market interest rate. It was developed in 1930s by Denis Robertson of Britain and Bertil Ohlin of Sweden. LFD has it that demand for and supply of loanable funds determines the interest rates. The loanable funds include savings deposits, loans or bonds and the funds market consists of loaners and borrowers. Loanable funds are demanded for investment, hoarding and dissaving.  A bank needs adequate deposits to be in a position to lend. Banks must develop or adopt effective deposit attracting innovations which should trigger increased borrowing by customers (Robertson & Ohlin, 1990). Critical control variables for loan base are Gross Domestic Product growth, country specific fixed effects, loan demand and in some specifications, time and bank-specific fixed effects. Bank performance depends of a fortified intermediation process which can be achieved through appropriate financial innovations that increase loan volumes for example use of mobile loans, branch loans and agency loans. Risk assessment, transforming lending into long-term partnership and invoice financing for short term needs can be used to enrich bank loans. Reducing loan defaults is also a viable means of ensuring healthy loans. The impact of all these can only be ascertained through external and internal studies.

Disadvantages of Loanable funds theory are; it assumes both savings and income are independent, it's indeterminate; it's impracticable, it assumes hoardings, savings, investment unrelated to interest rates; unsatisfactory integration of real and monetary factors, lastly it (unrealistically) assumes a constant level of national income. It is however, considered broader and realistic than classical theory of interest. This is due to the fact that it links liquidity preference, quantity of money, savings and investment; recognizes the effect of hoarding on interest rate; lastly, the theory recognizes the role of bank credit (source of loanable funds). The current study tested this theory at objective number two; to establish the effect of financial innovation on banks' loan portfolio bases. However, in adopting this doctrine, care was taken to

disconnect it from the classical interest theory, which disregards the characteristic feature of LFD, (its integration of bank credit into the theory of interest rate determination).

### 2.2.3 Schumpeter's Theory of Innovation

Schumpeter started studying in the 1930s, how market innovations affected capitalist systems. From his analysis of the capitalist model, he found a glaring difference between bankers who create credit to finance new ventures and entrepreneurs whose innovations create conditions for profitable new enterprises. Schumpeter (1939) stressed that the principal role of credit-creation by bankers was the monetary compliment of innovations. As independent agents with no proprietary interest in the new enterprises they fund, bankers are the sole risk bearers. This calls for special ability to judge potential for success in funding entrepreneurial activities.

Innovation was identified by Schumpeter (1939) Theory of Creative Destruction as the critical dimension of economic change. He asserted that economic change is linked to entrepreneurial activities, market power and innovation. He sought to prove that innovation-originated market power could provide better results than market forces and price competition. He argues that technological advance is the main source of economic growth and development. It further identifies desire for monopoly profits as the main incentive for galloping innovations.

The theory has strength in recognizing the role of innovation in cutting production time and costs thereby increasing a firm's competitive advantage and ability to brave unforeseen limitation. Its weakness is in the presumption that innovations are financed only by bank credit. It is highly institutional and overrates entrepreneurs' role by considering them innovators. Most importantly it downplays and overlooks the effect of trade cycles on an economy.

This motive-based theory helped the study identify banks' financial innovations and evaluate the effects of bank innovations on goal attainment especially of profitability, loan portfolio as well as returns on equity of NSE listed commercial banks in Kenya.

### 2.2.4 Financial Intermediation Theory

In the estimate of financial intermediation theory, financial innovations are triggered by search for new profit making ventures. This theory was developed in 1960 by Gurley and Shaw and later in the 1990s fronted by Franklin Allen and Anthony M. Santomero. According to the theory, search for profitable financial innovations are triggered by the economic environment.

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Market imperfections due to information asymmetries deviates the economy from neoclassical frameworks. The imperfections culminate into various transactions costs which financial intermediaries are seen to partially overcome. According to Diamond (1984), financial intermediaries are delegated monitors on behalf of the ultimate savers. According to Diamond and Donner (2007), banks (coalitions of depositors) provide households with insurance against idiosyncratic shocks that adversely affect their liquidity position. This theory was adopted to guide the pursuit of this study in determining the effect of financial innovation- a result of market research, on profitability. It was also applied in determining the banks' monitoring as well as insurance roles on owners' investment which the study evaluated in terms of returns on equity.

### 2.2.5 Assets /Entity theory

Entity theory is a concept that advocates for the separation of business transactions from transactions of its owners. According to Hayes (2022) the theory states that assets of the owners should not be mixed with the business, as owners cannot be personally liable for the debts of the business. The entity theory enables one to accurately determine the financial position of the business by distinguishing between personal from business assets and liabilities. The entity theory is understood to have started around 1600 as promulgated by Lord Coke, where he declared that a corporation is a separate entity or an artificial person created by a sovereign power.

The entity theory is largely associated with the limited liability concept, which applies to corporations and limited liability companies (LLCs) as opposed to a sole proprietorship structure. It states that owners (shareholders) have a separate identity from companies and that they are not personally liable to business creditors for company debts. The entity theory is essential to the smooth operation of commerce through the separation of ownership and control. The owner's finances should not be tied to the business in order to eliminate liability to the creditors.

The entity theory is often compared to the proprietary theory, which is essentially its opposite. The proprietary theory states that there is no fundamental difference between the owners of the business and the business itself. Basically the entity does not exist separately or otherwise from its owners. Proprietary theory applies to sole proprietorships. It doesn't encompass the concept

of limited liability. The accounting treatment for the theory shows a clear reflection of distinction and autonomy between owners and the entity.

It thus states;

Assets = Equity

Assets = Liabilities + Shareholders' Equity

Assets are rights that flow to and are owned by the entity. The source of assets is shareholder equity and liabilities. The income earned by an entity is the property of the entity until it is distributed to equity holders usually through dividends. The entity theory emphasizes how profit is determined. Profit is accountable to shareholders and the entity is responsible for satisfying the rights of equity holders. It inevitably makes the entity theory income statement-oriented. It is also criticized for its inherent detachment from reality and its possible contribution to agency problems. Despite the criticism, the entity theory has shaped the accounting of limited liability companies and their disclosure requirements.

The entity theory was adopted by this study to help unravel the relationships that exists between some of the study variables and how they relate with each other as well as how they affect each other in their operations. In particular clearly outlines the regular treatment of banks assets, liabilities, and dividends, herein treated as returns on equity. We use the entity formula together with the Du Pont model to calculate the banks' ROE and ROA (Martanovic, 2023). This is because it incorporates aspects of both the income statement and balance sheet. This approach conveniently gives both net profit margin and the total asset turnover.

Through the Entity accounting equation, we are able to predict the direction on actions between the study variables based on how the entity theory relates them. The final regression outputs; correlation coefficients, the p-values would ultimately accept or reject these relationships postulated by the entity theory. On the backdrop of the foregoing theory, the current study therefore deemed it necessary to launch an enquiry into how the various forms of financial innovations relate in affecting commercial banks' financial performance based on the ratios identified herein, in the 2007-2017 study period in Kenya.

## 2.3 Empirical Literature Review

Empirical literature review is a directed search of published works, including periodicals and books, that discusses theory and presents empirical results that are relevant to the topic at hand (Zikmund et al., 2010). Literature review is a comprehensive survey of previous inquiries related to a research question. Although it can often be wide in scope, covering decades, perhaps even centuries of material, it should also be narrowly tailored, addressing only the scholarship that is directly related to the research question (Kaifeng & Miller, 2008). Through the use of a systematic approach to previous scholarship, literature review allows a researcher to place his or her research into an intellectual and historical context. In other words, literature review helps the author declare why their research matters (Kaifeng& Miller, 2008).

### 2.3.1 Contemporary Innovations in the Banking industry in Kenya

In the Kenyan economy, banking products prior to the current financial innovations included Current and Savings Accounts; for corporate (Railway employees) and individual customers. Savings accounts were mainly held by literate customers (Ryan, 2007). The bank and Non-Banking Financial Institutions (NBFIs) recorded a post year 2000 growth stimulated by a relatively stable macroeconomic environment. New products and strategies aimed at maintaining market were introduced by banks to stave off new competitive banks. The Central Bank of Kenya (CBK) targeted an efficient financial sector capable of risk reduction in the payment and settlement systems of international standards. This it pursued through sustained implementation of its Payment Systems Development Programme (PSDP), (CBK, 2017). The following are the forms of innovation adopted in this study.

### 2.3.1.1 Mobile/ Telephone Banking

According to Balachandher et al (2001), telebanking (telephone banking) is a form of remote or virtual banking, which is essentially the delivery of branch financial services via telecommunication devices where the bank customers can perform retail banking transactions by dialing a touch-tone telephone or mobile communication unit, which is connected to an automated system of the bank by utilizing Automated Voice Response (AVR) technology.
 Mobile banking is a financial transaction made on a mobile device for example cell phone and tablet.  The activities include securing from fraud attacks to a client as well as offering a platform for paying bills or money transfers. Its advantages include ability to work anywhere any time and

peer to peer funds remittance across borders (which have enormous economic significance to receiving countries). Its disadvantages include limited range of capabilities as compared to personal or computer banking.

Access to and supportive factors of mobile banking positively relate with user satisfaction. It improves bank financial performance by enlisting more users. This is according to a Jordanian study on effects of mobile banking on customer interaction and bank performance, Khaled et al (2019). The study noted that uptake of mobile banking depends on level of publicity and the aspect of fear of fraud. Left unchecked, these risks would lower financial performance of the banks. In addition the study found that mobile banking applications help customers manage their finances better, easy recognizability of mobile banking provider boosts confidence, quality of some products enhance customer satisfaction, lastly clarity of mobile banking user lines increase customer satisfaction, Ibid (2019).

Singh and Sinha, (2016) on their study in India notes that; save for security reasons, mobile banking opens up significant business opportunities based on security of convenience and banks gain more financially from such openings. They also noted that age, perception and occupation influences uptake of mobile banking in India. The study noted concern on security on mobile banking as it could easily affect banks' earnings. Mutua (2010), from his study on effects of mobile banking on the financial performance of commercial banks in Kenya, noted a positive but weak relationship between the two variables. The weak relationship is attributed to effects of negative macroeconomic variables for example, inflation, post-election violence, forex rate fluctuations  despite the  rise in number of mobile banking users and quantities of money transacted through mobiles.

From her study on how mobile banking has affected the banking industry, Cleveland (2016) found that mobile banking keeps the banks in competition. Banks save billions of dollars in costs; deposits are cheaper and finally it noted a decrease in non-interest income alignment due to mobile banking. The study recommended segment service improvement based on the mobile banking platform for various types of customers. He equally called for cutting edge security to ensure full integration of all aspects of banking on the mobile banking platform. Deshwal (2015) in his study of mobile banking in India noted that; banks need to create awareness of the mobile

based banking products. Trust based on security and privacy influence mobile banking. Notably, ease and usefulness of mobile banking services determines uptake leading to bank's improved financial performance. He recommends cost reductions for the price conscious customers. A study by Bavaneshwari et al (2014) in Ponmolai area at Tricky, found a positive effect on bank performance via mobile banking. In order to increase profitability via mobile banking service, the study recommended that banks should update, publish, explain, simplify and, fortify services in order to win more customers and to become more competitive in the dynamic market.

Kato (2012) studied the effect of mobile banking on performance of commercial banks in Kenya. He established a positive relationship between the variables. According to Tharaka and Ranjani (2017) on financial effect of mobile banking in Sri Lanka; telephone banking variously benefit both banks and customers. For the banker it substantially lowers costs than those of branch-based services while for the customer it provides expanded access, significant time saving and increased convenience. Mobile banking has nearly all ATM's impact on productivity except the cash dispensing utility. The above study relates with this research on its objective and independent variable- mobile banking though in different times and economic contexts. The current study has adopted mobile banking services (MBS) as an independent variable and reveals the effect of mobile banking on financial performance of Kenya's listed commercial banks as gauged through its impact on dependent study variables; ROA, Loans and ROE.

### 2.3.1.2 Internet/Agency Banking

According to Agarwal (2016), the idea of Internet Banking (IB) is; "to give customers access to their bank accounts via a website and to enable them to enact certain transactions on their account, given compliance with stringent security checks". The Federal Reserve Board's (Office of the Comptroller of the Currency) Internet Banking Handbook (2001), describes Internet Banking as "the provision of traditional (banking) services over the internet". By its nature, IB offers, convenience, flexibility and a virtually absolute control over their banking. Services delivery is informational and transactional. It eliminates distance/ time barriers and opens up opportunity for unlimited productivity for the bank by linking them to distant customers. It is the most cost – efficient technological means of yielding higher productivity. Internet is the basic platform for agency banking; the two are technically considered proxies.

According to Vyas (2012), internet banking is the use of computer (PC) and a browser to get connected to a bank's website to execute any of their approved virtual functions. It is a borderless technology devoid of confines of time, place and method. The banks are interconnected through intranet (network) for example SWIFT. Benefits of internet banking to consumers include e-commerce (e-banking, e payment, e- trading,). E-banking enables: account information inquiries, bank accounts transfer, card accounts transfer, transfer of forex, the B2C disbursement on net among others. It is cheaper, easy to set up and it gives customers more choice hence loyalty. However, it calls for more risk reduction and mitigation (Vyas, 2012).

A study by Valence (2017) on the impact of e-banking on financial banking operations in Cameroon found that age determined usage of e-banking services. Customers favored e-banking over branch banking (brick and mortar). Notably, there was a negative correlation between profitability and e-banking of UBA banks implying a bit of the bank profits don't rely on e-banking. The study recommended more use of e-banking, improvement of services and security. According to Abrol (2014), highly educated and younger people are the main users of internet banking. From his study on impact of internet banking on customer satisfaction and business performance in India, he found that customers were satisfied with their banks' e-banking services which save on costs, time and offers unlimited remittance. The study also found that internet banking is essential for banks' survival and for a bank to compete effectively, it is mandatory. Kiragu (2017) in his study on effect of e-banking on the financial performance of Kenyan banks found that e-banking had positive impact on services offered to customers due to easy access to accounts, it therefore improved profits. The study also noted that e- banking has the potential of increasing costs which may lead to negative impact on performance. This necessitates diversification and reduction of subscription fees for PoS banking.

In a related study on Internet banking adoptions in Kenya at Nairobi city, it was noted that internet banking is relatively low in Kenya at 24.82%. It noted that e-banking is popular with male and younger generations and use of e-banking is pegged on perception of its usefulness. The study recommended that banks' websites should facilitate customers with 'one stop' comprehensive financial services and hands-on training to users in order to increase benefits. Njuguna *et al* (2013). A study by Kinyua, (2018) on the effects of internet banking on efficiency of commercial banks in Kenya, found that unit increase in internet banking and liquidity causes a

significant increase in efficiency and to a large extent: liquidity, bank size and capital adequacy influences efficiency and financial performance through internet banking. Wadhe and Saluja (2015), in their study on influence of e-banking on profitability of commercial banks in India found that there exists positive association between e-banking and both private and public sector banks' profitability. They however found negligible association between number of bank branches and banks profitability.

Sullivan (2000) compared banks in the $10^{th}$ Federal Reserve District, 19 that had transactional internet website as of the 1st quarter of 2000 to those that did not have such websites. He found the first group to be significantly located in areas with a more educated population and they had higher population fraction in the 18 to 64 age group and the banks were also significantly larger in size. Banks offering transactional website were also found to have higher non-interest income. Cheruiyot (2010) studied the role of internet on return on equity and return on assets of commercial banks in Kenya. He found a positive relationship between internet and the two measures. Lang and Noelle (2002) analyzed data on internet banking as of the $3^{rd}$ quarter of 1999. Through application of logit models, they found that a bank's choice of adopting internet banking is related to holding company affiliation in an urban area, higher non-interest income higher fixed expenses. Among banks that offer internet related services, greater numbers of service offerings were positively related to bank size and the length of time spent on offering internet banking. Strassman and Shu (2005) conducted a study on twelve US banks to find out whether IT provides banks with profit. Based on panel data analysis of nine years, the study found that IT investment demonstrated the highest marginal product among the study's input factors. Age factor wasn't considered.

Cheruiyot (2010) examined effect of internet banking on commercial banks ROA and ROE in Kenya, he found a positive relationship, the validity of which the current study set to test and compare given the time lapse. Unlike the logit model used by Noelle and Lang, this study did analysis of the same parameters using panel data diagnostics. Closely associated with their variable (internet banking) is Agency banking which entirely relies on the internet for its operationalization. The study therefore treated the proxies as one unit based on internet operations data.

Agency banking is a partnership between banks and non-bank firms in retail commercial outlets such as pharmacies, lottery kiosks, goods stores, and post office to provide specified banking services (Kumar et al, 2006). First developed in Brazil, agency banking has so far matured 99% over the country's municipalities with positive impact on the economy. South Africa and Kenya were the first to adopt this technology in Africa (CGAP, 2010). However, greater financial inclusion has been witnessed since 2010 through agency banking CBK (2016). Chemutai (2017) from his study in Kenya aimed at determining the effect of agency banking on customer growth, deposits and cost reduction, found that there was a significant growth in customers and new accounts as well as significant overall reduction in costs as a result of agency banking.

Closely associated with internet banking is personal computer (PC) banking. This is because they share similar operating medium- the internet. It is a service which allows the bank's customers to access their bank accounts for retail banking via a proprietary network, usually with the help of proprietary software installed on their personal computer. Berger (2003) argues that the relevant aspects of technological change include innovations that reduce costs related to the collection, storage, processing, and transmission of information, as well as innovations that transform the means by which customers access bank services. According to Radecki (1997), the immediate goal of PC banking is to take routine transactions and service requests out of branches in order to trim the branches. ATMs, Phone centers and PC banking create opportunities for cost savings within the current framework of branch structure. It also has the benefits of Telephone Banking and ATMs. Ogare (2013), from his study on the effect of electronic banking on the financial performance of commercial banks in Kenya, concluded that PC banking has a moderate influence on profitability explained by electronic banking. However, the statistical significance is different for each electronic banking component tested, so banks should adopt various forms of electronic banking for meaningful contribution to profits. Nader (2011) had his study on the effect of banking expansion on profit efficiency of Saudi banks. It was a multivariate approach with a number of explanatory variables. The tests rejected hypothesis for the relationship for; number of POSs, availability of PC banking and availability of mobile banking. It however accepted the hypothesis for phone banking, number of ATMs and Number of branches.

Given the fast rise in numbers of agency and other internet based banking in Kenya, and being a key variable in this study, it was of great interest to find out the current Kenyan situation on

internet/agency banking and its contribution to financial performance of NSE listed banks, and how it compares with past studies. The current study therefore adopted internet banking as an independent variable in order to find out its effect on dependent variables ROA, Loans and ROE so as to reveal its overall impact on financial performance of the listed commercial banks.

**2.3.1.3 Electronic Funds Transfer at Point of Sale (EFTPoS)**

An electronic funds transfer at the point of sale is an on-line system that allows customers to transfer funds instantaneously from their bank accounts to merchant account when making purchases (at purchase points). It uses a debit card to activate an Electronic Fund Transfer Process (Chorafas, 1988; Cause, 2017). Increased banking productivity results from the use of EFTPOS to service customers' shopping payment requirements instead of electrical duties in handling cheques and cash withdrawals for shopping. Horan (1980) categorized the Electronic Fund Transfer (EFT) system technology into four namely; Automated Teller Machines (ATMs), point-of-sale (POS), the Automated Clearing House (ACHs), and National Bank Card Networks (NBCNs). He found EFTPoS to be a time saver to all involved in the transaction.

Agboola (2006) in his study on ICT in banking operations in Nigeria using the degree of the utilization of identified technologies; the nature and degree of innovative technologies; and the impact of adoption of ICT devices on banks, found technology to be the main driving force of competition in the banking industry. During his study, Agboola (2006) witnessed increase in the adoption of smart cards, ETF, ATMs, electronic home and office banking as well as telephone banking. The study found that adoption of ICT leads to a wider, faster and more efficient market on top of improving the banks image. The study asserts the need for bank management to intensify investment in ICT based innovations and products to facilitate speed, convenience and accurate service, or lose out the competition. Kozak (2005) assessed the strategic impact of ICT in the rural banking sector and the benefits of introducing ICT in Ghana. The study reveals that the Atiwa rural bank lacks the desired technologies the desired to support its operations but also had the advantages of limitation of customers' waiting time, fast business with customers, cut down on its operating costs, provision of convenient banking services to its customers and attraction of large customer base thereby increasing its revenue volume and also experiencing a sharp increase in its profit level since the deployment of ICT into its systems.

Based on the theory of constraints, Tennakoon (2020) tested the impact of electronic banking practices and ownership on the operational efficiency of Sri Lankan commercial banks. Multiple regression analysis evidenced the strong positive impact of electronic banking practices on the operational efficiency of both categories of banks. While ATM topped, they also found internet and mobile banking significant.

The Kenyan financial system has in the last few years witnessed rapid increase in uptake and use of various forms of credit cards by the rapidly rising banked population (CBK, 2017). Given the presence and wide use of credit cards, it was therefore necessary to establish the impact of this development on the financial performance of commercial banks, a challenge this study undertook by using a multidimensional (panel) data from the competitive eleven NSE quoted banks for a period spanning eleven years.

### 2.3.1.4 Branch Networking

Networking of branches is the computerization and inter-connection of geographically scattered stand-alone bank branches into one unified system in the form of a Wide Area Network (WAN) or Enterprise Network (EN); for creating and sharing of consolidated customers information/ records (Alu, 2000). According to Mannah- Blankson (2004), branch networking offers; quicker inter-branch transactions rates, because it eliminates travel time and distance hence productivity per time period is increased, it also allows simulated division of labor among bank branches with its associated positive impact on productivity.

Hirtie (2005) from his study on the impact of networking size on bank branch performance found that despite innovation, USA bank branches have grown steadily. Banks with midsize branch networks may be at competitive disadvantage in branching activities and there was no systematic relationship between branch network size and institutional profitability – perhaps because banks optimize the size of their branch network options as part of an overall strategy involving both branch and non-branch based activities.

Kazumine (2017) from his study investigating whether branch network size influence positively the management and performance of Japanese regional banks, found that regional banks with more networked branches, can increase their loans and bills discounted as well as their small and mid-size enterprises (SME) loans and bills discounted. Their Return on Assets (ROA) and ROE

(Return on equity) was found to be lower. In a related study by Grzelonska (2005) in America on the benefits of branch networks on deposits and performance. It was found that the expected distance to branch is a significant factor in explaining consumers' choices of depository institutions and that dispersing the convenience of a branch by merely 0.26% may lead to decrease of total depositing by 6%. This clearly underlines the importance of branch networking of a bank to its financial performance.

Zhou et al (2019), a study in USA on branch network and customer omni-channel banking behavior, established that branch opening and networking increase customers branch transactions, however, the first branch opening leads to a migration of complex transactions to the branches which might result in a net decrease in online banking in the short term. As consumers interact more with physical channels, there is a gradual synergetic increase in customers' transactions via online banking as well as alternative channels due to warming spillover effects. Kushvinder (2022), a study on impact of branch network size and fixed assets investment impact on bank performance in India, found that opening up of additional bank branches had statistically highly significant positive relationship with return on assets. However he noted a negative relationship between total assets and return on assets.

Corlson & James (2003) in a study on branch banking, bank competition and financial stability, in the USA, found that branch banking increases competition and forces weak banks to exit the banking system. This consolidation strengthens the system as a whole without necessarily strengthening the branch banks themselves. In a related study on Branch Network Growth and Banks' performance (1981-2013), done in Nigeria, it was found that there is no positive relationship between the growth of branches in the rural, urban or foreign centers which implies there's need to open more branches if the banks want the assets to grow, Olajide et al (2013).

In the same group Salvo and Ferri (1998), a study on availability and cost of credit for small businesses; customer relationships and credit cooperatives, found a negative returns from loans in relation to branch-networks. On firm size and asset growth (as forms of financial innovation to gain edge) and their impact on a firm's financial performance, Ramadini (2024) studied listed companies in the financial subsector in Indonesia. Results partially showed that size of company affects its dividend policy while asset growth had no effect on dividend policy.

In Kenya, a study by Nyatika (2017) on the effect of spread in branch network on financial performance of commercial banks in Kenya, found that the spread of branch network is vital in increasing access to bank products and services in addition to addressing erstwhile unmet needs of customers, thereby increasing banks' financial performance. Musyoka (2011) in her study done in Kenya on the relationship between branch network spread and financial performance of commercial banks, found out that; there was a marked growth in all areas/ measures of performance including loans portfolio, assets, total profits , shareholders equity, and in deposits. The study found the correlation coefficients between these financial performance factors and branch network was high, meaning that banks' financial performance and growth highly relates with branch network. Studies on this parameter so far indicate a positive relationship between it and bank performance. Given its valuable input in the financial sector as evidenced by reviewed past studies, the current study identified and adopted branch-networking as an independent parameter. The study endeavored to relate the past observations to a time lagged analysis for 2008-2017 period, time long enough to make valid conclusions on a trend on the relationship between branch networking and bank financial performance determined by its effect on the study's dependent variables ROA, Loans and ROE.

**2.3.2 Drivers/Inhibiters of Financial Innovations**

This section outlines some of the factors which promote or inhibit financial innovations by commercial banks in order to enhance understanding of the nature of innovations especially the ones under study. In the theoretical review, it has been noticed, "there are many factors influencing both positively and negatively at different degrees and in different ways. The innovations adoption process is a mixture of push influences" (Warren, 2004). Further, Elliot (2002) asserts that innovation adoption is not only complex but also context-sensitive. Environmental and organizational context factors as well as technology or innovation related ones play a significant role (Elliot, 2002; Al-Qirim, 2003).

**2.3.2.1 Organizational Context Factors**

The organization context of a firm is characterized by availability and quality of financial resources, human resources, and managerial structures. Organizational factors equally play an important role in creation and adoption of innovations. For example, according to Warren (2004), the propensity with which innovations are adopted and employee educations have a

positive relationship. Education consists of knowledge, skills, and confidence necessary for successfully operation of innovation and their allied applications. Education therefore, is critical because it affects innovation acceptance as well as human capital by determining its competencies which determine the speed and the coverage of the adoption in organizations (Warren, 2004; Fillis, 2004).

Several arguments support a large size firms; they are assumed to direct innovation and spread its process due to economies of scale and scope in Research and Development (R&D) activities (Buzzachi, 1995). Economies of scale positively relate with cost reduction, availability of internal funds, spread of risk, and expertise among other factors necessary for development and adoption of financial products, (Mohieldin & Nasr, 2007) and (Megyery & Sader, 1996). According to Simpson and Docherty (2004), industry associations and government role though necessary, are not sufficient for successful adoption of innovation. However, industry champions can strategically motivate other potential adopters because they define adoption trajectories and "provide blueprints" for innovation adoption process.

### 2.3.2.2 Innovation Factors

In the view of Tornatzky and Klein, (1982), innovation or technology related factors focus on how features of the technology itself influence its adoption. Thirty distinct characteristics have been found to significantly affect adoption. These include the relative advantage the innovation offers compared to the costs involved in adopting it, its complexity and compatibility with the adopting organization, and how observable the results of the innovation are (Al-Qirim, 2003; Rogers, 1995; Russell & Hoag, 2004). Innovations are expected to generate competitive advantage via practical benefits including efficiency, reliability, increased levels of quality and service among others (Fillis, 2004; Gilbert, 2004; Warren, 2004). An awareness of benefits is a precondition for innovation adoption (Flanagin, 2000; Elliot, 2002; Simpson, 2004). On the other hand, lack of awareness of them is likely to fuel concerns about an innovation. In addition, Rotchanakitumnuai and Speece (2003) imply that innovation adoption is likely to be accelerated as more adopters start experiencing its previously perceived benefits. On the other hand, perceived set up and on-going costs, technical difficulties and innovation complexity are likely to make innovations unattractive, adversely affecting their adoption. The combination of positive and negative perceptions concerning an innovation represents an organization's readiness to

adopt it (Gilbert, 2004; Bodorick & Dhaliwal, 2002; Simpson & Docherty, 2004; Taylor & Murphy, 2004).

According to Hussein and Hassan (2010), a number of factors are noted to affect performance of banks and other financial institutions. The five major ones being; credit and deposit growth, asset quality, capital adequacy, profitability and risk. However, exogenous and endogenous factors which influence bank performance are more. For example from past studies; Dawood (2014) in his study on factors affecting profitability of commercial banks in Pakistan concluded that liquidity and profitability relate negatively. His finding is consistent with Gul et al. (2011) whose study was on factors affecting profitability in Pakistan. High liquidity means that banks have less short term borrowed fund deposits. Hussein and Hassan (2010) from their study on factors influencing the UAE Islamic and Conventional national banks had results indicated that from a set of internal and external factors considered as independent variables in including; GDP per capita, size, financial development indicator, liquidity, concentration, cost and number of branches; liquidity and concentration were the most significant determinants of conventional national banks' performance.

From his study on effect of capital adequacy and deposits on performance, Dawood (2014) concluded that both have a positive relationship with profitability of commercial banks. However, capital adequacy has a significant relationship while a deposit has an insignificant relationship. From the foregoing statement, it concluded that deposits do not lead to profitability for commercial banks. This result is consistent with Fredric (2014). This observation indicates that with more equity the chances of return on assets will be lower. Lastly, on bank size and performance, Dawood (2004) found an insignificant positive relationship exists between size and profitability of a bank. This result is similar to Fredric (2014) but inconsistent with Gul et al. (2011) which found a significant positive relationship of bank size with its ROA.

According to Olweny and Shipho (2011), additional dimension on study of bank performance is added through balanced portfolio theory. The theory posits that the portfolio composition of a bank, its profit and the return to the shareholders is an outcome of decisions made by the management and overall policy decisions. Hence, banks performance is affected by both internal and external environment.

In the view of Athanasoglou (2005), the banks' asset is another bank specific variable that affects bank profitability. Among others, bank assets include; fixed asset, current assets, credit portfolio, and other investments. A growing asset (size) is often related to the age of the bank. More often the loans given out are the main asset that generates major share of the banks' income. The quality and quantity of loan portfolio is therefore a factor which determines the profitability of banks.

### 2.3.3 Measurement of Financial Performance

Performance of a firm is a four elements multifaceted formulation consisting of ; human resource performance, including employee satisfaction; product or service performance; customer-focused performance (including customer satisfaction); financial and market performance, including revenue, profits, market position, cash-to-cash cycle time, and earnings per share;  and organizational effectiveness, including production and supply chain flexibility, time to market, level of innovation, (Alam, 2011). It is economic performance of the bank as measured by financial indicators such as;  the firm's stock beta and alpha, price-to earnings ratios, and Tobin's q-ratio are indicators for short-and long-term financial performances. These results are reflected in the firm's investment, return on assets, value added among others.  According to Avakiran (1995), the financial performance of financial Institutions especially of banks has been measured using bench-marking, measuring performance against budget, using a combination of financial ratios analysis or a mix of these methodologies.

Performance can also be based on operational efficiency and operational effectiveness, between risk and return, and others captured by the acronym CAMELS which refers to the five components of a bank's condition that are assessed: Capital adequacy, Asset quality, Management, Earnings, Liquidity, and a bank's Sensitivity to market risks. Ratings are assigned for each component in addition to the overall rating of a bank's financial condition (Jose, 1999). From a study on Ghanian banks, asset quality (considered one of the major driving forces of a firm) was found to be a factor of loan growth, bank market structure, bank size, inflation, real exchange rate and GDP growth Al Hassan et al (2014). Asset quality in this case was considered as a measure of performance. Other measures of bank performance include; banking experience, personnel efficiency, friendliness of staff, asset and liability management, reputation and availability of branches abroad (globalization), the size of and effective portfolio management,

financial soundness and profit after tax (BOU, 2002; Richard & Maloney, 2003; Ruth, 2001; Ian, 2000; Elizabeth, 2004).

Different factors have been used by researchers to measure bank performance. They include: fixed assets to total assets; liquid assets to fixed assets ratio; shareholders' equity; total borrowed funds to total assets; reserves for loans to total assets; total loans to total deposits; the market size; bank portfolio composition; market concentration; labor productivity; capital productivity, financial interrelation ratio; bank capitalization level; age of the bank; per capita Gross Domestic Product (GDP); customer satisfaction and the cost to-income ratio (Athanasoglou, 2008).

Dividend policy has for example been used by some banks and other financial institutions to measure performance. Gumeler et al (2022) for example used dividend as a measure and found out that simultaneously ROE, CR, DAR, and firm size influence dividend policy. Partially ROA was found to have a positive effect on dividend, but CR, DAR, and Firm size variables had no effect. Closely related to the above is Simanullang et al (2021) who used company /firm value as a measure of bank performance. It was used to capture effect of ROA and ROE, with the observation that ROA had a positive significant effect on firm value. However, though it had the same profitability ratio, it was different from ROE variable which had no effect on the issuer's value. Both studies were done on listed banks in Indonesia.

Financial performance of banks is often stated as a function of external and internal determinants. The external determinants are not related to bank management but reflect the economic and legal environment in which the bank operates therefore affects performance of the financial institution. The internal determinants originate from bank accounts (balance sheets and/or profit and loss accounts) and therefore can be termed bank-specific or micro determinants of performance.

Various explanatory variables have been proposed for both categories, in line with the nature and purpose of each study (Alam, 2011). Inquiries focused on internal determinants use variables like expenses management, human resource, size, risk, capital as well as bank's innovative vibrancy. On the other hand external determinants of bank profitability include factors like interest rates, inflation, cyclical output and variables representative of market characteristics (Alam, 2011). The latter refer to industry size, market concentration and ownership status of the banks. The current

study sought to establish the relationship between financial innovation and financial performance against the backdrop of both internal and external intervening variables.

From a study conducted in Kuwait on business consumers choice on domestic and foreign banks, Forcarelli and Pozzolo (2000), found that the major determinant factors for selecting a bank in Kuwait by business firms were; size of bank assets, personnel efficiency, banking experience, friendliness of staff, reputation, and availability of branches abroad. From the preceding literature on past studies, it is evident that much has not been done in developing countries especially in Africa and for that matter Kenya, probably because of lack of sufficient information and relative unfamiliarity with the global economy or, limited research.

### 2.3.4 Effect of Bank Innovations on Performance

Banks currently use financial innovations as strategic variables to outstrip the competition. They have become pillars for bank's performance improvement and maintenance of market effectiveness Batiz-Lazo and Woldesenbet (2006). A successful innovation gives the firm superior performance and a competitive advantage. The imitation that occurs during the Schumpeterian process of creative - destruction generates the need for enterprises to produce more and better innovations in order to maintain a competitive edge. According to Berger (2003), the relevant aspects of innovations/ technological change include those which reduce information management costs. They also include those which transform customers' access to bank services. Electronic channels for example phone centers, ATMs, and home banking are also being developed by banks for cost reduction for all and convenience of service delivery to customers.

The immediate goal is to remove delivery of usual services from branches in order to trim their branch network. PC, ATM and Phone centres create room for cost saving within the current branch network structure (Radecki, 1997). Humphery (2006) cites telephone banking, ATMs, internet banking and e-money as being among the significant innovations which affect the banking distribution system and significantly influence banking performance. According to Goddard (2007), bank management technologies, client relation management systems, among others are the major changes in internal banking systems which have positive influence on banking performance and profitability.

According to Dow (2007), banks using cost reduction technologies are able to offer lower prices. Automated Teller Machines (ATMs) are continuing to expand rapidly. Credit cards volume doubled between 1993 and 1997, and debit card volume increased by a factor of more than five over the same period (Wolf, 1998). By consolidating payments through cards, households can now hold the vast bulk of their wealth in mutual funds and pension funds and make payments electronically. According to a study by Dos Santors and Peffers (1995) on the introduction of ATMs (Automatic Teller Machines) by American banks, it was found that the competitive advantage and performance which is attributed to this acquisition were not realized by second tier adopters of the technology. This is because first mover advantage offers the enterprise better performance. According to Batiz - Lazo and Woldesenbet (2006), while process innovations have an internal focus and are efficiency driven, product innovations have a market focus and are driven by effectiveness. In fact, product innovations are introduced to satisfy an external user or market need, while the firm with a view towards improving its efficiency introduces process innovations. Mishra (2008) studied the economic growth implications of financial innovations that emerge in more sophisticated and complicated financial markets. He concluded that financial innovations in the form of new financial instruments, services, institutions, technologies and markets mobilizes financial surplus from ultimate savers and direct them into most productive investment avenues thereby raising the rate of capital accumulation, and hence, the rate of economic growth. Implicit within this finding is the fact that innovations, either in the product or process form, have a positive impact on financial savings.

According to Yuan (2007), financial products and services, result in improved matching of the needs of individual savers with those of firms raising funds for expanding future production. The resulting capital accumulation leads to economic growth. New businesses like Instinet, Open-IPO, Enron On-Line, eBay, or the host of B-to-B exchanges are innovations that aimed at lowering the transaction costs faced by buyers and sellers (Tufano, 2002). These transaction costs are search or marketing costs. Madan and Soubra (1991) examined how financial intermediaries attempt to maximize their revenues net of marketing costs, the findings show that as marketing costs fall, financial innovations exploit the easier access to buyers and sellers of securities, the cost saving function of financial innovations, transaction considerations, to time management. Oyelaran-Oyeyinka (1991) observes that with computerization, banks have been empowered to introduce new products and services such as ATM, and that there is fast delivery

of front office services and more efficient back office operations. Other researchers have however connected financial innovations with the economic growth through savings mobilization.

Arguably, this role of innovative products has been criticized for impacting negatively on financial saving by some empirical studies. For instance, according to Parker (1999), innovation relaxed liquidity constraints that many households had been facing by increasing their access to credit marketing. In a system of full-service banks, financial innovation stochastically lowers the system where commercial banks and investment banks are functionally separated, this is according to Boot and Thakor (1997). They concluded that full-services bank naturally tend to innovate less. Similarly priming assets through additional capital as an innovative way to enhance financial performance was noted by Kolcunova and Malovana (2019) to have a negative effect on loan growth for banks with relatively low capital surpluses. The same study as well confirms that the relationship between the capital surplus and loan growth is also important at times of stable capital requirements.

On the other hand, according to Kanatas and Qi (2003) it is economy of scale and scope and low information cost (the size of savings) which prompts a bank to integrate credit and other issues which reduce innovation in the industry where financial services are integrated. Furthermore, other studies have suggested that diversification discourage managers from getting involved in the innovations (Denis, 1997; Francis & Smith, 1995). From her study, Nyathira (2012) of RTGS and ACH on profitability of banks in Kenya established that the two financial innovations increase bank profits. In conclusion, it is clear from the preceding literature that there exists a relationship between financial innovation and performance. However, the nature and direction of this relationship remains contentious, could it be positive or negative? Parker (1999) and Derek (2005) established possibility of a negative relationship if the available innovation products do not encourage deposits but largely facilitate withdrawals or encourage unlimited access to liquidity. A study by Momina et al (2011) on e-banking on profitability of Pakistani banks, observed that proliferation and penetration of internet has opened new horizons and scenarios for the retail banking industry. The results show that e-banking has increased the profitability of their banks; it has enabled the banks to meet their costs and earn profits even in the short span of time. According to Simpson (2002), e-banking is mainly driven by prospects of operating

revenues maximization and operating cost minimization. A study on effect of online banking in emerging versus developed markets noticed lower costs and higher revenues in developed markets. Furst, Lang and Nolle (2002) from their study on the determinants of internet banking adoption observed that more profitable banks were non movers who adopted internet banking after 1998. On the other hand, Sullivan (2000) found no evidence of any benefit of internet banking in US click and mortar banks. Nader (2011) analyzed the profit efficiency of Saudi Arabia Commercial banks during the period 1998- 2007. His study found that availability of many ATMs, phone banking and a big number of branches positively impacted on profit efficiency of Saudi banks. Conversely he established that availability of PC banking, availability of mobile banking and the number of points of sale terminals (POSs) did not improve profit efficiency. From their study, Jayawardhena and Foley (2000) found that internet banking led to cost and efficiency gains for banks despite the fact that a few (approx. 0.5 m) adopted online banking in UK.

Financial services are the backbone of a bank. It depends on cost effective fund gathering from depositors and effective disposal of the same at a profit to borrowers (Dew, 2007). For banks, internet offers room for competitive advantage. This advantage lies in satisfaction of customer needs and more in cost reduction (Bradley & Stewart, 2003; Jaruwachirathanakul & Fink, 2005). In the opinion of Sathye (1999), encouraging customers to adopt internet for banking transactions can result in considerable savings on operating costs. This according to Polasik and Wisniewski (2009) is because it is the cheapest distribution channel for standardized bank operations like funds transfer and account management. Customer dissatisfaction with branch banking because of poor customer service is and long queues are a good reason for the rapid movement to electronic delivery (Karjaluoto & Pento, 2002). Senior management's commitment is also noted as a driving force in adoption and exploitation of technology (Shields et al, 2003). Hernando and Nieto (2006) in their study on effect of internet delivery channels on bank's performance, found out that adoption of internet as a delivery channel involved gradual reduction in overhead expenses (particularly, staff, marketing and IT) which translates to an improvement in banks´ profitability. From Shirley and Sushanta (2006) study on the impact of information technology on profitability in the banking industry, they found that though IT might lead to cost saving but higher IT spending can create network effects leading to lower profits. It is noted that firms from all sectors can benefit from financial innovations to cost effectively raise larger

amounts of money (Lerner, 2006). According to Paulson & Mc Andrew (1998), competitive market forces have led banks to cut costs through price rationalization and automation in order to improve efficiency.

Dawood (2014) posits that a negative relationship exists between cost efficiency and profitability while on their part, Arnaboldi and Claeys (2008) while comparing the performance of different online banking models over the period 1995-2004 in Finland, Spain, Italy and the UK, found out that internet banks had better performance marked by higher average returns to assets, with limited operational costs for the extra income generated. Athanasoglou (2005) suggest that enhanced managerial and scale efficiency leads to higher profitability. Mwongela (2015) from his study on the relationship between asset quality as a form of innovation and profitability of commercial banks in Kenya, established that asset quality as measured by LLP positively influence ROA of commercial banks.

In the view of Zarutskie (2013) loan portfolios are the major assets of lending institutions like thrifts and banks. The value of the loan portfolio depends not only on the interest rates earned on the loans but also on the likelihood of repayment of interest and the principal amount. Abdirahman (2020) from his study on effect of loan quality on the financial performance of commercial banks in Kenya noted that loan quality and bank size have a significant association and relationship with financial performance. In support of this view, Ishtiaq and Muqaddas (2014) while examining the determinants of dividends payout policy of the banking sector in Pakistan, observed a positive dividend payout ratio with safety and profitability and concluded that safety, risk and profitability measures are relatively strong measures for defining dividend policy. Moreover; banks with higher profitability and lower non-performing loans (NPLs) are believed to pay more dividends.

Lending being the principal business activity and the major source of income for most commercial banks, calls for not only enhanced volumes in lending through innovation but also fortified loan portfolio management (LPM) anchored on innovation to reduce risks inherent in the credit process. A study by Simiyu et al (2017) on effect of debt finance on financial performance of Saccos in Tharaka Nithi – Kenya, established a strong positive relationship between debt and ROE. However negative relationships existed between interest rate, loan tenure

and ROE. From Vietnam, Dang (2017) in his examination of how loan growth affects performance of banks, in the form of credit risk, bank profitability and bank solvency, found that; growth in lending increases loan loss provisions, lowers bank capital ratio while bank profitability gains positive effects from loan growth both in the short term and long term. Likewise Di Salvo (1998) and Bergen (1988) are both of the opinion that access to financial information, prompt repayment of loans when it falls due, and having investments with banks have the tendency to reduce the transaction cost of obtaining credit significantly. Customer loyalty for longer periods also reduces costs of credit.

From the foregoing literature review, it is evident that though authoritative in their own focal points, past studies left important areas worth studying for example; Silber (1975) focused on regulatory framework, the main question being "Do regulatory restraints encourage financial innovations?" His finding was that regulatory restraints do encourage innovations. It is noted that the study did not recognize the negative aspect/inhibitors of regulatory framework; Akhavein et al (2002) focused on a survey of 200 large banking organizations in US; the question was "what are the characteristics of large banks that adopted small business credit scoring? He also focused on regulation. His study is out of focus on effect of innovation, he actually called for studies on this area; Derek (2005); McAndrews (2002); Dow (2007) all had studies focused on ATM and its role on financial performance of commercial banks. Their findings were unanimous that ATMs have a positive effect on profitability, costs, productivity, market share increase, bank spread and it also gives first mover advantage to banks. Still on ATMs, Prager (2001) is of the opinion that ATMs surcharge is negatively related to deposit. The above studies are in the category which confirms positive effect of financial innovation on the performance of banks. The studies are based in Europe and other developed economies. It would be of interest to know the developing world's version of the same, hence this proposed study on Kenya.

There are researchers of the opinion that innovations had both positive and negative effect on the performance of banks, these include; Balachander and Rajendra (2001), Sullivan (2000), Lang and Noelle (2002), Stiroh and Rumble (2004). They variously argue that bank benefits from internet based finnovs depends on size and urban location, ATMs benefit bigger banks, diversification worsens risk return trade off in US but achieves the opposite in Europe. Could this situation be for Africa, especially Kenya in the preceding decade? A study was necessary to

test this trend, in Kenya hence the current study. At the other extreme end, we have studies, which clearly demonstrate negative impact of financial innovation on financial performance of commercial banks. These include Francis and Smith (1995), Denis (1997), Kantas and Qi (2003), Boot and Thakor (1997). They variously argue, for example, that its size of bank that prompt them to integrate credit and other issues, not financial innovation; diversification discourage managers from getting involved with them. Although these negative relationships between financial innovation and performance are observed from relatively older studies, these extreme outcomes have nothing scientifically linking them directly to time. This leaves gaps for further studies to discover what, for example, these innovations have on banks based in developing economies. For this purpose, the current study aimed at determining the effect of financial innovation on financial performance of NSE listed commercial banks in Kenya.

On the Kenyan economy, the following is part of researches done on the effect of financial innovation on performance of commercial banks and other financial institutions. Wafubwa (2013), on factors influencing performance of commercial banks, in Bungoma. The study found no influence of financial innovation except their presence; Mueni (2012) on factors affecting performance of commercial banks- it found among others financial innovation improve performance; Kato et al (2012) on mobile banking and performance of commercial banks- established a positive relationship; Ngumi (2013) on effect of bank innovations on financial performance of commercial banks in Kenya- had various findings but all positive to performance. The study used lumpsum innovations and limited intervening variables; Nyathira (2012) on financial innovation and its effects on financial performance of commercial banks in Kenya. It concluded that there is positive contribution to profitability by financial innovation. She however sampled all banks, technically negating the precision and reliability of the findings because practically this isn't feasible due to need for test runs and more focused sampling, secondly it only used secondary data as opposed to both primary and secondary data to test profitability alone, based on limited (2) variables RTGS and ACH. This limits its reliability; Nyaga (2014) on financial innovation on financial performance of commercial banks in Kenya- his findings show a positive effect of his only two financial innovations ATM and KEPSS on solo performance indicator (Profitability). It is therefore limited in scope; his study is limited in depth and scope for general reliability by banks; Cheruiyot (2010) on impact of internet banking on financial performance of commercial banks in Kenya. The study found that internet has a

small positive influence on Return on Equity (ROE) and Return on Assets (ROA). This study is limited given that it used a single finnov's effect on only two measures of performance ROE and ROA and completely ignored the effect of intervening variables.

## 2.4 Gap in Literature

Based on the above literature, it is evident that most studies had conflicting findings on effect of similar finnovs on financial performance of commercial banks. This calls for further research on the effect on the same on the Kenyan commercial banks in the 2007-2017 period. Secondly, a number of the studies reviewed covered relatively few variables; mostly centered on profitability as opposed to other conventional performance indicators, the current study therefore purposed to examine the effect of financial innovation (e-banking, mobile banking, EFTPOS, branch networking, internet/agency banking) based on three major bank performance indicators namely; profit and loan portfolio base. Thirdly, from literature it is noted that 'innovation-performance' studies have been concentrated on developed economies like US, Europe, Latin America and Asia thereby leaving gap for innovation performance literature on most developing economies especially in Africa, where technology transfers experience relative delays. Finance in general and specifically the banking sub-sector routinely undergo rapid changes in management and technology due to high market competition. This characteristic predisposes the sector to further research as recommended by most past studies for the region to stay abreast with most current innovation developments. In terms of methodology, most studies reviewed had ROA and ROE as dependent variables against the fact that in the economy, these two variables confound other dependent variables. The current study therefore adopted multi-level regression approach in effort to fill the gap. Given the above past study gaps, the current study therefore proposed to examine the effect of financial innovations on financial performance of commercial banks in Kenya between 2007 and 2017, time long enough to establish a trend.

# CHAPTER THREE
## METHODOLOGY

### 3.1 Introduction

This section discusses the research methodology which was adopted during the study. It includes the research design, study area, target population and sampling, data sources and collection, model specification, data analysis and presentation.

### 3.2 Philosophy of the Study

This study adopted a blend of both pragmatic and positivist research philosophies. Pragmatism involves research designs that incorporate operational decisions based on "what will work best" in finding answers for the questions under investigation. It deals with issues as they are, it therefore enables pragmatic researchers to conduct research in innovative and dynamic ways to find solutions to research problems. The choice of philosophy was determined by the research problem but the results of the study are considered more important. According to Alghamadi and Li (2011), pragmatic research does not belong to a specific philosophical system and realm. This study therefore blended it with Positivism research philosophy. This is an Auguste Comte philosophy proposed in 1854 and refined over the years. It is rooted in the belief that knowledge can be obtained through objective observations and measurements. It thus assumes that answers can be found by carefully measuring and analyzing data, particularly numerical data, Harriet (2010). The current study falls in the realms of pragmatic research philosophy and is infused with elements of positivism. The choice for use of philosophy is due to use of secondary data numerical in nature, from CBK annual bank reports for the period 2007- 2017 that were considered as they were devoid of prejudice and personal influence of data occurrences.

Based on a blend of the related philosophies highlighted above, the study objectively and independently (in line with pragmatism) analyzed effect of financial innovations on financial performance of banks as they were, without influence of personal values. The researcher had freedom to choose methods, techniques and procedures that best met the study needs and research objectives.

The study aimed at unraveling how performance of commercial banks in Kenya is influenced by financial innovations and how the innovations can be used to increase the banks' values through

return on their assets so that they can be of better service to stakeholders and the economy. The study also aimed at strategizing finnovs to improve banks' loan portfolios and returns on equity to enable them and their shareholders to finance further investments in the economy for growth and development.

## 3.3 Research Design

The study was based on correlational research design. Jackson (2009), states that a correlation research design enables the examiner to describe the relationships that exist between two or more variables. It investigates relationships between variables without the researcher controlling or manipulating any of them. A correlation reflects the strength and /or direction of the relationship between two or more variables; in this case financial innovations on banks' financial performance measured by profitability, loan portfolio size and return on equity against the backdrop of environmental and organizational factors (intervening variables). In addition, the researcher is allowed by correlation studies to make predictions from one variable to another. Through correlation coefficient, the researcher can assign a numerical value to the observed relationship upon which inferences are drawn (Jackson, 2009). Based on the above strengths of correlational research design, this study adopted it.

## 3.4 Study Area

The following data on Kenya is given as at the study period running upto end of fourth quarter of 2017 financial year. Kenya (580,367 km$^2$) is a developing economy situated in East Africa with a coastline on the Indian Ocean. It is endowed with various natural and human resources. Its economy is market based with a few state-owned enterprises. Kenyas GDP as at the study period is 70.53 billion with a nominal per capita of 1,455.36 USD. Its financial market is vibrant with various players, for example it has 42 commercial banks (12 of which are quoted at NSE), 49 insurance companies, 11 Microfinance companies, 200 SACCOs among others. Kenya adopts open trade policy, which predisposes its financial/capital markets to high competition and volatility. This calls for extra measures by financial institutions in order to retain and expand their operations (CBK, 2017; GoK, 2017). This study focused on commercial banks because of their unparalleled contribution to the economic growth and development in Kenya (they contribute 54% to finance sector GDP), their backward and forward inter-industry linkages is the

highest and a vital factor for balanced growth, and notably most of financial innovations have been in the banking sector.

## 3.5 Target Population and Sampling

The target population was considered at institutional level where the study targeted 42 licensed commercial banks in Kenya (Appendix I). Purposive sampling technique was used to get sample population. The sample population was 12 NSE listed banks (Appendix II). This is 28.57% of the population and above acceptable minimum 10% level, Piroska (2012). The main reasons for choosing the NSE quoted companies were; it is a group of old traditional banks with a history and data spanning over decades of bank operations in Kenya. Secondary data on them was readily available at individual bank level, CMA and the CBK, which are the mandated statutory regulators of NSE. The shroud of secrecy on bank operations of the sampled banks was nil because quoted financial intermediaries operate and by law, display their financial reports in public domain. The data was effectively obtained from CBK annual reports for the years 2007-2017.

According to the Central Bank of Kenya annual supervision report of year 2017, as at 31st December, 2017, 12 (28.57%) of commercial banks in Kenya were quoted at the NSE (See appendix ii). Central Bank of Kenya is the major licensing and regulating institution of commercial banks and mortgage finance institutions in Kenya therefore it was used as an authoritative source for banking sector information (data used in the study).

## 3.6 Data Collection

The study used secondary data. [See appendix iii for raw data]. Data was collected online from CBK portal and physically authenticated by CBK front office. The collected data was counter-checked with data from CMA and NSE on the sampled banks for completeness. The data was found complete for all individual sampled banks. The data comprised of audited financial reports of listed commercial banks. The data sought to provide information on forms of financial innovations and their perceived effects on financial performance of commercial banks in Kenya in the period 2007 to 2017.

The data was numerical in nature. It had a mix of discrete and continuous data. One category of the data was on bank incomes (expressed in Ksh) associated with incomes attributed to finnovs

EFT, MBS, IB, BN, Total assets and Loans. This category had incomes expressed in finite / whole numbers. Additionally the number of banks (12) in the study and the number of study years (11) were also expressed in discreet numbers.

The other category of data though quantitative, was of the continuous type. They were ratios expressing relative returns on bank assets (ROA) and returns on bank equity (ROE).

The observations and frequencies of the above highlighted data as extracted and collated from CBK's bank annual reports are presented under raw data table in appendix III.

The 12 NSE listed commercial banks were all (100%) used in the study. These banks supplied the study with 11 years (2007-2017) of data for 8 (data points per year) for 8 main variables namely ROA, EFT, MBS, IB, BNT, Loans, ROE and TA. This amounted to a set of 1,056 data points which was in various formations run by Stata 15 software to seek information on the effect of finnovs on financial performance of the commercial banks in Kenya, premised on the three study dependent variables ROA, Loans and ROE. The data points were adequate to set a reliable trend.

No cases of collapse or mergers were noted for any of the sampled banks during the study period. However, effective 30 May, 2018, Barclays Africa reverted to her group's name, Absa Group Africa. It's notable that the bank didn't collapse, it only changed names and this came after the study period which ended in the fourth quarter of financial year 2017.

## 3.7 Data Analysis

It is important to note that this study used only secondary data. The study was based on fixed effect, random effect models or pooled regression of panel data analysis. Pooled regression was necessary because we had cross-sectional data with various observations over time for several banks. The raw data was log-transformed prior to diagnostic tests. This was done to transform skewed data to approximately conform to normality. For the dependent variables, log-transformation helped overcome issues with meeting the requirements of normality and homoscedasticity of the residuals for multiple linear regressions which was subsequently employed in this study. Linear regression models were used because; they are simple to implement and make estimation procedure simple; they perform best on linear data which the study had and with linear regression, overfitting can be reduced by regularization.

Diagnostic tests were done to check stationarity and reliability of data before analysis to ensure that spurious results were not obtained. These included panel data root test and Hausman test which was specifically used to discriminate among the three models.

According to Baltagi (2003), panel data analysis (which was adopted by this study) has more accurate inference of model parameters due to more degrees of freedom and more sample variability hence improving the efficiency of econometric estimates. It has the advantage of a greater capacity for capturing the complexity of human behavior than mere cross section or time series data. It easily controls impact of omitted variables, easily uncovers dynamic relationships and simplifies computation and statistical inference. According to Faraway (2002), multiple linear regressions are applied in situations with more than one independent variable. Likewise, Jackson (2009) states that multiple regression analysis involves combining several predictor variables in a single regression equation. With multiple regression analysis, we can assess the effects of multiple predictor variables (rather than a single predictor variable) on the dependent measure. Panel data was analyzed using fixed effect, random effect models and pooled regression analysis.

At the first stage, correlation between financial innovation factors and financial performance (multi-collinearity test) was done. The coefficients of multiple correlations were obtained to establish the level of variation in performance attributed to the independent variables (forms of innovation). The null hypotheses, $H_0$, was accepted or rejected at 0.05 confidence level. The multi-collinearity test preceded regression analysis; this was to test if there were high levels of multicollinearity which could undermine statistical significance of regression coefficients. At the second stage, multiple regressions was carried out to show the interactive effect of the independent variables (forms of innovation) on the dependent variables (measures of financial performance). For the case of panel data, various studies have suggested or applied different models including random effect model, pooled regression model and the fixed effect model. Pooled regression can be defined as an ordinary least square (OLS) technique of estimation used in panel data analysis that ignores specific effects. Due to this omission, the method violates basic assumptions of the error term such as orthogonality.

It was noted that each of the three objectives was stand-alone (independent) and mutually exclusive from each other in content and operationalization. Each could therefore form a complete study on its own. The study also noted that ROA, Loans and ROE had available and complete data of their own (generated from annual bank data) for for all the (12) banks under study for the entire study period. The three variables were noted to be consistently (but alternately) confounding /explanatory to each other at various coefficient levels throughout the study period. (Notably, all the three had positive significance levels), this raised a statistical fact /reality that couldn't be held constant nor ignored in improving the internal validity of the study output. They were also noted to have low multicollinearity with each other and other X variables of the study. Alongside the five conventional finnov variables (EFT,MBS,ASST,BNT and INTB), they (ROA, Loans and ROE) had P and F statistic of 0.0000 for all the three objectives, meaning their coefficients together with other variables were jointly different from zero hence they were (stepwise/alternately) jointly significant in explaining the compatriot outcome variables. They were therefore alternately incorporated into the study as confounding variables.

According to Bhandary (2020), a variable must either be cause or effect but not both at the same time. He further states that a dependent variable in a study can be independent at another level in the same study or in another study. In the case of the current study, the level (time) at which the dependent variables were alternately used as confounding variables was based on specific objectives.

In the same thought, according to Thomas (2020), the value of a dependent variable depends on an independent variable, so a variable cannot be both independent and dependent at the same time. However, there exists confounding variables which are correlated to the IV and causally related to DV and they influence both the supposed cause and the supposed effect. She further states that to ensure internal validity of a study a confounding variable cannot be ignored, however one can only change a single DV into independent/confounding variable at a time (especially in a controlled study). Time in the current study is specific to the objective under analysis, not the study itself. McLeod (2023) and Thomas (2020) further states that the independent variable is usually applied at different levels (multi-level) to see how the outcome differs. For the current study, this means that only one of the three alternative /confounding variables can be used as a dependent variable at any one time while the other two remain

confounding. In this study, the multiple levels were based on each of the three objectives which adopt each of ROA, loans and ROE as dependent variables. For example when ROA is the dependent variable, ROE and Loans are treated as confounding/ independent variables together with the other X variables. The study therefore adopted the three variables as alternate confounding variables based on each of the three independent objectives.

The study variables were: Dependent (Y) variables; ROA (return on assets), ROE (Return on Equity) and Loan portfolio. The principal (main) explanatory variables predetermined at the onset of the study were; Branch networking (in milllion Ksh), Mobile banking services (in million Ksh), Electronic funds transfer (in Billion Ksh), Total Bank Assets (in Billion Ksh) and Internet/Agency Banking (in Thousands Ksh). However, as already stated above, during data collection and data analysis, ROA though initially set as an independent variable, was confirmed to have statistically significant explanatory tendencies on Loans and ROE just as other independent variables. The latter two (Loans and ROE), each independently exhibited similar behaviour on the other two initial (principal) dependent variables. In line with Bhandary (2020), Thomas (2020), and McLeod (2023), the three (ROA, Loans and ROE) were therefore adopted as alternating/ multi-level confounding (independent) variables in the study.

Given the above, the independent variables therefore were: $X_1$, $X_2$, $X_3$, $X_4$, $X_5$ and three alternately/ stepwisely confounding variables $X_6, X_7, X_8$. These explanatory variables and their metric measurements are specified in table 3.1 below.

**Table 3.1: Explanatory variables**

| Symbol | Abbrev. | I. Variable | Unit of   Measure in Ksh. |
|--------|---------|-------------|---------------------------|
| $X_1$ | BN | Branch networking | Millions (Ksh) |
| $X_2$ | MBS | Mobile banking services | Millions (Ksh) |
| $X_3$ | EFT | Electronic funds transfer | Billions (Ksh) |
| $X_4$ | TA | Total Bank Assets | Billions (Ksh) |
| $X_5$ | IB | Internet/Agency Banking | Thousands (Ksh) |
| $X_6$ | ROA | Return on Assets (Alt.) | % |
| $X_7$ | LN | Loans (Alt.) | Millions (Ksh) |
| $X_8$ | ROE | Return on equity (Alt.) | % |

Note: 1. Branch networking refers to branch spread and allied computerization and interconnecting of geographically scattered stand-alone branches and franchises into one unified system in the form of WAN or Enterprise Network (EN). It is measured in terms of incomes (in Ksh) perceived to accrue to the commercial banks from adoption of this form of innovation.

2. Alt. means Alternating, that is $X_6$, $X_7$ and $X_8$ were applied as confounding variables at multi-level. Meaning only two confound (together with other X variables) when one of the three alternating variables is treated as a dependent variable.

3. The unit of measure for ROA and ROE were percentage given that they are ratios. Unit of measure for the rest of the variables was Ksh. The figures represent amounts of money the commercial banks received or lost by adopting the listed financial innovations. This is in line with the study's main objective, "The effect of financial innovations on financial performance of commercial banks in Kenya".

The study used regression analysis to determine the effect of predictor variables on the dependent variables. The general expression of a pooled regression model can be stated as follows;

$$Y_{it} = X'_{it} \beta + \upsilon_{it} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.1)$$

Where; $Y_{it}$ is the dependent variables taking the form $i = 1, 2, 3$ where $1 = $ ROA, $2 = $ Loan portfolio and $3 = $ ROE. $X'_{it}$ is a vector of explanatory variables which are financial innovations and includes branch networking, mobile banking, electronic funds transfer, banks assets and internet/agency banking in addition to two other alternating/multi-level confounding variables. $\beta$ are parameter estimates to be estimated. While $\upsilon_{it}$ is the error term which represents the residual or disturbance factors or values that are not captured within the regression model during the study period $t$, of eleven years. The time aspect was incorporated in the regression equation with its effect implicit in the regression outcome.

The problem with ignoring the individual specific characteristics as assumed by the pooled regression is that, the estimates obtained in the above case may not be consistent. To solve this problem, it is important to implement individual characteristics in the model. This is because one

bank may have some characteristics that are different from other banks. These characteristics may be random or fixed for each bank. The appropriate model for this regression thus should take into consideration the individual characteristics of the sampled banks. This model can either be the random effects or the fixed effects model. The main difference between the two models is their assumption about the individual characteristics. While random effects model assumes that these effects are bank specific, fixed effects model takes the assumption that the individual characteristics are fixed. The three dependent variables (ROA, LA and ROE) were separately regressed against independent variables (EFT, MBS, IB, TA and BNT plus two multilevel confounders). This isolatory treatment (as opposed to regressing all the three dependent variables at once) helps lower multicollinearity and improve p-values. It also gives room for multiple response measures (per dependent variable) which are generally more reliable than single response measure. Clarity, ease of interpretation and understanding is also greatly improved.

In order to achieve the first objective of the study, which was to determine the effect of financial innovations on commercial banks' return on assets, a specified model based on equation (3.1) which takes into account individual characteristics was developed. The model was specified as follows;

$$Y_{1it} = \beta_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \beta_5 X_{5it} + \beta_6 X_{6it} + \beta_7 X_{7it} + \upsilon_{1it} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3.2)$$

Where $Y_{it}$ is the dependent variable (ROA)

$X_{1it}, X_{2it} \dots X_{7it}$ are vectors of explanatory variables as outlined in table 3.1 above .

$\beta_1, \beta_2 \dots \beta_7$ are parameters to be estimated.

$\upsilon_{1it}$ is the error term.

To achieve objective two which was to establish the effect of financial innovations on loan portfolio base, a specific form of general equation (3.1), expressed below was used.

$$Y_{2it} = \alpha_0 + \alpha_1 X_{1it} + \alpha_2 X_{2it} + \alpha_3 X_{3it} + \alpha_4 X_{4it} + \alpha_5 X_{5it} + \alpha_6 X_{6it} + \alpha_7 X_{7it} + \varepsilon_{2it} \dots\dots\dots (3.3)$$

Where $Y_{2it}$ is Loans advanced, $X_{1it}, X_{2it} \dots X_{7it}$ are vectors of explanatory variables as outlined in table 3.1 above.

$\alpha_0, \alpha_1 \dots \alpha_7$ are parameters to be estimated.

$\varepsilon_{2it}$ is the error term.

The third objective that aimed at determining the effect of financial innovations on banks' returns on equity was achieved by specifying a model based on equation (3.1) and taking into account the bank individual characteristics. The specific equation is expressed as;

$$Y_{3it} = \eta_0 + \eta_1 X_{1it} + \eta_2 X_{2it} + \eta_3 X_{3it} + \eta_4 X_{4it} + \eta_5 X_{5it} + \eta_6 + X_{6it} + \eta_7 X_{7it} + \lambda_{3it} \quad ..... (3.4)$$

Where $Y_{3it}$ = ROE at year $t$

$X_{1it}, X_{2it} \dots X_{7it}$ are vectors of explanatory variables as outlined in table 3.1 above.

$\eta_0, \eta_1 \dots \eta_7$ are parameters to be estimated.

$\lambda_{3it}$ = error term.

The outcome of the parameter estimates will allow determination of the relationships between the dependent variables $Y_{(1,2,3)}$ and the independent variables $X_1, X_2, X_3, X_4 \dots X_7$ as per definition in table 3.1. Linear regression model adopted for 3.2, 3.3 and 3.4 above was preferred because it takes into account the bank's individual characteristics; secondly it performs best on linear data type which was collected from the banks in the study. It makes it easy to reduce over-fitting through regularization and lastly linear models are noted for easy to understand interpretations on a modular/weights level.

To identify the appropriate model to be used in the regression between fixed and random effects model, the Hausman test for model specification was employed. The null hypothesis for this test is that the preferred model is the random effects (RE) against the alternative that the preferred model is fixed effects (FE) model. Rejection of the null hypothesis will imply that the model to be used is the FE while failure to reject the null hypothesis means the appropriate model would be the RE model. In addition to the above, the study employed descriptive statistical analysis for secondary data because it is effective for digestion of large quantities of data and effectively communicates their important aspects in the study. To ensure non spurious regression results, a number of diagnostic tests were carried out on the data used in the study. These tests included the panel unit root test, test for multicollinearity and test for heteroskedasticity. The regressions were done with log transformed data for all variables. This was because log transformation makes

highly skewed distributions less skewed. This was important in order to limit the effects of outliers in the data therefore helping in meeting the inferential statistics and improving the validity of the regression outcome. The analyzed data are presented in frequency tables, correlation and regression matrices (Kothari, 2004).

# CHAPTER FOUR

# RESULTS AND DISCUSSIONS

## 4.1 Introduction

This chapter presents the descriptive statistics, diagnostic tests as well as empirical findings of the study. It also gives a detailed analysis of the effect of innovations on the performance of commercial banks in Kenya.

## 4.2 Descriptive Statistics

This section contains interpretation of descriptive statistics of the data that was used in the analysis (The raw data is attached as appendix III). The descriptive statistics includes the mean, standard deviation, maximum and minimum values of the data set as shown in table 4.1 below.

**Table 4.1: Descriptive statistics**

| Variable | Obs | Mean | Standard deviation | Min | Max |
|---|---|---|---|---|---|
| Return on Asset (ROA) | 132 | 3.744471 | 1.696728 | -2.07 | 7.7 |
| Electronic Fund Transfer (EFT) | 132 | 36.95451 | 13.72557 | 12.75 | 116.431 |
| Mobile Banking Service (MBS) | 132 | 44.17228 | 32.31779 | 1.347 | 120.23 |
| Internet /Agency banking (IB) | 132 | 5799.955 | 2526.484 | 1830 | 15848 |
| Total assets (TA) | 132 | 126248.9 | 114976.2 | 587 | 555630 |
| Branch networking (BNT) | 132 | 6035.523 | 6505.473 | -1434 | 28482 |
| Return on Equity (ROE) | 132 | 25.50092 | 9.975976 | -16.9 | 56 |
| Loans advanced (LA) | 132 | 78148.26 | 71881.8 | 3342 | 411666 |

**Source: Own Compilation from Data used in the study**

Note**:** Units of measurement for the variables are indicated in table 3.1

Table 4.1 above presents the results of descriptive statistics for the variables used in the study. The unit of measurement is Ksh for EFT, MBS, IB, TA, BNT and LA. While ROE and ROA are measured in percentages (ref. table 3.1).

Return on assets in the study, is a measure of income generated by the assets owned by commercial banks in Kenya for a particular year. The mean value of return on assets was 3.74 percent with a standard deviation of 1.697. The mean value of 3.74 implies that on average, the banks in Kenya made a profit of 3.74 percent during the study period. The maximum value was 7.7 per cent and a negative minimum value equivalent to 2.07 percent. The large difference between maximum and minimum values is indicative of the difference in sizes of the banks. Multinationals mostly lead due to huge strategic backup by mother banks in the developed

world. A few indigenous banks like Equity bank Ltd have also made strides to big asset bases. Negative value noted here is a situation where the commercial banks made losses; they had to pay higher in cost as opposed to the revenue earned from the assets that they acquired. This mostly affected newly established and relatively smaller banks. The standard deviation value 1.697 is an indication of big variation in the performance of the commercial banks in the country for the study period. Big and established banks like Kenya Commercial bank, Equity Group Holdings and Cooperative bank of Kenya Ltd had higher returns on assets.

The mean value of electronic funds transfer was Ksh.36.954 billion with a standard deviation of Ksh.13.725 b. The mean indicates that on average the commercial bank transferred Ksh.36.954 billion through EFT during the study period. The standard deviation of Ksh.13.725 billion is another indicator of high disparities in the amount of money that was transferred via electronic means by the banks during the study period. This high variability can be explained by differences in technology adoption by the various banks as well as their customers. Customer base also had a role to play here with highly subscribed banks for example KCB and CO-OP bank leading in EFT incomes.

Mobile money banking had a mean value of Ksh. 44.17228 million with a standard deviation of Ksh.32.31779 million. The mean indicates an average of Ksh.44.172 million transacted through mobile technology in the study period. The relatively low maximum value (Ksh.120.23 million) could be an indicator to the limiting effect of legal transfer ceilings. The low minimum value at Ksh.1.347 million could be indicative of low technology use at a point in the study period, strict regulations as well as high risks associated with mobile technology. The big standard deviation (Ksh.32.3117 million) indicates rapid uptake, increase in value and volumes transacted as well as streamlined technology operations.

The mean value for internet/agency banking was Ksh.5799.955 thousand with a standard deviation of Ksh.2526.484 thousand. Although this indicates big disparities in the value of transactions done over the internet, the improvement (max value of Ksh.15848 thousand and a min value of Ksh.1830 thousand) suggests a continuous increase in the value of transactions conducted over the internet due to uptake of this and related technology. It may also mean that more established banks with more agency outlets and improved internet connections reap higher

incomes. It is also indicative of gradual take up of new money transfer technology especially in developing countries.

The mean of total assets owned by the banks during the study period was Ksh.126248.9 billion with a standard deviation of Ksh.114976.2 billion. The big disparity in the assets can be used as one of the explanations for why there was a huge difference in the amount of profits earned by the various commercial banks in the country over the study period. The big difference between the maximum Ksh.555630 billion and minimum Ksh.587 billion is indicative of; multinational banking corporations with access to large offshore capital; small and struggling indigenous banks operating against hard economic times as well as; high competition in the financial sector. This has always necessitated mergers, buyouts or exit.

The mean value of return to equity was estimated as 25.58198 per cent with a standard deviation of 9.99 percent. This is a clear indication of high returns to the owners of the various commercial banks on their investments attributed to impact of financial innovations. The standard deviation (9.9962 percent) also indicates that there were huge disparities in the returns for the various years attributable to rapid progress in financial innovations in the Kenyan banking industry.

The mean value for branch networking for the banks under study was Ksh.6035.523 million with a standard deviation of Ksh.6505.473 million. The deviation is a confirmation of large disparities in income between the banks under study as a result of branch networking. Big banks with wide branch networks have higher returns.

The mean value for the loans advanced by the various commercial banks was Ksh.78148.26 million with a standard deviation of Ksh.71881.8 million. This further suggests that, for the commercial banks under analysis, there was a big difference in the amount of loans advanced to the various borrowers who vary from households to corporates. The maximum was Ksh.411666 million while the minimum was Ksh.3342 million. Several factors influence loans given out and profits earned from them. It's only safe to indicate that larger banks with wide customer base reaped more owing to higher disposable funds with them. The low minimum values are subject to low economic downturns amongst other limiting factors such as legal lending requirements. Interest rates were held constant in this study.

## 4.3 Diagnostic Tests

The study undertook diagnostics on the data used for the regression analysis. The diagnostics carried out on the data included panel unit root test, stationarity and multicollinearity tests. The panel unit root test is presented independently in table 4.2. However for the sake of clarity and flow of ideas, results for Hausman and Multicollinearity tests are presented before regression output for each objective.

### 4.3.1 Panel unit root test

A unit root test was carried out using Im Pesaran Shin (IPS) panel unit root test. The test was necessary to ensure that all study variables were stationary before any other analysis was done so as to avoid getting spurious results. Where the results were not stationary at level, differencing was carried out to achieve stationarity. The results of this test are shown on table 4.2 below.

**Table 4.2: Results for Panel unit root test**

| Variable | Level | t- statistic | P-value | Remarks Stationary at; |
|----------|-------|--------------|---------|------------------------|
| LROA | level | -3.0788 | 0.0010 | I (0) |
| LEFT | level | -1.2878 | 0.0989 | I (0) |
| LMBS | level | -1.2007 | 0.8851 | |
| | $1^{st}$ difference | -4.6892 | 0.0000 | I (1) |
| LIB | level | -1.0236 | 0.1530 | |
| | $1^{st}$ difference | -4.6892 | 0.0000 | I (1) |
| LBN | level | -2.4712 | 0.0067 | I (0) |
| LTA | level | -1.2649 | 0.1029 | |
| | $1^{st}$ difference | -3.8745 | 0.0001 | I (1) |
| LROE | level | 0.7027 | 0.7589 | |
| | $1^{st}$ difference | -5.0057 | 0.0000 | I (1) |
| LA | level | -1.9662 | 0.0246 | I (0) |

**Critical values for IPS**

**Source: Stata IPS output**

1% $\Rightarrow$ -2.100

5% $\Rightarrow$ -1.920

10% $\Rightarrow$ -1.830

Table 4.2 above presents the IPS output for unit root test of the study variables.
Unit root tests are used to determine if trending data should be first differenced or regressed on deterministic functions of time to render the data stationary.

Ipshin estimates the t-test for unit roots in heterogeneous panels developed by Im, Pesaran and Shin (IPS, 1997). According to Baum (2001), it allows for individual effects, time trends and common time effects. Based on the mean of the individual Dickey-Fuller t-statistics of each unit in the panel, the IPS test assumes that all the series are non-stationary under the null hypothesis. Lags of the dependent variable may be introduced to allow for serial correlation in the errors. The exact critical values of the t-bar statistic are given in IPS. After transformation by factors provided for a given data set (available for no more than 8 lags on any series), the Psi(t-bar) statistic is distributed standard normal under the null hypothesis of non stationarity.

Criteria: If t-statistic calculated is greater than t-critical, reject $H_0$ of unit root presence and conclude variable is stationary. Or, using P values; if P-value is statistically significant, reject the $H_0$ of unit root presence and conclude variable is stationary. From the output presented in table 4.2 above, half of the variables; LROA 0.0010, LEFT 0.0989, LBN 0.0069 and LA 0.0246 were found to be stationary at level while the other half; LMBS 0.0000, LIB 0.0000, LTA 0.0001 and ROE 0.0000 were stationary at first difference. Differencing offered solution to non-stationarity especially in the random walk with or without a drift, the form which the data took. Since the values were stationary either at level or at first difference, it means that there exists short-run and long-run and/ or constant relationships between the variables, that is, they are stationary and dependent. This paved way for use of the variables for further analysis in the study. "Level" as used here refers to the significance level against which we test the result following a unit root process. We reject the null when the p-value is less than or equal to a set significance level, often 0.05 (5%), or 0.01(1%) and even 0.1(10%).

**4.4 Empirical Results**

This section discusses the empirical results from the models specified in chapter three. The findings are presented together with the model diagnostics that were carried out. The section is arranged such that each sub-section presents the empirical findings of each objective.

**4.4.1 Results for objective1; Effect of financial innovations on Return on Assets**

This section presents the study output on the effect of financial innovations on return on assets (ROA). It tables the Hausman test, the multicollinearity test and the regression output for the first study objective.

**4.4.1.1 Hausman test for Effect of financial innovations on Banks' ROA (objective one)**

The study conducted Hausman test on the data to determine the appropriate regression model to be used in the analysis of effect of financial innovations on return on assets. The results are presented in table 4.3 below.

**Table 4.3: Hausman test for ROA model (objective 1)**

|  | Coefficients | | | |
|  | (b)<br>Fe | (B)<br>Re | b-B<br>Difference | sqrt (diag(V_b_V_B)<br>S.E. |
| --- | --- | --- | --- | --- |
| EFT (Electronic Funds Transfer) | -.3351787 | -.4216465 | .0864678 | .1411925 |
| MBS (Mobile Banking Service) | .0483214 | .0518425 | -.0035211 | . |
| BN (Branch Networking) | .2810697 | .3725221 | -.0914523 | .0293908 |
| TA (Total Assets) | .1064143 | .1299753 | -.023561 | . |
| ROE (Return on Equity) | -.2184155 | -.2233705 | .004955 | . |
| LA (Loans Advanced) | -.1857467 | -.2107666 | .0250199 | .0391536 |

b consistent under $H_0$ and $H_a$; obtained from xtreg

B = consistent under $H_a$, efficient under $H_0$; obtained from xtreg

Test: $H_0$: difference in coefficients not systematic

Chi2 (6) = (b-B) ' [(V_b-V_B) ^ (-1)] (b-B)

= 8.34

Prob>chi2 = 0.2140

( V_b-V_B is not positive definite)

Note: P value (0.214) insignificant hence we fail to accept the null hypothesis. (P > 0.05).
Table 4.3 above shows the output of Hausman test carried out on the data to help determine which model to use in regression analysis. The Durbin-Wu- Hausman test (also called Hausman specification test) is a statistical hypothesis test in econometrics named after James Durbin, De-Min Wu, and Jerry A. Hausman. The test evaluates the consistency of an estimator when compared to an alternative, less efficient estimator which is already known to be consistent. It helps one to evaluate if a statistical model corresponds to the data, William (2012).

The test reveals to us whether the fixed effect or random effects model fits the data better, and thus which one to use. To decide between Fixed and Random effects, we run a Hausman test where the null hypothesis is that the preferred model is Random effects versus the alternative the fixed effect. Hausman basically tests whether the unique errors are correlated with the regressions. The null hypothesis is that they are not. If the p-value of the Hausman test is less than the significance level, then we reject the null hypothesis and conclude that the pooled OLS model is appropriate. If the p-value is greater than the significance level then we cannot reject the null hypothesis so we use the fixed effect model. The significance level is set at 0.05. In our Hausman test output in table 4.3 above, it is noted that P- value (0.214) is insignificant hence we fail to accept the null hypothesis. (P >0.05). The results indicate that the estimates were insignificant therefore random effects model was selected for use in analyzing and presenting the panel data (regression analysis) on return on assets.

### 4.4.1.2 Multicollinearity test for objective 1; Effect of finnovs on Banks' ROA

The study employed Pairwise correlation analysis to test for multicollinearity. The results of the study are summarized in table 4.4 below.

**Table 4.4: Multicollinearity output for ROA ( objective 1).**

|  | ROA | BN | MBS | EFT | TA | IB |
|---|---|---|---|---|---|---|
| ROA ( Return on Assets) | 1.000 | | | | | |
| BN (Branch Networking) | 0.6418 | 1.0000 | | | | |
|  | 0.0000 | | | | | |
| MBS (Mobile Banking Service) | 0.1775 | 0.3547 | 1.0000 | | | |
|  | 0.0148 | 0.0000 | | | | |
| EFT (Electronic Funds Transfer) | -0.0271 | 0.0433 | 0.3904 | 1.0000 | | |
|  | 0.0075 | 0.0062 | 0.0000 | | | |
| TA (Total Assets) | 0.4989 | 0.7620 | 0.4561 | 0.0907 | 1.0000 | |
|  | 0.0000 | 0.0000 | 0.0000 | 0.0301 | | |
| IB (Internet Banking) | 0.3812 | 0.5892 | 0.2854 | -0.0629 | 0.6640 | 1.0000 |
|  | 0.0000 | 0.0000 | 0.0009 | 0.0473 | 0.0000 | |

**Source: Pairwise correlation test for multicollinearity.**

Table 4.4 above shows the output of Pairwise correlation for variables used in regression analysis for ROA. The table has correlation coefficients in the first row (all noted to be less than 0.8) and P-values second row were (all noted to be equal to or below 0.05). Multicollinearity is the occurrence of high intercorrelations among two or more independent variables in a multiple

regression model. Multicollinearity can lead to skewed or misleading results when a researcher or analyst attempts to determine how well each independent variable can be used most effectively to predict or understand the dependent variable in a statistical model.

Multicollinearity undermines statistical significance of regression coefficients and thus, with multicollinearity, there is likelihood of accepting an incorrect null hypothesis or rejecting a correct null hypothesis. It is therefore important to test for multicollinearity between independent variables to ascertain acceptable levels of relationships between them before regression.

According to Gujarati (2009), multicollinearity is regarded high if the correlation coefficient is more than 0.8. From the results presented in table 4.4 above, the correlation coefficients had values less than 0.8, therefore no variable had high correlation with another variable. This paved way for use of the variables with no further transformations.

**4.4.1.3 Regression output for Effect of finnovs on return on assets (objective one)**

This is the first objective of the study, to achieve the objective the study regressed data based on equation 3.2 and the results are illustrated in Table 4.5 below. Multiple linear regression is a statistical technique that can be used to analyze the relationship between a single dependent variable and several independent variables. The objective of multiple regression analysis is to use the independent variables whose values are known to predict the value of the single dependent variable, Hayes (2023).

To estimate the effect of banking sector innovations on return on assets for commercial banks, the study started by estimating three regression models. The models included pooled regressions, the random effect model and the fixed effect model. To discriminate among the three models, the study conducted the Hausman test so as to identify the best model to be used. For objective one, ROA, the appropriate model (based on the Hausman test presented on table 4.3) was the random effects model. This is because the P-value of the Hausman test was found to be 0.214 which was statistically insignificant for all conventional statistical significance levels. This implies that the null hypothesis that the preferred model is the RE model could not be rejected. Rather, the hypothesis was accepted and therefore Table 4.5 below presents the RE regression output.

**Table 4.5: Regression Results for ROA  (objective 1).**

| Dependent variable: ROA | | | | |
|---|---|---|---|---|
| I.Variable | **Coefficient** | **Std error** | **t-statistic** | **P-value** |
| EFT ( Electronic Funds Transfer) | -0.422 | 0.282 | -1.50 | 0.135 |
| MBS (Mobile Banking Service) | 0.052 | 0.056 | 0.93 | 0.050 |
| BN ( Branch Networking) | 0.373 | 0.045 | 8.37 | 0.000 |
| TA (Total Assets) | 0.130 | 0.053 | 2.45 | 0.014 |
| ROE (Return On Equity) | -0.223 | 0.072 | -3.09 | 0.002 |
| LA (Loans Advanced) | -0.211 | 0.068 | -3.08 | 0.002 |
| Cons | 2.478 | 1.493 | 1.66 | 0.097 |

Wald chi2 (6) = 98.34

Prob > chi2 = 0.0000

Hausman test: P- value = 0.2140

  R-squared:    Within = 0.2385

                        Between = 0.8466

                        Overall = 0.5134

**Source: Stata 5 regression output**

Table 4.5 above is the output for regressions of variables to unravel the associations between the independent variables and the dependent variable, ROA. It aims to answer the study's objective one. Regression is a statistical technique that relates a dependent variable (in this case ROA) to one or more independent variables. A regression model is able to show whether changes observed in the dependent variable are associate with changes in one or more of the independent variables.

Regression as a powerful tool of data analysis helps businesses and researchers make informed decisions by predicting outcomes based on historical data. Aiding in forecasting, risk assessment, and identifying trends, regression analysis plays an important role in diverse fields. In research it plays three main roles namely prediction, association discovery and model validation.

From table 4.5, the probability of the Wald test was found to be 0.000, meaning that it was statistically significant at one per cent level of significance. This means that the coefficients of the variables in the model were jointly different from zero implying that EFT, MBS, BN, TA, ROE and LA were jointly important in explaining ROA. Table 4.5 also indicates that the overall

R-squared was 0.5134. This means that on average, 51.34 percent of all variations in ROA are explained by EFT, MBS, BN, TA, ROE and LA, holding all other factors constant.

The coefficient of branch networking was found to be 0.373. The coefficient was positive and statistically significant at one percent level. This implies that a one percent increase in incomes attributed to branch networking would lead to a 0.37 percent increase in ROA holding all other factors constant. The positive effect is an indication that if commercial banks in Kenya enhance branch networking, their return on assets would improve. This would be as a result of more people getting enrolled to the more accessible banking services leading to more returns. This finding is in agreement with Kadioglu *et al* (2017), who found that a unit change in branch networking had a corresponding increase in financial performance of commercial banks in Turkey. Kadioglu *et al* (2017) argued that branch network in banks was important in enhancing efficiency in operations and therefore reducing the time customers would have spent seeking for banking services in branches other than the branch where their accounts are held. This encourages more people to operate bank accounts which increase the bank's asset base and thus positively contributing to its profitability.  The finding also agrees with Nader (2011) who in his study on Saudi Arabian banks found that increase in branches had positive effect on profit efficiency of the commercial banks. In this same league is Kushvinder (2022) whose study on the impact of branch network size and fixed assets investment on bank performance in India  found that opening up of new branches had statistically highly significant positive relationship with return on assets. The above cases however are in contrast with Di Salvo (1998), and Berger et al (1998) who found evidence of run-offs plus / or decline in deposits and a decline in small business lending following mergers, especially those linking larger banks. These negative reactions to increase in bank branches and sizes lead to lower returns on assets of the affected banks. Nyatika (2017) in his study on spread in branch network and financial performance of commercial banks in Kenya found that the interaction between spread and deposits, bank size and capital adequacy do not moderate the relationship between spread of branch networks and return on assets. These mixed results mostly on banks in outside the African market gave room for further assessments of effect of bank spread and networking on their return on assets. Findings of the current study shows that branch networking has a significant positive influence on return on assets of commercial banks in Kenya.

The coefficient of total assets (TA) was found to be 0.130. It is positive and statistically significant at five percent level of significance. This implies that a one percent increase in TA would lead to 0.13 percent increase on ROA *ceteris paribus*. The positive effect is an indication that if commercial banks in Kenya increased their asset levels, their profitability as measured by ROA would improve and thus boost the customer confidence. An increase in the bank's assets signifies an increase in the bank investable funds. It is through these investments that the bank earns higher profits. It is therefore advisable for the banks to invest more on valuable assets base as it gives them more leverage in the banking sector competition. The finding of the current study is however out of sync with Miriam and Ikpor (2017) whose study on impact of financial asset investment on bank's financial performance in Nigeria found a negative and significant relationship between financial assets and ROA, which they attributed to maintenance costs of fixed assets which leads to declines in ROA. In Kenya, Keneza (2016) in her study on factors affecting the financial performance of commercial banks listed on NSE, similarly found a weak negative association between asset quality and ROA. However, there are a couple of studies with alternative opinions. Trujillo (2013) from his GMM Estimator study on determinants of profitability of banks in Spain found that high bank assets, high customer deposits and good efficiency led to bank profitability.

In Kenya, Cheruiyot (2016) from his study on effect of assets on profitability of commercial banks concluded that there is great positive relationship between asset quality and profitability of commercial banks in Kenya. This profitability marks good returns on assets. Both Al Hassan (2014) and Nzoka (2015) from their studies on effect of assets on the financial performance of commercial banks in Kenya, found positive relationship between bank assets and financial performance of commercial banks in Kenya. The foregoing studies though done during different study periods, have similar findings with the current study which has confirmed a positive and statistically significant influence of total assets on financial performance of commercial banks in Kenya.

The coefficient of Return on equity was found to be -0.223. The coefficient was negative and statistically significant at one percent level of confidence. This implies that a one percent increase on ROE would lead to a decrease in ROA equivalent to 0.223 percent holding all other factors constant. This observation is in line with Lee (2023) and Marshall (2024) who are both of

the opinion that a company's ROA falls when its ROE stays at the previous level. This is because ROA accounts for a company's debts while ROE doesn't. If a bank takes no debt, its shareholder's equity and its total asset would be the same therefore ROE and ROA would be equal. If the bank takes a financial leverage, ROE would rise above ROA.

The negative effect observed by the current study implies that if banks in Kenya increase dividend and other investor payouts, the value for ROA invariably decreases, and less would be reinvested therefore financial performance is technically affected negatively in the subsequent periods. The study concludes that ROE payouts have a negative inverse effect on ROA. It is therefore advised that a delicate balance between the two (being major facets of any investment) should be struck with a view to minimizing losses to ROA which form a bedrock for financial health of a commercial bank.

The coefficient for loans was found to be -0.211. It was negative and statistically significant at one percent level of confidence. This implies that, holding all other factors constant, a one percent increase in loans by the banks during the study period would lead to a decrease on ROA equivalent to 0.211 percent. This negative observation conforms to Kadioglu et al (2017) who in their study in Turkey on the effect of asset quality on bank profitability found a significant negative relationship between non- performing loans and bank profitability. Likewise in West Africa, Al Hassan et al (2014) in their empirical examination of asset quality in a crisis period in Ghanian banks found that persistence of non-performing loans is among factors that negatively impact on bank asset quality. The current study's output also conforms to Abdirahman (2020) whose study in Kenya on effect of loan quality on the financial performance of commercial banks in Kenya found that loan quality has a significant association and relationship with financial performance of commercial banks. He further found that non-performing loans have significant negative effect on financial performance. Likewise Ogada et al (2019) which concluded that non-performing loans negatively affect bank performance in Kenya.

The negative relationship found by the current study is an indicator to banks that loans inherently lead to negative performance therefore they should be deployed cautiously to surpass risks and to enhance returns on loans /performance. The loans variable should be prudently managed to avoid negatively tipping optimal levels of financial operations. This view is in line with Zarutskie

(2013) who posits that loan portfolios are the major assets of lending institutions like thrifts and banks. He advocates for a fortified loan portfolio management anchored on reduce risks inherent in the credit process. From the foregoing, it is evident and concluded that ROA depends on the quality of loan portfolio and the study finds a negative relationship between the two variables. The coefficient of EFT was -0.422, negative and statistically insignificant at all conventional levels of significance. The finding is contrary to the a priori expectation of a positive relationship. Studies on the effect of EFT on bank performance have yielded mixed results. For example, Agboola (2006) from his study on electronic payment systems and tele-banking services in Nigeria found a positive relationship between EFT and financial performance of banks. Similarly Chofaras et al (1989) in their study on implementing networks in banking and financial services found that increased banking productivity results from the use of EFTPOs. These transactions are perceived to conventionally increase returns on the banks' assets.

Some studies have however produced contradicting results. For example Nader (2011) from his study on the effect of number of PoS terminals, availability of PC banking and availability of mobile banking on performance of Saudi Arabian banks, he found that these factors didn't improve profit efficiency of the commercial banks. Similarly Kiragu (2017) found a positive but insignificant EFT influence on financial performance of commercial banks in Kenya. The foregoing mixed observations from various geographical markets at various time periods created room for further investigation by the current study.

The current study's outcome which is negative was attributed to lack of sufficient awareness about the operations of EFT and thus considered a risk by most customers. The high variability of EFT in the sampled banks could be attributed to inadequate national legal and non-uniform intra-bank regulatory frameworks.

**4.4.2 Results for objective 2; Effect of financial innovations on Banks' Loan portfolio**
This section presents the study output on the effect of financial innovations on loans. It tables the Hausman test, the multicollinearity test and the regression output for the second study objective.

**4.4.2.1 Hausman test for Effect of financial innovations on Banks' Loans (objective two)**
The study conducted Hausman test on the data to determine the appropriate regression model to be used in the analysis for the loans model. The results are presented in table 4.6 below.

**Table 4.6: Hausman test output for Loans model (objective 2).**

|  | Coefficients | | | sqrt (diag (V_b_V_B)) |
|  | (b) | (B) | b-B | |
|  | Fe | Re | Difference | S.E. |
| --- | --- | --- | --- | --- |
| EFT (Electronic Funds Transfer) | .5033615 | -.2443343 | .7476958 | .0933854 |
| MBS (Mobile Banking Service) | .0805175 | .0799232 | .0005943 | .0351754 |
| BN (Branch Networking) | .3824799 | .549581 | -.1671011 | . |
| TA (Total Assets) | .0150352 | .0616964 | -.0466612 | . |
| ROA ( Return on Assets) | -.278198 | -.3290806 | .0508826 | . |
| ROE (Return on Equity) | -.2914508 | -.3183916 | .0269408 | . |

b consistent under Ho and Ha; obtained from xtreg

B = consistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho:  difference in coefficients not systematic

$\quad$ Chi2 (6) = (b-B) ' [(V_b-V_B) ^ (-1)] (b-B)

$\quad\quad\quad$ = $\quad$ 99.40

$\quad$ Prob>chi2 = $\quad$ 0.0000

$\quad$ (V_b-V_B is not positive definite)

Note: P value (0.000) is significant (P < 0.05) hence we accept the null hypothesis.

Table 4.6 above shows the output of Hausman test carried out on the data to help determine which model to use in regression analysis for Loan portfolio.

The Durbin-Wu- Hausman test (also called Hausman specification test) is a statistical hypothesis test in econometrics named after James Durbin, De-Min Wu, and Jerry A. Hausman. The test evaluates the consistency of an estimator when compared to an alternative, less efficient estimator which is already known to be consistent. It helps one to evaluate if a statistical model corresponds to the data, William (2012).

The test reveals to us whether the fixed effect or random effects model fits the data better, and thus which one to use. To decide between Fixed and Random effects, we run a Hausman test where the null hypothesis is that the preferred model is Random effects versus the alternative the fixed effect. Hausman basically tests whether the unique errors are correlated with the regressions. The null hypothesis is that they are not.

If the p-value of the Hausman test is less than the significance level, then we reject the null hypothesis and conclude that the pooled OLS model is appropriate. If the p-value is greater than the significance level then we cannot reject the null hypothesis so we use the fixed effect model. The significance level is set at 0.05.

In our Hausman test output in table 4.6 above, it is noted that P- value (0.000) is significant hence we accept the null hypothesis, (P < 0.05). Since the results indicate that the estimates were significant, fixed effects model was selected for use in analyzing and presenting the panel data (regression analysis) on loan portfolio.

**4.4.2.2 Multicollinearity test for Effect of finnovs on banks' loan portfolio (objective 2)**

The study employed Pairwise correlation analysis to test for multicollinearity. The results of the study are summarized in table 4.7 below.

**Table 4.7: Multicollinearity output table for Loans (objective 2).**

|  | LA | BN | MBS | EFT | TA | IB |
|---|---|---|---|---|---|---|
| LA (Loans Advanced) | 1.000 | | | | | |
| BN (Branch Networking) | 0.7865 | 1.0000 | | | | |
|  | 0.0000 | | | | | |
| MBS ( Mobile Banking Service) | 0.4587 | 0.3547 | 1.0000 | | | |
|  | 0.0000 | 0.0000 | | | | |
| EFT (Electronic Funds Transfer) | 0.0013 | 0.0433 | 0.3904 | 1.0000 | | |
|  | 0.0098 | 0.0062 | 0.0000 | | | |
| TA (Total Assets) | 0.7948 | 0.7620 | 0.4561 | 0.0907 | 1.0000 | |
|  | 0.0000 | 0.0000 | 0.0000 | 0.0301 | | |
| IB (Internet Banking) | 0.6516 | 0.5892 | 0.2854 | -0.0629 | 0.6640 | 1.0000 |
|  | 0.0000 | 0.0000 | 0.0009 | 0.0473 | 0.0000 | |

**Source: Pairwise correlation test for multicollinearity.**

Table 4.7 above shows the output of Pairwise correlation for variables used in regression analysis for Loans. The table has correlation coefficients in the first row (all noted to be less than 0.8) and P-values second row were (all noted to be equal to or below 0.05).

Multicollinearity is the occurrence of high intercorrelations among two or more independent variables in a multiple regression model. Multicollinearity can lead to skewed or misleading results when a researcher or analyst attempts to determine how well each independent variable can be used most effectively to predict or understand the dependent variable in a statistical

model. Multicollinearity undermines statistical significance of regression coefficients and thus, with multicollinearity, there is likelihood of accepting an incorrect null hypothesis or rejecting a correct null hypothesis. It is therefore important to test for multicollinearity between independent variables to ascertain acceptable levels of relationships between them before regression.

All P-values (second row) were noted to be equal to or below 0.05. The null hypothesis was therefore rejected. Similarly, the correlation coefficients (first row) shown in Table 4.7 indicate low levels of multicollinearity therefore ruling out the problems of multicollinearity. According to Gujarati (2009), multicollinearity is regarded high if the correlation coefficient is more than 0.8. From the results presented in table 4.7, all the correlation coefficients had values less than 0.8, therefore no variable had high correlation with another variable. This paved way for use of the variables with no further transformations.

### 4.4.2.3 Regression output for Effect of finnovs on banks' Loan portfolio (objective 2)

This section analyses the second objective of the study which was to establish the effect of financial innovation on the banks' loan portfolio. In order to explore the objective, the study regressed study data based on equation 3.3 and the results are illustrated in table 4.8 below.

Multiple linear regression is a statistical technique that can be used to analyze the relationship between a single dependent variable and several independent variables. The objective of multiple regression analysis is to use the independent variables whose values are known, to predict the value of the single dependent variable, Hayes (2023).

To estimate the effect of banking innovations on loans for commercial banks, the study started by estimating three regression models. The models included pooled regressions, the random effect model and the fixed effect model. To discriminate among the three models, the study conducted the Hausman test so as to identify the best model to be used. For loans, the appropriate model for objective two (based on the Hausman test presented on table 4.6 was Fixed Effects model. This is because the P-value of the Hausman test was found to be 0.0000 which was statistically significant for all conventional statistical significance levels. This implies the null hypothesis that the preferred model is the RE model was rejected and the alternative hypothesis was accepted and therefore Table 4.8 below presents the results of the FE model for the second objective.

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**Table 4.8: Regression Results for Loans (objective 2).**

| Dependent variable: Loans I.Variable | Coefficient | Std error | t-statistic | P-value |
|---|---|---|---|---|
| EFT (Electronic Funds Transfer) | 0.503 | 0.384 | 1.31 | 0.194 |
| MBS (Mobile Banking Service) | 0.081 | 0.065 | 1.22 | 0.224 |
| BN (Branch Networking) | 0.382 | 0.063 | 6.06 | 0.000 |
| TA (Total Assets) | 0.015 | 0.065 | 0.23 | 0.017 |
| ROA ( Return On Assets) | -0.278 | 0.118 | -2.36 | 0.020 |
| ROE (Return On Equity) | -0.291 | 0.086 | -3.38 | 0.001 |
| Cons | 14.532 | 1.366 | 10.63 | 0.000 |

$F_{(6,102)} = 10.29$

Prob>F = 0.0000

Hausman test P-value = 0.0000

R-squared  within = 0.3770

between = 0.8290

overall = 0.5928

Table 4.8 above is the output for regressions of variables to unravel the associations between the independent variables and the dependent variable, Loans. It aims to answer the study's objective one.

Regression is a statistical technique that relates a dependent variable (in this case ROA) to one or more independent variables. A regression model is able to show whether changes observed in the dependent variable are associate with changes in one or more of the independent variables Regression as a powerful tool of data analysis helps businesses and researchers make informed decisions by predicting outcomes based on historical data. Aiding in forecasting, risk assessment, and identifying trends, regression analysis plays an important role in diverse fields. In research it plays three main roles namely prediction, association discovery and model validation.

From table 4.8, the probability of the F-statistic was found to be 0.000, meaning that it was statistically significant at one per cent level of significance. This means that the coefficients of the variables in the model were jointly different from zero implying that EFT, MBS, BN, TA, ROE and ROA were jointly important in explaining Loans. Table 4.8 indicates that the overall R-squared was 0.5928. This means that on average 59.28 percent of all variations in Loans are explained by EFT, MBS, BN, TA, ROE and ROA, holding all other factors constant.

The coefficient of branch networking (branch spread and their attendant WAN linkages) was found to be 0.382. The coefficient was positive and statistically significant at one percent level. This implies that a one percent increase in branch networking would lead to a 0.382 percent increase in Loans holding all other factors constant. The positive effect is an indication that if commercial banks in Kenya increased their branch networking, there would be an improvement in their loan levels. This would be as a result of more people getting increased accessibility to all networked banks, branches and departments and their rapidly accessible services due to influence of networking, predictably leading to more loan uptakes.

The current study's finding is in agreement with Mannah-Blackson (2004) whose study in Ghana found that branch networking offers quicker rate of interbank transactions as the consequence of distance and time are eliminated, productivity per time period is increased and simulated division of labor among bank branches with its associated positive productivity among the networked branches. Increased branch networking would inevitably make loan access less branch-specific therefore more beneficial to the customers as well as the bank. This finding also conforms to Kazumine (2017) whose study on regional banks in Japan found that banks with better branch networking can increase their loans and bills discounted as well as their small and midsize enterprises loans and bills discounted.

In Kenya, Nyatika (2017) on the effect of branch networking on financial performance of commercial banks found that the scope of networking is instrumental in improving access to bank services and products and addressing unmet needs of customers thereby increasing financial performance. Similarly, Musyoka (2011) in her study on the relationship between branch networking and financial performance of commercial banks in Kenya found that there was a considerable growth in all areas and measures of performance including total profits,

assets, loans portfolio, shareholders' equity and in deposits. Based on the observed positive effect of networking on financial performance of commercial banks, the study concludes that branch networking is enhances financial performance therefore investment in better and more efficient BNT resources is recommended.

The coefficient of ROA was found to be -0.278. It is negative and statistically significant at five percent level. This implies that a one percent increase in ROA would lead to 0.278 percent decrease in loans *ceteris paribus*. The negative effect is an indication that if commercial banks in Kenya have increases in their returns on non-loan assets, their performance as measured by Loan levels would decrease. This observation points to the negative effect of competition for resource allocation between competing investment portfolios; the higher outlays for non-loan assets the lower the loaning power and therefore the lower the incomes from loans *ceteris paribus*. The study finding conforms to Nzoka (2015) which found that assets quality alone can't solely determine the financial performance of a commercial bank. He also confirmed that the relationship between asset quality and financial performance was negative. This finding contradicts Abata (2014) who found that asset quality is a sensitive factor which measures the soundness and profitability of commercial banks. The finding also contradicts Cheruiyot (2016) whose study in Kenya found a positive relationship between asset quality (which is implied in positive returns) and profitability of commercial banks.

The observed negative relationship between ROA and loans calls for a cautious investment in order to get higher asset quality and at the same time lower rates of non- performing loans which could be realized through credit risk identification and management. In conclusion, effect of ROA on loans is generally negative and banks should strive to keep it as low as possible given the fact that it is an aspect of bank business that can't be avoided completely.

The coefficient for total assets was found to be 0.015; it was positive and statistically significant at 0.05 level. The result has an implication that a one percent increase in total assets would lead to 0.015 percent increase in loans of the commercial banks in Kenya during the study period. This positive relationship with loans indicates the importance bank assets it its credit creation and leveraging operations. This finding agrees with Abata (2014) who states that asset quality is a small but very sensitive factor that measures the soundness and profitability of commercial

banks and it basically focuses on the quality of loans. This same view is shared by Andrea (2024) in a report from ECB banking supervision. The European report observes that the lower the asset base and quality the higher the credit risk of a firm. There is need for banks to hold more assets or capital to cover related credit risks and book higher provisions to prepare for expected losses. However, we get incongruent findings from random studies. For example Kolcunova and Malovana (2019) from their study on effect of higher capital requirements on bank lending: the capital surplus matters, empirical results indicate that higher additional capital requirements have a negative effect on loan growth for banks with relatively low capital surpluses.

The coefficient of Return on equity was found to be -0.291. The coefficient was negative and statistically significant at one percent level of confidence. This implies that a one percent increase on ROE would lead to a decrease in loans equivalent to 0.291 percent holding all other factors constant. This finding is in line with Ishtiaq (2014) who found a negative association between dividend payout measure with financial efficiency and risk. This means dividend payouts negatively impact on income generating ventures such as loaning. The negative effect implies that during the study period, if a bank in Kenya increased dividends and other equity payments, conventionally its assets available for loaning for example cash is expected to decrease, therefore less would be available for loans. Through this sequence of events, the bank's financial performance in the subsequent periods is technically affected (negatively) due to reduction of expected earnings from loans in the subsequent periods. This view is supported by Martanovic (2023) who states that by increasing financial leverage through increased debt (and tax deductible interest payments), a firm can increase its ROE.

P-values for electronic funds transfer (0.194) and mobile banking services (0.224) were found to be statistically insignificant. The study therefore couldn't offer further analysis.

**4.4.3 Results for objective 3; Effect of financial innovations on Banks' Return on Equity**
This section presents the study output on the effect of financial innovations on Return on Equity. It displays the Hausman test, the multicollinearity test and the regression output for the third study objective.

**4.4.3.1 Hausman test for Effect of finnovs on banks' ROE (objective three)**

The study conducted Hausman test on the data to determine the appropriate regression model to be used in the analysis for ROE model. The results are presented in table 4.9 below.

**Table 4.9:  Hausman Test output for ROE model (objective 3).**

| | Coefficients | | | |
|---|---|---|---|---|
| | **(b)** | **(B)** | **b-B** | **sqrt (diag(V b V_B)** |
| | **Fe** | **Re** | **Difference** | **S.E.** |
| EFT (Electronic Funds Transfer) | -.7560933 | -.8952594 | .1391661 | .2402863 |
| MBS (Mobile Banking Service) | .0397703 | .0459521 | -.0061818 | .0136878 |
| BN (Branch Networking) | .3057913 | .3065267 | -.0007354 | .0378905 |
| TA (Total Assets) | .1229859 | .1303508 | -.0073648 | .0164852 |
| ROA (Return on Assets) | -.3870828 | -.3390896 | -.0479932 | .0594954 |
| LA (Loans Advanced) | -.344868 | -.2818382 | -.0630298 | .0598661 |

b consistent under $H_o$ and $H_a$; obtained from xtreg

B = consistent under $H_a$, efficient under $H_o$; obtained from xtreg

Test: $H_o$:  difference in coefficients not systematic

$\quad$ Chi2 (6) = (b-B) ' [(V_b-V_B) ^ (-1)] (b-B)

$\qquad$ = $\quad$ 2.99

$\quad$ Prob>chi2 = $\quad$ 0.8100

 Note: P value (0.81) is insignificant hence we fail to accept the null hypothesis. (P > 0.05).

Table 4.9 above shows the output of Hausman test carried out on the data to help determine which model to use in regression analysis for ROE.

The Durbin-Wu- Hausman test (also called Hausman specification test) is a statistical hypothesis test in econometrics named after James Durbin, De-Min Wu, and Jerry A. Hausman. The test evaluates the consistency of an estimator when compared to an alternative, less efficient estimator which is already known to be consistent. It helps one to evaluate if a statistical model corresponds to the data, William (2012).

The test reveals to us whether the fixed effect or random effects model fits the data better, and thus which one to use. To decide between Fixed and Random effects, we run a Hausman test where the null hypothesis is that the preferred model is Random effects versus the alternative the fixed effect. Hausman basically tests whether the unique errors are correlated with the regressions. The null hypothesis is that they are not.

If the p-value of the Hausman test is less than the significance level, then we reject the null hypothesis and conclude that the pooled OLS model is appropriate. If the p-value is greater than the significance level then we cannot reject the null hypothesis so we use the fixed effect model. The significance level is set at 0.05.

In our Hausman test output in table 4.9 above, it is noted that P- value (0.8100) is insignificant hence we fail to accept the null hypothesis, (P > 0.05). The results indicate that the estimates were insignificant therefore random effects model was selected for use in analyzing and presenting the panel data (regression analysis) on return on equity.

**4.4.3.2 Multicollinearity test for Effect of finnovs on banks' ROE (objective 3)**

The study employed Pairwise correlation analysis to test for multicollinearity. The results of the analysis are summarized in table 4.10 below.

**Table 4.10: Multicollinearity output table for ROE (objective 3)**

|  | ROE | BN | MBS | EFT | TA | IB |
|---|---|---|---|---|---|---|
| ROE (Return on Equity) | 1.000 | | | | | |
| BN (Branch Networking) | 0.5591 | 1.0000 | | | | |
|  | 0.0000 | | | | | |
| MBS (Mobile Banking Service) | 0.0545 | 0.3547 | 1.0000 | | | |
|  | 0.0500 | 0.0000 | | | | |
| EFT (Electronic Funds Transfer) | 0.0242 | 0.0433 | 0.3904 | 1.0000 | | |
|  | 0.0078 | 0.0062 | 0.0000 | | | |
| TA (Total Assets) | 0.3334 | 0.7620 | 0.4561 | 0.0907 | 1.0000 | |
|  | 0.0001 | 0.0000 | 0.0000 | 0.0011 | | |
| IB (Internet Banking) | 0.1813 | 0.5892 | 0.2854 | -0.0629 | 0.6640 | 1.0000 |
|  | 0.0375 | 0.0000 | 0.0009 | 0.0473 | 0.0000 | |

**Source: Pairwise correlation test for multicollinearity.**

Table 4.10 above shows Pairwise correlation test for multicollinearity for variables that were used in regression analysis for ROE.

The table has correlation coefficients in the first row (all noted to be less than 0.8) and P-values second row were (all noted to be equal to or below 0.05).

Multicollinearity is the occurrence of high intercorrelations among two or more independent variables in a multiple regression model. Multicollinearity can lead to skewed or misleading results when a researcher or analyst attempts to determine how well each independent variable can be used most effectively to predict or understand the dependent variable in a statistical model.

Multicollinearity undermines statistical significance of regression coefficients and thus, with multicollinearity, there is likelihood of accepting an incorrect null hypothesis or rejecting a correct null hypothesis. It is therefore important to test for multicollinearity between independent variables to ascertain acceptable levels of relationships between them before regression.

Since P-values (second row) were noted to be equal to or below 0.05, null hypothesis was therefore rejected. The correlation coefficients (first row) shown in Table 4.10 also indicate low levels of multicollinearity therefore ruling out the problems of multicollinearity. According to Gujarati (2009), multicollinearity is regarded high if the correlation coefficient is more than 0.8. From the results presented in table 4.10 the correlation coefficients had values less than 0.8, therefore no variable had high correlation with another variable. This paved way for use of the variables in regression analysis with no further transformations.

**4.4.3.3 Regression output for Effect of finnovs on return on Banks' Equity (objective 3)**
This is the third objective of the study. In order to explore the objective, pertinent data was regressed using equation 3.4 and the results are illustrated in Table 4.11 below.

Multiple linear regression is a statistical technique that can be used to analyze the relationship between a single dependent variable and several independent variables. The objective of multiple regression analysis is to use the independent variables whose values are known to predict the value of the single dependent variable, Hayes (2023).

In order to estimate the effect of banking sector innovations on return on equity for commercial banks, the study started by estimating three regression models; pooled regression, the random effect model and the fixed effect model. To discriminate among the three models, the study conducted Hausman test so as to identify the best model to be used. For ROE (objective three) based on the Hausman test (table 4.9), the appropriate model was Random Effects model. This is

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because the P-value of the Hausman test was found to be 0.8100 which was statistically insignificant, implying the null hypothesis FE is rejected. Table 4.11 below presents the empirical findings for the third objective.

**Table 4.11: Regression Results for ROE (objective 3).**

**Dependent variable: ROE**

| I.Variable | Coefficient | Std error | t-statistic | P-value |
|---|---|---|---|---|
| EFT (Electronic Funds Transfer) | -0.895 | 0.339 | -2.64 | 0.008 |
| MBS (Mobile Banking Service) | 0.046 | 0.071 | 0.65 | 0.016 |
| BN (Branch Networking) | 0.307 | 0.064 | 4.81 | 0.000 |
| TA (Total Assets) | 0.130 | 0.068 | 1.93 | 0.050 |
| ROA (Return on Assets) | -0.339 | 0.111 | -3.05 | 0.002 |
| LA (Loans Advanced) | -0.282 | 0.083 | -3.41 | 0.001 |
| Cons | 5.035 | 1.807 | 2.79 | 0.005 |

Wald chi2 (6) = 29.62
Prob > chi2 = 0.0000
Hausman test: P- value = 0.8100
 R-squared:   Within = 0.2027
              Between = 0.2862
              Overall = 0.2077
**Source: ROE regression output.**

Table 4.11 above is the output for regressions of variables to unravel the associations between the independent variables and the dependent variable, ROE. It aims to answer the study's objective one.

Regression is a statistical technique that relates a dependent variable (in this case ROA) to one or more independent variables. A regression model is able to show whether changes observed in the dependent variable are associate with changes in one or more of the independent variables. Regression as a powerful tool of data analysis helps businesses and researchers make informed decisions by predicting outcomes based on historical data. Aiding in forecasting, risk assessment, and identifying trends, regression analysis plays an important role in diverse fields. In research it plays three main roles namely prediction, association discovery and model validation.

From table 4.11, the probability of the Wald statistic was found to be 0.000, meaning that it was statistically significant at one per cent level of significance. This means that the coefficients of the variables in the model were jointly different from zero implying that EFT, MBS, BN, TA,

ROA and LA were jointly important in explaining ROE. Table 4.11 indicates that the overall R-squared was 0.2077. This means that on average, 20.77 percent of all variations in ROE were explained by EFT, MBS, BN, TA, ROA and LA, holding all other factors constant. The relatively low R-squared of 0.2077 is plausibly attributed to tail-end prioritization in respect to legal procedure of firms declaring dividends only after meeting operational, and especially legal and statutory financial obligations. At times decisions by AGMs to plough-back pre-dividend incomes for expansion purposes, boosting liquidity, provisions for risks, research and development allocations inevitably lowers ROE's R-squared.

The coefficient of branch networking was found to be 0.307. The coefficient was positive and statistically significant at one percent level. This implies that a one percent increase in branch networking would lead to a 0.307 percent increase in ROE, holding all other factors constant. The positive effect is an indication that if commercial banks in Kenya enhance branch networking activities, their returns on equity would improve. This would be as a result of more people getting attracted to the more accessible banking services brought about by enhanced branch networks leading to more returns. In their study, Kadioglu *et al* (2017) who found that a unit change in branch networks had a corresponding increase in financial performance of commercial banks in Turkey.

On the other hand, Hirtie (2005) from his study on USA banks found that banks with mid-size branch networks may be at a competitive disadvantage in branching activities and there was no systematic relationship between branch networking size and institutional profitability. This therefore would mean that no meaningful gains on returns on equity may be directly attributed to bank branch networking. This view echoes Kazumine (2017) whose investigation on influence of branch network on performance of Japanese regional banks found that banks with more branches could increase their loans and bills discounted but their ROA and ROE were found to be lower. These conflicting finding gave room for further work in this field. In Kenya,

Musyoka (2011) found from her study on the relationship between branch network on bank financial performance of commercial banks found that there was a positive growth in all indicators including loans, assets, net profits, dividends and deposits. Similarly current study, as noted above, has confirmed a positive effect of branch networking on ROE of Kenyan

commercial banks during the study period. Based on the positive influence of BN, it is therefore recommended that Kenyan commercial banks should investment more on new bank branches and effective and more efficient modern networking technology in order to reap higher values from ROE via BN influence in addition to other forms of finnovs with positive impact on financial goals of the banks.

The coefficient of return on assets was found to be -0.339. The coefficient was negative and statistically significant at one percent level. This implies that a one percent increase in ROA would lead to a decrease in ROE equivalent to 0.339 percent in ROE holding all other factors constant. The negative relationship between the two variables is contrary to conventional expectation where increases in incomes from various assets would benefit shareholders by way of higher dividends. This income comes from fixed and movable assets employed by the bank to generate incomes. From incomes, the company pays creditors and other expenses before declaring dividends, the shareholder's income (ROE). A study by Gumeler et al (2022) on effect of ROA, current Ratio, Debt Asset Ratio and firm size on company dividends of quoted Indonesian financial firms, found that partially the ROA variable has a positive effect on dividend policy while the other study variables have no effect. The study equally shows that Simultaneously ROA and other study variables, CR, DAR, and firm size jointly influence dividend policy.

Simanullang et al (2021) and Abundanti et al (2020) are both in agreement and respectively state that ROA has a significant positive effect on firm value and that asset based profitability has a significant effect on dividend policy, and dividend policy in turn has a significant effect on firm value. In spite of the above positive trend observed on ROA's influence on ROE, a negative observation was registered by Ramadini (2024) on his study on effect of ROA, company size, and asset growth on dividend policy on Indonesian financial companies. The study found that bank size affects dividend policy while ROA and asset growth had no effect on dividend policy. From the Kenyan financial sector like Kisaka et al (2015) from their study on the relationship between profitability and dividend payout of NSE listed commercial banks, had one key finding; that there is a strong positive relationship between profits and dividend payout. This is in contrast with the results of the current study. The divergent observations by different studies on the effect of ROA on ROE calls for further evaluation of the topic.

The coefficient for loans advanced was found to be -0.282. It was negative and statistically significant at one percent level. This implies that, holding all other factors constant, a one percent increase in loans by the commercial banks during the study period would lead to a decrease on ROE equivalent to 0.282 percent. The negative relationship is an indicator to commercial banks that long-term loans, non- performing loans as well as the firm's high cost credit facilities have the risk and a tendency to hold up returns if not lead to outright losses.

This finding is in tandem with Kadioglu et al (2017) who found existence of significant negative relationship between non-performing loans and bank profitability in Turkey. The finding also conforms to Amooko (2015) whose study in Ghana found that non-performing loans have significant negative effect on banks' profitability. This would translate to reduced or non-declaration of dividends. Dang (2017) noted the negative relationship between loans and dividends declared from his study on effect of loan growth on bank performance in Vietnam. He therefore emphasized prudent loan management through caution in lending activities, risk governance and increased skills of loaning officers in order to prevent or reduce loan based losses. It is therefore evident that loans play a vital role on equity returns, however loan management should be careful to curtail credit risks and losses.

From literature reviewed, the only form of loans with positive effect on ROE are bank borrowings from other financial institutions to strengthen the borrower bank's capital base and operations. For example Linda et al (2012) from their study on the role of banks in dividend policy documented a significant inverse relation between a firm's dividend payouts and the intensity of a firm's reliance on bank loan financing. Similarly Simiyu et al (2017) on their study on effect of debt financing on performance of Saccos in Tharaka Nithi- Kenya, found a strong positive relationship of 0.984 between debt and ROE. However as noted earlier, this approach is technically different from loans advanced to customers by the bank under study, the approach which this study adopted.

The coefficient of EFT was -0.895, negative and statistically significant at one percent level. Studies on the effect of EFTPos on bank performance have yielded mixed results. Momina et al (2011) found from their study that bank efficiency has risen as the costs have been reduced; cost of labor, provision of services, time saved, accuracy, reliability and quality of services improved.

The cost reductions lead to higher savings and incomes which translate to increase in dividends declared (ROE). This study is in agreement with Kozak (2005) whose study in USA on the influence of IT on profits and cost effectiveness found an optimistic relationship between IT productivity and cost saving. The relationship shows a positive indirect effect of cost savings on perceived increases in dividend earnings *ceteris paribus.* In the league of positive results, we also have Agboola (2006) whose study on effect of electronic banking on bank performance in Nigeria established existence of a positive relationship between increase in use of EFTPos by banks and efficiency and higher financial performance. From Kenya, Kiragu (2017) found a positive but insignificant EFT influence on financial performance of commercial banks in Kenya. In contrast to the highlighted studies with positive results in EFT- ROE relationship, Strassman and Shu (2005) from their survey of twelve US banks from 1989 to 1997 found that IT cannot improve banks earnings especially at their inceptive stages. This finding is in tandem with the current study's observation which noted a significant negative relationship at -0.895 for the 2007 to 2017 period for Kenyan commercial banks.

The negative findings by the current study was attributed to relative lack of awareness about full operations and potential of EFT in the banking sector and thus considered a risk by most customers who remain suspicious on grounds of reported cybercrimes. Most customers largely avoid its use. Nonetheless the study concludes that EFT plays a role in moving funds albeit with a non priori negative overall influence. This is vital pointer to the need for research into more modern, efficient and risk-free EFT technology. Bank investment in the said areas should be prioritized by private enterprises and the state. Alongside it, there is also need for consumer education on need for and various aspects of EFT and ways to stay risk-free in their EFT operations.

The coefficient for MBS was found to be 0.052, positive and statistically significant at 0.05 conventional level. This implies that a one percent change in MBS would lead to a 0.052 per cent increase in the banks' ROE *ceteris paribus*. The relationship between mobile banking and ROE is largely deduced from overall observations from other bank performance parameters. This is because records on studies that directly link the two are not available. The positive effect implies that if banks increase mobile banking services in their financial improvement initiatives their ROE margins would increase. This would be as a result of more people accessing more bank

services via phones and network related connections. MBS leads to ease of access and cost reductions for both customers and the banks. The banks would also gain from account commissions and mobile transaction charges. Overall financial performance gains by banks have an effect on terminal profits from which ROE (dividend payouts) is effected.

The current study's findings tallies with those of Bavaneshwari et al (2014) in Ponmolai area at Trichy- India, which found a positive effect on bank performance via mobile banking. In order to increase profitability via mobile banking service, the study recommended that banks should update, publish, explain, simplify and, fortify services in order to win more customers and to become more competitive in the dynamic market. Similarly Cleveland (2016) found that mobile banking keeps the banks in competition. Banks save billions of dollars in costs; deposits are cheaper. The study recommended segment service improvement based on the mobile banking platform for various types of customers.

In Kenya, Mutua (2010) from his study on effects of mobile banking on the financial performance of commercial banks in Kenya noted a positive but weak relationship between the two variables. The weak relationship is attributed to effects of negative macroeconomic variables for example, inflation. Likewise Kato (2012) studied the effect of mobile banking on performance of commercial banks in Kenya. He also established a positive relationship between the variables; he equally called for cutting edge security to ensure full integration of all aspects of banking on the mobile banking platform. Despite the predominant positive relationships observed between mobile banking and bank performance, Cleaveland (2016) noted a decrease in non-interest income alignment due to mobile banking. This outlier observation calls for further studies in this area.

The above studies relate with the current research on its objective and independent variable-mobile banking services though in different times and economic contexts. The current study reveals a positive effect of mobile banking on financial performance of Kenya's listed commercial banks. It therefore supports further use of MBS by commercial banks so that they reap more returns on their equity.

The coefficient for total assets was 0.130, positive and statistically significant at 0.05 level. This means that, holding all other factors constant, a one percent increase in TA would lead to a 0.13

percent increase in the bank's ROE during the study period. It is notable that the current study considered total assets as a summation of all conventional forms of bank assets excluding loans which is treated as a stand-alone variable in order to seek more specific information on it. It is also presumed that positive returns from any or all asset factors lead to increase in profits, from which return on equity is conventionally realized, *ceteris paribus*.

The observation of the current study is in agreement with Hussein and Hassan (2010) who found that a number of factors are noted to affect the performance of banks and other financial institutions. The major ones being; asset quality, credit and deposit growth, capital adequacy, profitability and risk. He however noted that exogenous and endogenous factors which influence bank performance are more than those used in the study. In the view of Athanasoglou (2005), the banks' asset is another bank specific variable that affects bank profitability. Among others, bank assets include; fixed asset, current assets, credit portfolio, and other investments. A growing asset (size) is often related to the age of the bank. A growing asset and bank size are both signs of better ROA and ROE of the bank.

Similarly, from his study on effect of capital adequacy and deposits on performance, Dawood (2014) concluded that both have a positive relationship with profitability of commercial banks. However, capital adequacy has a more significant relationship. Both capital adequacy and deposits translate to higher returns on assets and equity. Gul et al (2011) is also consistent with the above studies, he found a significant positive relationship between bank assets and size with its ROA and ROE. Mwongela (2015) from his study on the relationship between asset quality and profitability of commercial banks in Kenya found that asset quality as measured by LLP positively influences ROA and ROE of commercial banks. While the current study is in agreement with the above outlined studies' findings, Mwongela (2015) also noted that non-performing / idle assets lead to negative returns on ROA and ROE. Meaning banks should optimally hold and use assets for positive returns on ROE.

# CHAPTER FIVE

## SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

### 5.1 Introduction

This chapter presents summary, conclusions and recommendations, significance of the study as well as areas for further research.

### 5.2 Summary of the Study

The study sought to determine the effect of financial innovations on financial performance of commercial banks in Kenya. Specifically the study intended to determine the effect of financial innovation on banks' return on assets, to establish the effect of financial innovations on the banks' loan portfolio and lastly to examine the effect of financial innovation on the banks' return on equity. The study was anchored on constraint-induced financial innovation theory, Schumpeter's innovation theory and loanable funds theory. Correlational research design was adopted with purposive sampling technique. Panel data for a period between 2007- 2017 from selected 12 commercial banks listed at Nairobi Security Exchange was used. The data was analyzed using fixed and random effect regression models. Evidence from previous studies on whether bank innovations influence bank financial performance showed that there were mixed reactions based on the environment of operation and the level of adoption of financial innovations in the banking sector. The mixed reactions, changing times and the rapid changes in innovations and global financial sectors created gaps for this study.

### 5.2.1 Summary of Effects of Financial innovations on Return on Assets

The first objective of the study was to determine the effect of financial innovations on return on assets of commercial banks in Kenya. The study found that financial innovations have varied effects on financial performance of Return on Asset of commercial banks in Kenya in various ways. The overall R squared was 0.5134; meaning 51.34 per cent of all variations in Return on Assets were explained by the independent variables EFT, MBS, BN, TA, ROE and LA *ceteris paribus.*

Specifically, Branch networking had a correlation coefficient of 0.373 with ROA. The relationship was positive and statistically significant at one percent level. It was found to have a positive influence on return on assets of commercial banks. Similarly Total assets had a positive influence on ROA of commercial banks with a correlation coefficient of 0.130 which was positive and statistically significant at 5 percent level.

The confounding variable finnov ROE, had a correlation coefficient of -0.223 which was negative but significant at one percent level. It had negative effect on banks' ROA. Similarly confounding finnov Loans had a correlation coefficient of -0.211 which was negative but significant at one percent level. It also had negative effect on banks' Return on Assets.

Mobile banking services had a correlation coefficient of 0.052 and significant at 0.05 levels. It had a positive influence on banks' ROA. On the other hand, Electronic funds transfer at point of sale (EFT), was found to be statistically insignificant.

### 5.2.2 Summary of Effects of Financial innovations on Loan portfolio

The second objective of the study was to establish the effect of financial innovations on banks' loan portfolio, in Kenya. The study found that financial innovations have varied effects on financial performance on Loan portfolio of commercial banks in Kenya in various ways. The overall R squared was 0.5928, meaning 59.28 per cent of all variations in Loan portfolio were explained by the independent variables EFT, MBS, BN, TA, ROE and ROA *ceteris paribus.*

At individual finnovs level, the study found that both Branch networking and banks' Total assets value had statistically significant correlation coefficients with DV Loans, and both positively influenced Loan portfolio. In particular Branch networking had a correlation coefficient of 0.382 and was significant at one percent level. On its part, finnov Total Assets had a correlation coefficient of 0.015 with Loans, and it was significant at five per cent level.

The study found that both ROA and ROE had negative influence on dependent variable Loans. ROA had a correlation coefficient of -0.278 while ROE had a coefficient of -0.291. Both were statistically significant at all conventional levels. Given the above, they (ROA and ROE) were found to be significant in affecting loan portfolio, albeit negatively. The study found that the

relationships between both finnovs EFT and MBS with Loans were statistically insignificant at all conventional levels.

**5.2.3 Summary of Effects of Financial innovations on Return on Equity**

The third objective was to examine the effect of financial innovations on the banks' return on equity. The study found that financial innovations have varied effects on financial performance on Return on equity of commercial banks in Kenya in various ways. The overall R-squared was 0.2077, meaning 20.77 per cent of all variations in Return on equity were explained by the independent variables EFT, MBS, BN, TA, Loans and ROA *ceteris paribus.*

The study found that branch networking had a positive relationship with ROE. It had correlation coefficient of 0.307 and the relationship was statistically significant at one percent level. Total assets also had positive influence on return on equity at 0.05 levels of significance. It had 0.13 correlation coefficient with ROE. On its part Mobile banking services exhibited a positive relationship with ROE. It had a correlation coefficient of 0.046 with ROE. The observation was significant at five percent level.

Electronic funds transfer, Loans advanced and Return on assets all had negative influence on /relationship with ROE. All the three observations were within acceptable significance levels. EFT had correlation coefficient of -0.896 with ROE. Its significance level was at one per cent. Finnov Loans had a correlation coefficient of -0.282 with ROE. The relationship was significant at one per cent level. Finnov Return on assets (ROA) had a correlation coefficient of - 0.339 with ROE. This relationship was significant at one per cent level. All the three predictors were however noted to impact negatively on ROE.

In summary, for objective one; which was to determine the effect of financial innovation on banks' return on assets, The overall R squared was 0.5134; meaning 51.34 per cent of all variations in Return on Assets were explained by the independent variables of the study; EFT, MBS, BN, TA, ROE and LA *ceteris paribus.* The study also found that three finnovs (MBS, BN, TA) had positive impact on banks' Return on Assets while two confounding finnovs (ROE

and LA) had negative impact on banks' Return on Assets in Kenya during the study period. One finnov, EFT was insignificant.

On the second objective; which was to establish the effect of financial innovation on the banks' loan portfolio, the study found that the overall R squared was 0.5928, meaning 59.28 per cent of all variations in Loan portfolio were explained by the independent variables EFT, MBS, BN, TA, ROE and ROA *ceteris paribus.* It was also found that two finnovs (BN and TA) positively impacted on banks' Loans while two confounding finnovs (ROA and ROE) negatively impacted on banks' Loan portfolio in Kenya during the study period. Two finnovs EFT and MBS were found to be insignificant.

On the third objective; which was to examine the effect of finnovs on return on banks' Equity, the study found that the overall R squared was 0.5928, meaning 59.28 per cent of all variations in Loan portfolio were explained by the independent variables EFT, MBS, BN, TA, ROE and ROA *ceteris paribus.* In particular it was found that three finnovs (MBS, BN and TA) positively impacted on banks' ROE while three finnovs (EFT, ROA and LA) negatively impacted on banks' Return on equity in Kenya during the study period.

In addition to the above, the following general (not objective specific) observations were made from the study:
The study data set was complete and adequate. It covered all the 11 years of the study period with both dependent and independent variables, as evidenced by the raw data at appendix III. The four theories on which the study was anchored ably guided it. These theories were Capital asset pricing theory, Loanable funds theory, Schumpeter's theory of innovation and Financial intermediation theory.

It's also noted that ROE was the only DV that had all finnovs impacting on it with half (MBS, BN and TA) impacting positively and the other half (EFT, ROA and LA) impacting negatively. On the other hand, Loans was the only DV that had least number of Finnovs impacting on it during the study period. Only two finnovs  BN and TA had positive impact on Loans. Similarly only two confounding variables/ finnovs ROA and ROE had negative impact on Loans. All other finnovs were above confidence levels therefore not applicable.

The finnovs with most recurrent positive impact (highest positive impact/correlation values) on all the study's dependent variables were Branch networking, Total assets and mobile banking service.

On the other hand, finnovs with the most recurrent negative impact (lowest impact/correlation values) on the DVs were ROE, ROA and LA. The finnov with most recurrent insignificant effect on all the DVs was EFT followed by MBS.

Finally the study notes that financial innovations had higher correlation with, and impact on Loans, followed by Return on assets as indicated by their respective R-squares; 0.5928 and 0.5134 respectively. This means that the finnovs under study had 59.28% and 51.34% influence on financial performance of both loan portfolio and return on assets respectively, holding all other factors constant.

Finnovs had the lowest impact on return on equity as indicated by R-squared of 0.2077. This means that, *ceteris paribus*, the finnovs under study accounted for only 20.77% change in ROA of commercial banks in Kenya during the study period.

## 5.3 Conclusions and recommendations

*a) For study objective one*, the study found that the overall R-squared was 0.5134; meaning 51.34 percent of all variations on Return on assets were due to effect of the financial innovations (used in the study). Holding all other factors constant, this positive impact is directly attributed to Branch networking, Mobile banking services and Total assets. The three respectively had positive effect factors of 0.373, 0.052 and 0.130.

The remaining 48.66% variations in Return on assets are attributed to; finnovs with negative impact on ROA like ROE and Loans (which account for -0.434), plus other intervening organizational and legal factors which were held constant or attributed to error factor in this study.

Based on the above observations for objective one, the study therefore concludes that on average, financial innovations majorly enhanced return on assets of commercial banks. The study therefore recommends increase in number of networked bank branches for wider reach and more

efficient and secure transactions as supported by the positive effect (coeff 0.373) of finnov Branch networking.

Based on the conclusion of positive impact of finnov Mobile banking services (coeff 0.052), the study recommends that Kenyan commercial banks should embrace enhanced mobile/telebanking and they should go for consumer friendly technology, they should reach-out more new customers on various networks and also improve on anti-cybercrime efforts for safety of the bank, customers and other stakeholders. In this effort, the banks should liaise with reputable private and state security agencies on networking initiatives.

Based on the findings and conclusions on positive impact of finnov Total assets (coeff 0.130), the study recommends that commercial banks should broaden their asset base and factor it in various forms, fixed and liquid. This is because assets give necessary edge for bank investment, loaning and other desirable development initiatives. While pursuing this effort, legal requirements (industry and statutory) should be adhered to.

It was noted that some finnovs had negative relationship (ROE and LA both with coeff -0.223 and -0.211 respectively) with Return on assets. The study concludes that in their pursuit of better financial leverage in the banking sector, a number of methods and innovations they employ to achieve this goal may turn out negative to the organization's goals or lead to outright losses. This confirms innate flaws of some finnovs. It is therefore recommended that such loss-prone finnovs should be reviewed with a view to improve their efficacy; their use be given second thought and where not measuring up to expectations, be avoided.

Lastly on the finnov (EFT p-value 0.135) that had no impact at all on ROE, it is concluded that not all financial improvement efforts and methods succeed because some promising innovations used actually bear no significant fruit. The study therefore recommends that commercial banks should drop such finnovs unless they prove overally gainful with other financial growth parameters.

*b) For study objective two,* it was found that the overall R-squared was 0.5928; meaning 59.28 percent of all variations on Loan portfolio during the study period were due to effect of the financial innovations used in the study. This positive impact is directly attributed to Branch

networking and Total assets with coeff 0.382 and 0.015 respectively. The remaining 40.72% variations on Loans in the regression are attributed to; finnovs which had negative impact on Loans like Return on assets and Return on equity, in addition to other intervening organizational and legal factors which are held constant or attributed to error factor in this study.

Based on the above observations for objective one, the study concludes that on average, financial innovations had positive effects and majorly improved loan portfolios of commercial banks by upto 58.29% during the study period 2007-2017. The study therefore recommends that the two finnovs responsible for this growth should be strengthened through funding for further research, expansion and increased efficiency levels. More branches and up-to-date networking should be pursued. Banks should also revamp Total asset levels to optimal levels to gain more from its positive gains on Loans.

Given that some finnovs (ROA and ROE with coeffs -0.278 and -0.291 respectively)) had negative impact on Loans leading to a cumulative negative impact of -0.569. The study concludes that in pursuit of better financial leverage in the banking sector, a number of methods and innovations employed to achieve this goal may yield negative/ harmful impact on the organization's Loan portfolio goals. The finnovs plus other intervening variables which are held constant in the study plus error term, led to a cumulative decrease in loans performance equivalent to 40.72%. It is also concluded that the two finnovs ROA and ROE were compounding by nature and technically inevitable. The study therefore recommends that commercial banks should look into how the impact of the two should be mitigated and re-assesed with a view to strengthen their relationships with other bank growth portfolios or reducing their effect in the Loans-Finnovs growth matrix. It is equally recommended that commercial banks should reduce their ROE payouts with a view to plough back on assets in order to bolster overall growth ratios.

Lastly on finnovs (EFT and MBS) that were noted to have insignificant impact on Loans, it is concluded that not all financial improvement efforts and methods succeed because some seemingly promising innovations employed actually bear no significant output. The study therefore concludes that they should be dropped especially on efforts seeking growth from loans portfolio.

*c) For study objective three*, it was found that the overall R-squared was 0.2077, meaning 20.77percent of all variations on the dependent variable Return on equity during the study period were due to effect of the financial innovations used in the study. This positive impact is directly attributed to finnovs with positive impact namely Mobile banking services, Branch networking and Total assets (with coeffs 0.046, 0.307 and 0.130 respectively).

Though positive, the study observes that the overall R squared for finnovs on ROE is relatively low compared to those for compatriot DVs ROA and Loans, both rated at 51.34% and 59.28% respectively. It's therefore concluded that there is an underlying problem within the finnovs – ROE matrix which calls for further investigation. The remaining 79.23 % of variations on Loans during the study are attributed to; finnovs which had negative impact on ROE like EFT, Loans and Return on assets, plus other intervening organizational, market and legal/ statutory factors which were held constant or attributed to error factor in this study.

Based on the above observations for objective three, the study concludes that on average, financial innovations majorly improved loan portfolios of commercial banks by up to 20.77%. The study therefore concludes that use of finnovs are beneficial to commercial banks as they improve the banks' return on equity as observed with MBS, BN, TA. Given the above, the study recommends that the commercial banks should use more of the three positively significant variables in order to reap more Returns on equity. Through research they should be fortified to higher efficiency levels to improve their productivity.

The study also recommends an audit by the banks, of accounts that link ROE and other finnovs accounts to reveal the cause for low overall (R-squared) impact of the finnovs on ROE as compared to other DVs with a view to make appropriate adjustments in their growth outlays in order to improve ROE**.**

Given that some finnovs (EFT, ROA and LA) had negative impact on Return on equity, leading to a cumulative negative impact of 15.16 per cent, the study concludes that in pursuit of better financial leverage in the banking sector, a number of methods and innovations employed by the banks to achieve their financial goals do yield negative/ harmful impact to the organization's Return on equity goals. It is therefore recommended that commercial banks should re-evaluate or downscale use of the three finnovs with negative impacts.

Lastly on objective three, having no finnovs with insignificant impact on ROE, it is concluded that all financial improvement efforts and methods used in the study registered impact albeit with varied (positive or negative) results. It is therefore recommended that commercial banks should research more on and adopt other emerging financial performance improvement innovations in order to achieve and keep competitive edge in the financial sector.

*d) Recommendations on general observations* from the study, it's been found that there are some positive relationships between innovations and performance in the banking sector for example the effect of branch networking and total assets on bank performance have consistently remained positive on all the dependent variables during the entire study period. This implies that, banks which adopt various innovations in their operations register improvements in various aspects of their operations. For this reason, the study recommends that, commercial banks should continue investing in various positive and promising dimensions of innovation as a way of improving on financial performance and keep pace with the current innovation supply and financial market demands.

In line with Kenya's Vision 2030 economic pillar, there is need for more focused and purposeful funding for research and innovation in the financial sector with emphasis on areas indicated by mal-performing financial innovations. This initiative calls for commitment of both private and public sectors. This is because in any economy (Kenya included) financial sector, particularly commercial banking is a critical factor for sustainable economic growth and development.

Lastly, the state through the financial sector regulatory authorities like the Central Bank of Kenya and the Capital Market Authority should partake in the financial innovation matrix with a purpose to closely monitor and regulate such developments with assurance on their standards, integrity and safety especially on the deposit and payment systems for example MBS and EFTPos.

## 5.4 Significance of the Study

a) The findings of this study prove that finnovs have positive impact on financial performance of commercial banks in Kenya as evidenced by prevalent positive overall impacts (R-sq 0.5134, 0.5928 and 0.2077) of financial innovations on the three respondent variables. Three finnovs (BN, MBS and TA) also stand out with consistent positive coefficients on all three dependent

parameters throughout the study period. Based on this observation, the study has / shall help commercial banks in identifying some effective finnovs from the pool of finnovs and other technologies available to them in their pursuit of achieving set financial goals.

b) Based on Pragmatic research philosophy, the study used correlational design and employed fixed, random and pooled regression of panel data analysis. The methodology used has proved to be very effective in achieving results as witnessed by detailed and simple output in chapter four herein. Therefore scholars and specifically banks shall gain from use of this proven method in isolating specific effects of financial innovation and related technology use in their corporate decisions and operations.

c) This study has also proved that there are some finnovs which inherently have negative impact on financial performance of commercial banks for example ROE, ROA and LA which mostly had persistent significant negative influence on financial performance of commercial banks during the study period. The study therefore is hoped to inform bank management policies and decisions with a view to re-examine finnovs and their use in order to mitigate negative effects or completely overturn their impact for overall good of the banks.

d) The study's isolation of EFT and MBS as predominant no-impact or negative-impact finnovs, informs the commercial banks on the reality of loss making finnovs outlays. It therefore backs grounds for dropping these or others with similar impact after an effective re-examination of each against bank goals. The same gain to banks and treatment to finnovs applies to finnovs with impacts oscillating between positive negative for and different dependent variables.

e) It is hoped the banks shall benefit from outcome of security and improvement pursuits recommended by this study. The study reveals nil (insignificant) or mostly negative impact of some finnovs such as EFT, MBS, against a prori expectation. Upon which funding, examination, and action by banks and the state on cyber- security concerns are prescribed**.**

## 5.5 Suggestions for Further Research

a) This study specifically concentrated on the effect of financial innovations on financial performance of commercial banks in Kenya. The study period was 2007-2017. Its dependent variables were Return on Asset, Loans portfolio base and Return on Equity. The financial

innovations under study were Mobile Bank Services, Electronic Fund Transfer, Total assets, Internet/Agency banking and Branch networking. Based on the nature of this study and its findings, the study suggests a similar research on effects of financial innovations on non-quoted banks/ and other financial institutions in Kenya.

b) Secondly, since the current study focused only on commercial banks listed by Nairobi Security Exchange, there is need for another study to determine the effect of financial innovation on financial performance of non-banking financial institutions in Kenya and lastly to explore financial innovation challenges facing the banking sector in Kenya.

c) Lastly, to underscore and promote uptake and use of various modern finnovs, the current study voices need for a study to explore the challenges facing market available finnovs in Kenya.

**5.6 Limitation of the Study**

a) The study being anchored on secondary data was potentially faced with challenges like data gaps and unsynchronized data; however the limitation was overcome by proper sieving of data available from CBK annual bank reports by aligning them to study requirements. Data from CBK was found to be complete and adequate.

b) Secondly, data on the effect of financial innovation on bank costs was not available from the records of individual banks, the Capital Markets Authority, Nairobi Security Exchange and Central Bank of Kenya, a reality that technically blocked study on this premise.

c) Lastly data on ATM wasn't available therefore Asset base, being a critical form of financial innovation, with ready and complete data was adopted by the study. The study adopted the statistically accepted multi-level regression analysis to enable variable role interchange for ROA, Loans and ROE which though dependent, were also noted to double (at the other levels) as significant confounding regressors to each other throughout the study period. This was done to improve quality of the study results.

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# APPENDICES

## Appendix I: List of commercial banks in Kenya

1. Bank of Africa (K) Ltd
2. Bank of Baroda (K) Ltd
3. Bank of India
4. Barclays Bank of Kenya Ltd
5. Citibank N.A. Kenya
6. Commercial Bank of Africa (CBA)
7. Guaranty Trust (GT) Bank
8. Habib Bank A.G. Zurich
9. Spire Bank Ltd
10. Kenya Commercial Bank Ltd
11. Dubai Bank Kenya Ltd
12. National Bank of Kenya Ltd
13. Stanbic Bank
14. Standard Chartered Bank (K) Ltd
15. Kenya Commercial Bank
16. Equity Bank
17. Family Bank Ltd
18. United Bank of Africa (UBA) Kenya Limited
19. Sidian Bank Ltd
20. Diamond Trust Bank Kenya Ltd
21. Ecobank Ltd
22. Gulf African Bank (K) Ltd
23. First Community Bank
24. Consolidated Bank of Kenya Ltd
25. Development Bank of Kenya Ltd
26. African Banking Corporation Ltd
27. Jamii Bora Bank Ltd. Commercial
28. Co-operative Bank of Kenya Ltd
29. Credit Bank Ltd

30  Charterhouse Bank Ltd

31  Chase Bank (K) Ltd

32  Fidelity Commercial Bank Ltd

33  Guardian Bank Ltd

34  Imperial Bank Ltd

35  Investment &Mortgages Bank Ltd

36  Middle East Bank (K) Ltd

37  NIC Bank Ltd

38  M-Oriental Bank Ltd

39  Paramount Bank Ltd

40  Prime Bank Ltd

41  Trans-National Bank Ltd

42  Victoria Commercial Bank Ltd.

Source: CBK, (2017)

**Appendix II: List of sampled banks (NSE listed).**

1. CFC Stanbic bank

2. Diamond Trust Bank Kenya

3. Equity Bank Ltd

4. Investments & Mortgages Holdings Ltd

5. Kenya Commercial Bank Ltd

6. NIC Bank Ltd

7. Standard Chartered Bank Ltd

8. The Co-operative Bank of Kenya Ltd

9. Commercial Bank of Africa

10. Family Bank Ltd

11. African Banking Corporation Ltd

12. Bank of Africa (K) Ltd

Source: CBK, (2017)

## Appendix III: Raw data

| Bank | YEAR | ROA % | Value of EFT trans(B) | No of MBS (in M) | Int bnking Trans (Thousands) | Branch networking (in M) | Total assets (in B) | Return on equity % | Loans advanced (in M) |
|------|------|-------|------------------------|-------------------|-------------------------------|---------------------------|----------------------|---------------------|------------------------|
| KCB | 2007 | 3.1 | 116.431 | 14.58 | 6943 | 3863 | 124527 | 30.07 | 56477 |
| KCB | 2008 | 3 | 18.653 | 16.92 | 7328 | 5394 | 181974 | 26.9 | 79343 |
| KCB | 2009 | 3.57 | 21.723 | 10.205 | 8619 | 6426 | 18004 | 27.33 | 96558 |
| KCB | 2010 | 5.17 | 26.537 | 21.689 | 9353 | 11538 | 223025 | 28.23 | 98543 |
| KCB | 2011 | 3.77 | 29.394 | 29.118 | 8869 | 15756 | 228704 | 31.18 | 105432 |
| KCB | 2012 | 5.2 | 34.34 | 41.708 | 8245 | 15756 | 304112 | 29.8 | 150875 |
| KCB | 2013 | 5.5 | 26.67 | 55.96 | 8433 | 17746 | 323194 | 28.4 | 185432 |
| KCB | 2014 | 5.93 | 32.756 | 69.138 | 15848 | 22362 | 376969 | 31 | 257399 |
| KCB | 2015 | 5.01 | 36.325 | 85.607 | 9165 | 23445 | 467741 | 29 | 324284 |
| KCB | 2016 | 5.64 | 37.974 | 107.44 | 7639 | 28482 | 504778 | 35.2 | 373031 |
| KCB | 2017 | 4.94 | 39.64 | 109.21 | 8349 | 27472 | 555630 | 30.9 | 411666 |
| EQUITY | 2007 | 4.3 | 12.75 | 6.94 | 6923 | 2364 | 69328 | 15.85 | 21836 |
| EQUITY | 2008 | 6.1 | 17.26 | 7.37 | 7543 | 4757 | 78001 | 24.2 | 40858 |
| EQUITY | 2009 | 5.66 | 23.033 | 8.567 | 8792 | 5570 | 98434 | 22.4 | 59868 |
| EQUITY | 2010 | 6.95 | 37.356 | 19.975 | 6805 | 9312 | 133890 | 32.9 | 72346 |
| EQUITY | 2011 | 6.09 | 24.481 | 30.039 | 9798 | 16060 | 157931 | 34.53 | 98432 |
| EQUITY | 2012 | 7.4 | 27.01 | 41.177 | 10808 | 16060 | 215829 | 37.6 | 107543 |
| EQUITY | 2013 | 7.7 | 29.181 | 53.56 | 12791 | 18233 | 238194 | 36 | 150872 |
| EQUITY | 2014 | 7.26 | 33.669 | 68.7 | 3472 | 20112 | 277116 | 49.4 | 192973 |
| EQUITY | 2015 | 6.56 | 47.494 | 80.998 | 8788 | 22388 | 341329 | 47.2 | 229394 |
| EQUITY | 2016 | 6 | 53.257 | 101.33 | 5635 | 22778 | 379749 | 43.5 | 221039 |
| EQUITY | 2017 | 5.68 | 56.43 | 112.48 | 6923 | 23086 | 406402 | 37.3 | 221698 |
| DTB | 2007 | 2.8 | 27.46 | 5.93 | 2275 | 869 | 38914 | 18.61 | 19754 |
| DTB | 2008 | 3.1 | 30.29 | 7.36 | 2541 | 1305 | 42073 | 24.5 | 25460 |
| DTB | 2009 | 3.44 | 33.411 | 8.304 | 2735 | 1634 | 47509 | 21.32 | 30364 |
| DTB | 2010 | 4.9 | 47.666 | 19.92 | 3160 | 2872 | 58606 | 35.64 | 45763 |
| DTB | 2011 | 3.1 | 32.584 | 31.319 | 3301 | 4670 | 92431 | 31.4 | 54387 |
| DTB | 2012 | 4.9 | 31.97 | 40.55 | 3477 | 4670 | 94512 | 31.4 | 76328 |
| DTB | 2013 | 4.9 | 31.955 | 51.89 | 3312 | 5566 | 114136 | 30 | 93567 |
| DTB | 2014 | 4.47 | 32.773 | 68.27 | 3441 | 6307 | 141176 | 24.5 | 95258 |
| DTB | 2015 | 3.69 | 41.344 | 82.893 | 4701 | 7055 | 190948 | 23.5 | 128266 |
| DTB | 2016 | 3.64 | 48.378 | 102.75 | 4825 | 8876 | 244124 | 24.4 | 141702 |
| DTB | 2017 | 3.05 | 49.34 | 109.72 | 4943 | 8228 | 270082 | 19.1 | 156843 |
| CBA | 2007 | 1.9 | 16.2 | 4.92 | 3278 | 62 | 3249 | 10.8 | 16049 |
| CBA | 2008 | 2.1 | 17.7 | 5.92 | 3682 | 79 | 3803 | 11.9 | 26303 |

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|---|---|---|---|---|---|---|---|---|
| CBA | 2009 | 3 | 19.058 | 7.152 | 4841 | -7 | 58904 | 13.2 | 30087 |
| CBA | 2010 | 2.3 | 18.044 | 18.37 | 4859 | 2695 | 68239 | 17.4 | 42875 |
| CBA | 2011 | 2.06 | 26.963 | 29.446 | 5196 | 3210 | 78321 | 18.2 | 56783 |
| CBA | 2012 | 2.67 | 25 | 39.214 | 4834 | 4128 | 80432 | 22.3 | 67983 |
| CBA | 2013 | 2.7 | 29.289 | 48.94 | 4910 | 2210 | 50239 | 19.4 | 83476 |
| CBA | 2014 | 3.2 | 36.116 | 63.43 | 5148 | 3140 | 60327 | 24.6 | 92667 |
| CBA | 2015 | 3.9 | 39.067 | 78.175 | 5155 | 5021 | 80347 | 26.1 | 107683 |
| CBA | 2016 | 3.9 | 42.817 | 96.32 | 7745 | 7593 | 210878 | 27.6 | 105082 |
| CBA | 2017 | 4.2 | 46.23 | 98.24 | 8243 | 7189 | 229525 | 22.8 | 107038 |
| STD CHAT | 2007 | 5.3 | 23.48 | 22.41 | 3892 | 4897 | 9765 | 45.27 | 39469 |
| STD CHAT | 2008 | 4.7 | 26.67 | 10.32 | 4832 | 4709 | 100392 | 41.3 | 43299 |
| STD CHAT | 2009 | 5.39 | 28.273 | 6.342 | 5839 | 6726 | 124806 | 28.23 | 56695 |
| STD CHAT | 2010 | 5.37 | 21.787 | 17.01 | 7797 | 7668 | 142880 | 37.94 | 65873 |
| STD CHAT | 2011 | 3.7 | 26.631 | 26.823 | 6069 | 9245 | 187654 | 40.11 | 78945 |
| STD CHAT | 2012 | 5.9 | 28.805 | 39.299 | 4246 | 11519 | 195493 | 37.6 | 96583 |
| STD CHAT | 2013 | 6 | 33.099 | 49.7 | 5338 | 13316 | 220524 | 37 | 112456 |
| STD CHAT | 2014 | 6.42 | 39.558 | 64.71 | 6597 | 14300 | 222636 | 35.4 | 128768 |
| STD CHAT | 2015 | 3.83 | 42.817 | 78.899 | 6069 | 8974 | 234131 | 21.9 | 122905 |
| STD CHAT | 2016 | 5.1 | 43.152 | 94.12 | 6517 | 12764 | 250274 | 29.1 | 132497 |
| STD CHAT | 2017 | 3.34 | 44.12 | 62.43 | 6832 | 9510 | 285125 | 21.3 | 139406 |
| NIC | 2007 | 3.2 | 24.62 | 11.23 | 4782 | 1048 | 39432 | 22.13 | 22209 |
| NIC | 2008 | 3.4 | 28.26 | 9.48 | 5120 | 1474 | 43609 | 26.7 | 29955 |
| NIC | 2009 | 3.3 | 30.587 | 5.391 | 6267 | 1529 | 46326 | 28.11 | 31133 |
| NIC | 2010 | 4.41 | 35.02 | 16.899 | 7021 | 2416 | 54776 | 30.6 | 43785 |
| NIC | 2011 | 2.6 | 22.346 | 26.915 | 6910 | 3476 | 66943 | 33.95 | 53478 |
| NIC | 2012 | 4.2 | 28.102 | 37.976 | 7589 | 4311 | 101772 | 28.6 | 62895 |
| NIC | 2013 | 4.6 | 30.09 | 49.35 | 7071 | 5221 | 112917 | 29.6 | 85692 |
| NIC | 2014 | 4.44 | 32.916 | 62.71 | 7748 | 6081 | 137087 | 26.9 | 97984 |
| NIC | 2015 | 3.99 | 37.878 | 77.465 | 6905 | 6260 | 156762 | 23.7 | 111286 |
| NIC | 2016 | 3.66 | 43.309 | 93.999 | 6481 | 5926 | 161847 | 19.6 | 112509 |
| NIC | 2017 | 2.94 | 45.37 | 96.57 | 6578 | 5676 | 192817 | 19.6 | 118459 |
| COOP | 2007 | 3 | 15.57 | 6.27 | 6022 | 2228 | 75278 | 33.61 | 38433 |
| COOP | 2008 | 3.7 | 18.24 | 8.24 | 7520 | 3337 | 91022 | 23.9 | 53263 |
| COOP | 2009 | 3.26 | 20.881 | 4.201 | 8697 | 3727 | 114234 | 24.21 | 62274 |
| COOP | 2010 | 3.61 | 33.375 | 15.985 | 6827 | 5559 | 153984 | 27.52 | 73489 |
| COOP | 2011 | 2.3 | 25.067 | 25.034 | 8193 | 6543 | 167432 | 29.41 | 83972 |
| COOP | 2012 | 4.8 | 26.996 | 35.822 | 7229 | 9574 | 199663 | 33.1 | 99346 |
| COOP | 2013 | 4.7 | 33.18 | 47.876 | 9586 | 10705 | 228874 | 30 | 109543 |
| COOP | 2014 | 4.43 | 40.753 | 60.03 | 9939 | 12515 | 282689 | 29.5 | 181370 |
| COOP | 2015 | 4.14 | 41.336 | 74.029 | 11242 | 14073 | 339550 | 28.5 | 212711 |
| COOP | 2016 | 5.15 | 45.282 | 90.669 | 10355 | 18024 | 349998 | 30 | 241395 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| COOP | 2017 | 5.34 | 46.2 | 92.1 | 12467 | 16502 | 382830 | 24.2 | 7232 |
| CFC | 2007 | 3.1 | 32.37 | 8.29 | 2241 | 921 | 29467 | 27.59 | 16403 |
| CFC | 2008 | -0.5 | 28.94 | 6.25 | 3037 | 1313 | 587 | 18.4 | 44205 |
| CFC | 2009 | 1.35 | 47.181 | 4.021 | 3829 | 1333 | 98401 | 21.22 | 44978 |
| CFC | 2010 | 1.96 | 67.079 | 15.049 | 2754 | 2104 | 107139 | 20.96 | 54872 |
| CFC | 2011 | 4.7 | 27.794 | 24.698 | 3954 | 3458 | 122674 | 30.82 | 66578 |
| CFC | 2012 | 3.5 | 30.384 | 35.346 | 3236 | 4712 | 133378 | 26 | 73467 |
| CFC | 2013 | 4.1 | 33.796 | 47.966 | 2283 | 7005 | 170726 | 31.3 | 79834 |
| CFC | 2014 | 4.31 | 38.101 | 60.34 | 3893 | 7391 | 171347 | 27.7 | 89797 |
| CFC | 2015 | 3.56 | 41.163 | 74.547 | 5336 | 7077 | 198578 | 25.1 | 103535 |
| CFC | 2016 | 5.2 | 42 | 89.902 | 4716 | 7213 | 21765 | 24.2 | 118483 |
| CFC | 2017 | 5.7 | 47.21 | 91.54 | 5213 | 7654 | 24341 | 25.7 | 135443 |
| Afri bank corp | 2007 | 2.8 | 54.48 | 18.56 | 2845 | 185 | 6700 | 22.77 | 3342 |
| Afri bank corp | 2008 | 3.3 | 56.23 | 12.84 | 1840 | 224 | 6826 | 23.2 | 3567 |
| Afri bank corp | 2009 | 2.82 | 60.074 | 3.07289 | 2141 | 257 | 9118 | 21.43 | 3992 |
| Afri bank corp | 2010 | 4.67 | 67.376 | 13.7796 | 3259 | 480 | 10297 | 29.46 | 3550 |
| Afri bank corp | 2011 | 2.5 | 30 | 22.6933 | 3587 | 520 | 17643 | 30.28 | 5678 |
| Afri bank corp | 2012 | 2.9 | 31.494 | 32.4254 | 3975 | 557 | 19071 | 26.4 | 9956 |
| Afri bank corp | 2013 | 2.9 | 29.929 | 44.35 | 3695 | 578 | 19639 | 23.6 | 11678 |
| Afri bank corp | 2014 | 1.49 | 36.077 | 55.9993 | 3117 | 319 | 21439 | 12.1 | 13513 |
| Afri bank corp | 2015 | 1.61 | 42.243 | 72.0955 | 4935 | 355 | 22058 | 12.5 | 15538 |
| Afri bank corp | 2016 | 4.1 | 44 | 84.9056 | 4052 | 222 | 22422 | 7.4 | 15022 |
| Afri bank corp | 2017 | 0.82 | 46.76 | 86.32 | 5120 | 203 | 24804 | 6.4 | 16371 |
| Family | 2007 | 2.9 | 28.62 | 27.49 | 1830 | 268 | 9432 | 20.96 | 4102 |
| Family | 2008 | 5 | 43.85 | 48.32 | 2091 | 531 | 10713 | 34.1 | 5890 |
| Family | 2009 | 2.5 | 74.17 | 120.23 | 2108 | 343 | 13683 | 23.43 | 7676 |
| Family | 2010 | 2.48 | 31.762 | 2.398 | 2654 | 501 | 20188 | 16.01 | 9965 |
| Family | 2011 | 3.7 | 32.584 | 13.554 | 2564 | 684 | 29432 | 15.72 | 16784 |
| Family | 2012 | 2.7 | 29.253 | 24.076 | 3668 | 843 | 30985 | 17.4 | 22674 |
| Family | 2013 | 4 | 35.406 | 32.73 | 4987 | 1758 | 43501 | 29.5 | 33657 |
| Family | 2014 | 4.24 | 40.026 | 45.757 | 5968 | 2618 | 61813 | 24.7 | 39681 |
| Family | 2015 | 3.55 | 44.061 | 52.395 | 4572 | 2883 | 81190 | 24.2 | 57975 |
| Family | 2016 | 3.2 | 43 | 73.982 | 6981 | 633 | 69432 | 5 | 53485 |
| Family | 2017 | -1.99 | 54.82 | 81.56 | 7120 | -1371 | 69051 | -0.118 | 46928 |
| Bank of afr Nai | 2007 | 2 | 30.57 | 47.32 | 2451 | 158 | 11567 | 12.5 | 4579 |
| Bank of afr Nai | 2008 | 0.7 | 29.42 | 34.75 | 3260 | 93 | 12823 | 56 | 6856 |
| Bank of afr Nai | 2009 | 1.53 | 51.725 | 90.348 | 3562 | 260 | 16978 | 16.23 | 9120 |
| Bank of afr Nai | 2010 | 1.81 | 24.964 | 1.74 | 3569 | 484 | 26699 | 16.45 | 11456 |
| Bank of afr Nai | 2011 | 2.15 | 29.261 | 11.079 | 2864 | 540 | 36843 | 11.87 | 22654 |
| Bank of afr Nai | 2012 | 1.3 | 30.209 | 20.809 | 3564 | 636 | 48958 | 12.7 | 29845 |
| Bank of afr Nai | 2013 | 2 | 33.69 | 28.546 | 4298 | 1028 | 52683 | 15.7 | 33784 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Bank of afr Nai | 2014 | 0.33 | 37.03 | 41.781 | 4597 | 204 | 62212 | 26 | 39236 |
| Bank of afr Nai | 2015 | -2.07 | 38.766 | 53.468 | 6324 | -1434 | 69280 | -16.9 | 41075 |
| Bank of afr Nai | 2016 | 2.39 | 40 | 65.593 | 5981 | -16 | 55996 | -0.2 | 37480 |
| Bank of afr Nai | 2017 | 0.06 | 47.82 | 71.53 | 6240 | 35 | 54191 | 0.4 | 33589 |
| I&M | 2007 | 4.3 | 52.82 | 10.58 | 4321 | 1294 | 25673 | 33.47 | 19215 |
| I&M | 2008 | 4.4 | 43.64 | 6.91 | 5682 | 1620 | 37022 | 31.2 | 25887 |
| I&M | 2009 | 3.94 | 75.5 | 1.347 | 6684 | 1752 | 44486 | 29.2 | 24592 |
| I&M | 2010 | 4.8 | 32.509 | 10.191 | 7307 | 3004 | 62552 | 23.15 | 34765 |
| I&M | 2011 | 2.23 | 36 | 20.077 | 6358 | 4032 | 76843 | 32.17 | 47834 |
| I&M | 2012 | 5.2 | 34.3 | 28.205 | 6647 | 4722 | 91520 | 28.5 | 56873 |
| I&M | 2013 | 5.5 | 37.456 | 40.245 | 7609 | 6060 | 110316 | 29.5 | 72435 |
| I&M | 2014 | 5.64 | 44.003 | 53.407 | 7138 | 7749 | 137299 | 35.5 | 91163 |
| I&M | 2015 | 5.66 | 50.29 | 67.052 | 7793 | 8364 | 147846 | 32 | 104302 |
| I&M | 2016 | 2.47 | 54 | 81.653 | 8553 | 8651 | 164116 | 27.6 | 104302 |
| I&M | 2017 | 4.09 | 62 | 84.58 | 8943 | 7516 | 183953 | 21.5 | 126983 |

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