THE EFFECT OF MOBILE BANKING ON OPERATIONAL EFFICIENCY OF COMMERCIAL BANKS IN KENYA

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DECLARATION

This research project is my original work, and it has never been presented in any other university for the award of any degree

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DEDICATION

I dedicate this research project study to my fellow students at KCA University. To enhance further research studies at the universities in Kenya.

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ACRONYMS AND ABBREVIATIONS

CAK	Communication Authority of Kenya
CBA	Commercial Bank of Africa
CBK	Central bank of Kenya
KCB	Kenya Commercial Bank
MNO	Mobile Network Operators
OE	Operational Efficiency
SMS	Short Messages Services
TAM	Technology Accepted model
USSD	Unstructured Supplementary Service Data
UTAUT	Unified Theory of Acceptance and Use of Technology
VMNO	Virtual mobile network operator
FEM	Fixed effect model
REM	Random effect model
LSDV	Least Square Dummy Variable

OPERATIONAL DEFINITION OF TERMS

Mobile banking accounts it covers the customers' accounts opened through a mobile (KCB, 2019)

Mobile banking deposits involves the ratio of the total deposit advances and the total deposits (Ndirangu, 2015).

Mobile banking Loans it involves a ratio of the non-performing loans to the total loans and advances (KShs) (Chironga et al., 2017)

Mobile banking is a channel through which customers interact with a financial institution or a bank via a mobile device which include the amounts, the number of users, and the totals accounts that are transacted through the use of mobile phones. (Barnes & Corbitt, 2003)

ABSTRACT

This study's main objective was to determine mobile banking's effect on commercial banks' operational efficiency. The study looked at mobile banking accounts, mobile banking loans, and mobile banking deposits concerning commercial banks' operational efficiency in Kenya. The study was guided by the unified theory of acceptance and use of technology model (UTAUT), technology acceptance model (TAM), and financial deepening theory. The study adopted a descriptive research design targeting 41 commercial banks. The study adopted a census survey using secondary data from Kenya's central bank and the commercial banks' annual financial reports in Kenya. Data on the number of bank deposits mobilized as savings, the number of loans and advances issued by the banks, and the number of registered bank accounts. The study covered nine years from 2010-2018. STATA software was used in data analysis, descriptive and statistical inferential. The independent variables were measured against the dependent variable to examine if they affected commercial banks' operational efficiency. Multiple regression equations estimated the relationship between the variables. Hausman Test was used to specify the adoption of Random effect or Fixed effect models in panel data. The Hausman tested and fixed effect model was selected. The diagnostic tests covering heteroscedasticity, autocorrelation, multicollinearity, and normality tests were also conducted. The findings were presented using graphs and tables. The results were as follows: mobile bank accounts ($\beta=0.0365$, $p>0.05$), mobile loans ($\beta=0.474$, $p<0.05$), and mobile deposits ($\beta=0.015$, $p>0.05$). The study concluded that only mobile banking loans had a significant effect on commercial banks' operational efficiency in Kenya. The study recommended that commercial banks invest more in mobile loans and mobile deposits since the two had a positive relationship with commercial banks' operational efficiency in Kenya. The study results would enhance the adoption of more financial innovation in the banking industry that would contribute to the economy's overall grow.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

It is becoming increasingly crucial for all financial institutions to adopt financial innovations due to computer information technology advancement. The banking industry has continued to grow in terms of operational efficiency, financial inclusion, and stability. Kenya's central bank has come up with the legal and statutory framework to govern financial innovations like mobile banking. It will support the government of Kenya's efforts to ensure that the financial sector remains relevant, competitive, and in line with the technological innovations and vision 2030. The emergence of new economic changes has enabled organizations and institutions to raise their competitive edge, improve their operational efficiency, and better satisfy their clients' ever-changing needs and market demands (CBK, 2016). Due to the development of technology, especially in the telecommunication sector, mobile phone devices that have been used mainly for communication are now used to provide portable internet and electronic financial services. The focal point has been using this financial innovation to bring on-board the unbanked and those who have limited or no or limited access to financial services. Innovations in the industry, such as mobile banking, have aided the facilitation of this condition (Beshouri & Gravråk, 2010).

Mobile banking is a service offered by commercial banks or other monetary institutions that enables their clients to carry out transactions virtually any time of the day. It is possible to utilize a mobile device, including the feature phone, tablets, and smartphones. The customer can use USSD code, sim tool kit, or a smart bank app to carry out banking services provided they have internet connectivity (BBVA, 2012). Globally, the retail financial banking sector is changing due to computer technology's

evolution, precisely the advances in mobile money transfer platforms. In Europe, Activo bank (Portugal) and Millennium BCP (Poland) have received awards as the best mobile banking institutions in the region. In Canada, we have Scotiabank with a global footprint in Latin America, the Caribbean, and Central America. Bank of America launched its mobile banking services in early 2007, Chase bank JP Morgan Chase has chase mobile. In China, there is the ICBC iPhone Financial App, which has extra features like forex exchange. Britain has Monetize plc, a company offering financial services using mobile devices in the USA, Africa, India, and the UK with a global partnership with Visa Inc. In the Philippines, G-Cash offers international mobile banking services. Banks provide these services through the USSD code or SMS, web browser, and mobile phone apps. These stem from the advancements in the telecommunication industry, which have led to the changes in retail banking from brick and mortar to the use of mobile Technology (BBVA, 2012)

Most European banks are developing mobile banking, and other financial innovations products developed and packaged in ominchannels to enable the customers to choose the services on their preferences. European banks are using advanced data analytics tools to analyze customer data. This will allow them to develop new products and offer customized products like mobile, internet, electronic funds transfer, mobile services access like cheque and mobile deposits, account balances check, bill payments, and investment products. These have led to increased bank sales revenues and reduced operational cost on the recent study on the Omni channel's excellence in retail mobile banking (Rizzi & Taraporevala, 2019).

In Africa, mobile financial services are the number one preference for many mobile operators, commercial banks, microfinance, and other financial service providers, governments, and technology companies. In countries where financial services inclusion is limited, like sub-Saharan Africa, the mobile money transfers platforms pledge convenience, adequate reliability, faster, a lower-cost, and rapid, scalable option than traditional banking (Kendall, Schiff & Smadja, 2014). According to the study by Harelimana (2017), mobile banking services, processes, and products by Unguka Bank Ltd lead to an increase in revenue for the bank in the last three years, which is an indicator of the bank's operational efficiency. In South Africa, we have Wizzit, a secure and efficient mobile banking solution for the country's underbanked and unbanked customers.

According to Temenos (2019), the Commercial Bank of Africa developed a mobile loan product in partnership with Safaricom, replicating them in other African countries. In 2014, the Commercial Bank of Africa partnered with Vodacom in Tanzania to start M-Pawa services, a replica of M-Shwari. Then, the CBA Bank teamed up with MTN in Uganda to develop and customize the MoKash services for Uganda and Rwanda in 2017, and eventually the bank to bank partnership in Côte d'Ivoire to create the MoMoKash mobile service via a partner bank in Côte d'Ivoire in the year 2018.these has experienced tremendous growth in mobile banking services in these countries hence bringing financial inclusion and deepening into reality to their customers.

In Kenya, according to the CAK first quarter statistics report 2019/2020 (July - September 2019) financial year, the active mobile money subscriptions are 31.2 million. The number of Agents is 235,168. The number of transactions was 661.6 million for (withdrawals and sending) valued over KSh.1.7 trillion made out of this.

The number of mobile commerce transactions was 425.3 million, meaning that KSh.1.6 trillion was spent on the E-commerce ecosystem during that financial year. Person-to-Person mobile money transfers accounted for Ksh.665.0 billion; this is an indication that people are actively using mobile banking in Kenya, and this has a massive impact on how banks operate (CAK, 2019)

In Kenya, the mobile network operators like Safaricom introduced mobile money service M-PESA in 2007, and immediately became popular, drastically changing and increasing Kenyans' access to financial services. Safaricom's M-Pesa and other mobile money transfer platforms have to give a new commercial bank innovation phase in electronic banking. A classic example is a competition over a mobile platform, like Equitel mobile product by Equity Bank. Collaboration between commercial banks and (MNO) mobile network operators in the provision of mobile financial services has become a possibility like the case of CBA's M-Shwari and Fuliza, KCB M-PESA, Equity's Eazzy pay, and Family bank Pesapap. The introduction of agency banking like Cooperative Banks' Coop Kwa Jirani and other commercial banks, mobile agency banking, Microfinance institutions, and mobile banking products. It has also led to Industry coordination using platforms such as the PesaLink that offer money transfer alternatives. PesaLink enables the transfer of money or payments by members of a particular bank to another using their mobile phone (Cook & McKay, 2017). All these financial innovations enable service providers to deliver quality services to their customers.

1.1.1 Mobile Banking

Mobile phones have been in use for the past thirteen years to provide banking and other financial related services (Aithal, 2016). Mobile banking has been defined by Barnes & Corbitt (2003) as a channel through which customers interact with a financial institution or a bank via a mobile device. Pousttchi and Schurig (2004) expound mobile banking as that kind of execution of financial services in which an electronic procedure is applied. The bank clients use mobile communication techniques in conjunction with mobile gadgets, including a feature or smartphone. Mobile banking is a way through which a bank's customers utilize the institution's mobile banking service. Customers can access these services through the use of the USSD code, SMS, or banking app. They can enjoy bank services like account opening, and cash withdraw, deposit, funds transfer, pay bills, check balances, purchase airtime, and bank loan using their mobile phones.

Mobile banking in this study context is the integrated mobile banking, which is the integration of the mobile phone which has a sim card with the mobile network operator money transfer platform and the commercial banks' core banking platform (Deloitte, 2010). The integrated mobile banking gives commercial banks and other financial institutions more notable venues to increase their customer base using mobile and internet banking channels. They access a more comprehensive geographical location enabling the customers to access the bank products and services at their convenience while using the integrated mobile banking. The commercial banks' clients can get real-time financial services. Commercial banks and their customers can get the following benefits: commercial banks can offer safe, secure, convenient mobile banking services available for 24/7.increase in profit revenue for the banks which are generated through

mobile banking channels which are generated from withdrawal charges, deposit, balance inquiry, pay bills, fees and other charges which are generated from the million transactions which are done through mobile banking. All these services are offered using automated mobile banking services that ensure the bank is reducing its operational cost in-office staff, paperwork, and office space rent.

Commercial banks can enable their customer to open their accounts remotely using the USSD code or the mobile sim tool kit or using the banks' mobile apps to integrate mobile banking services. This will enable them to boost customer satisfaction with the commercial banks' mobile banking services due to the perceived ease of use, convenience, fast, safe mobile banking, which is customer-centric. This is indicated by the exponential growth in the number of mobile banking subscribers. This enables customers to pay bills like school fees, utility payments like water, electricity, hospital bills, insurance premiums, and salary payments to their staff while using mobile banking at the click of their mobile phones instead of traveling the bank branches. This may lead to the reduction of branch operational cost, ATM operating cost which is substituted by the integrated mobile banking (Softwaregroup.com, 2020)

The mobile bank features that make them usable are that the phones are portable, convenient, easier to use, and offer personal real-time access to financial products. Mobile banking innovation has enhanced customer financial services access, where the customer can move to the nearest telecommunication network operator agent to access the money, enabled through agency banking (Aithal, 2016). Agency banking involves commercial banks or microfinance institutions to provide financial services through other non-bank, retail outlets like shops, supermarkets, kiosks, and merchant shops. In Kenya, Agency banking started its operations in 2010 by the CBK allowing it due to

the development in mobile money transfer by telecommunication firms, which made banks to develop bank mobile agency banking to compete with other non-bank mobile money providers (Mwangi & Wanyoike, 2012)

1.1.2 Operational Efficiency

Operational efficiency refers to the systematic utilization of available resources like material resources and human capital, the well-planned operation of technology, machines, tools and equipment, materials funds (Kimani, 2015). Better utilization of any or a combination of these can increase the output of goods and services and reduce costs. Operational efficiency means the commercial banks' ability to offer all their financial services using the available inputs to achieve their goals (Rabiu et al., 2019).

Operational efficiency is the efficient utilization of financial capital and material resources or the efficient use of people, machines, computers, equipment, tools, and materials funds. Prudent consumption of any or an amalgamation can raise the output of goods and services and decrease operational costs. Improving efficiency has long been a challenge for the financial services industry. Still, cost management is about lowering expenses and creating more revenue per unit of cost (Alber et al., 2019). Operational efficiency means a firm or financial institution's ability to achieve its goal using the available resources at a minimal cost. Moreover, the operational efficiency of the bank simply means the capability of a bank to offer all the banking services using its available resources to achieve its objective or goals

There are different operational efficiency measures, covering growth performance, profitability performance, technical capability, and production performance. Profitability performance: Commercial banks, financial fintech firms, and other business services institutions have the primary goal of profit-making. Which will enable

them to grow, stabilize, remain competitive, and attain shareholders' vision? The banks use these ratios to measure the efficiency of their operation. The commercial bank efficiency ratio computes a bank's operational expenses as a percentage of its revenue. The efficiency rate enables the bank to measure how the bank can utilize the investment assets into income. Since a bank's operating overheads are in the numerator and its revenue is in the denominator,

Operational Efficiency Ratio is given by Operating Expenses divided by revenue, not including interest. A higher-efficiency ratio means the banks are not performing well. In contrast, a lower efficiency ratio is a better functional level (Kenton, 2019). Productivity performance: Various People can define productivity performance in different situations like in the fields of accounting, engineering, economics, industrial production. Institutional psychology can expound productivity in divergent ways. Productivity is the ratio of total output divided by the entire input. It is tough to measure the intangible outcomes from banks, which are difficult to ascertain. Thus, if operational efficiency is a broader word, productivity is a yardstick of profitability, as observed as the economies of scale change. Productivity versus efficiency can also involve the examination of economies of scale. Institutions seek to maximize production levels to achieve efficient economies of scale, which then aids in decreasing per-unit costs and rise per-unit return; for example, the investment in mobile and electronic banking is generating more income in terms of fees to the banks (Patil, 2012). Financial Analysts can compute different production efficiency methods using this expression: Output Rate divided by Standard Output Rate multiply by 100.

Growth performance: The primary goal for any business organization is to grow. Different parameters in the banking sector can measure growth. Commercial banks'

growth can be looked at geographical on the number of branches or the bank's presence in all the places. Banks increase mobile money transfers, mobile loans/credit, bank transactions, and bank accounts (Kinyanzui, Achoki & Kiriri, 2018). Which they noted that they are growing from 2014 to 2015 as indicated in their study on electronic banking and financial performance of commercial banks in Kenya (Mutisya & Atheru, 2019), which leads to an increase in mobile transaction fees, other charges, and commissions (Rabiu et al., 2019) bank advance loans. All these financial innovations will lead to commercial banks' growth in profitability, and profit growth can lead to reserve growth and equity growth.

Technical Efficiency: Technical Efficiency is the legal basis for evaluating banks' efficacy. Technical capability produces the most output utilizing a certain level of input or minimum resources to provide a designated production group. This concept reflects the firm's ability to deliver goods and services while avoiding wastage within the firms or organization budget (Goyal, Singh, Singh & Aggarwal, 2018). Technical efficiency is concerned with engaging human resources, machinery, and capital resources to generate products like goods, services, and commodities. Banks' technical capability is the difference between the noted amount of input and output variables concerning the best scenario's input and output variables. An efficient commercial bank can attain a maximum value of one in contrast with an inefficient commercial bank, which can decrease to the rank of zero (Alber et al., 2019). Technical efficiency can include tangible or non-tangible inputs and outputs, which may not be measurable. Cost efficiency can be expounded as a bank's capability to offer products and services without misusing resources due to allocative inefficiency and the consequence of technical or allocative incompetence.

The commercial banks are undergoing financial innovation modifications due to the changes in information technology and telecommunication money transfer platforms. The changes have brought about the need for commercial banks to look for ways to operate effectively and efficiently by reducing their operational cost while maximizing their profits through the leverage of electronic banking like mobile, internet banking, and agency banking. Operational efficiency is the main goal for financial institutions or organizations. Managers can use strategies like promoting operational optimization and using technology to ensure that they operate efficiently (Kinyanzui, Achoki & Kiriri, 2018).

According to a study done by Kamau and Oluoch (2016), there is a significant positive relationship between ROE and the use of mobile banking services by commercial banks' performance. Another study by Kinyanzui, Achoki, and Kiriri (2018) on the effect of transferable credit on operational efficiency in commercial banks in Kenya found that mobile banking has a desirable impact on commercial banks' performance, which is an attribute of the credit services offered using different channels like mobile loans.

Banks need to increase their operational efficiency level to remain relevant, practical, and competitive with non-bank financial providers. Operational efficiency is the combination of diverse aspects of the banks' operations to enable them to operate at minimum cost and increase their profit margins by satisfying their customer needs. Banks can achieve this by using innovative products, services, and processes like mobile banking, electronic banking, agency banks, mobile bank loans, deposits, payment options, mobile money transfers, and savings products. All these enable banks to use available resources while maximizing their profits (Donovan, 2011) commercial banks' operational efficiency regarding their profitability, growth, and technical

capability. Commercial bank performance can be measured using several financial ratios to allow business analysts to analyze their operational efficiency.

Mobile banking development by commercial banks, microfinance, and other financial players mainly makes banks profitable and operates efficiently and effectively. Banks generate more revenue through the commissions charged on mobile banking services like account balance check, money P2P transfer commission, and bill payments commission on mobile money withdraw from the bank. All these have a positive impact on commercial banks' profitability (Harelimana, 2017). A study which was done in Nigeria by Rabiu et al., 2019 found that mobile banking and internet services offered by banks improved the operational efficiency of banks through the provision of mobile and electronic banking services 24/7 to their clients, easy access to financial services, and reduction of the time of serving a customer.

Operational changes are achieved by automating many processes, reducing operating expenses, reducing paperwork, bank branches using artificial intelligence and data analytics to predict customer behavior, and developing products depending on the customer ecosystem. Commercial banks offer mobile banking services like mobile payments, funds transfer, bank loans, and saving products at low cost, with maximum revenue on commissions, depending on the transaction number, generating more revenue. By introducing new products like CBA M-Shwari product, KCB M-Pesa (Cook & McKay, 2017), these products reduce operational costs by reducing processing time, queuing time, travel, transaction, office cost while offering fast, convenient, reliable services to their bank customers.

According to (Reimink 2019), banks can improve their operational effectiveness by taking a balanced approach that will improve operational efficiency and the one with the ability to respond to the current and future market needs, which keeps on changing as financial innovations emerge with the on-going development in technology. Commercial banks' operational efficiency examined in the following ways, one at the extent to which Banks improved in such operations to provide quality services to their clients and the ability of the bank to use the mobile banking innovations products and services to improve on their operational efficiencies (Rabiu et al., 2019b)

1.1.3 Commercial banks in Kenya

As of 31 December 2018, the Kenyan banking industry comprises the Central Bank of Kenya (CBK), the regulatory authority, and 44 banking institutions, excluding the charterhouse bank, imperial bank, and chase bank. Therefore, there are 40 commercial banks and one mortgage finance company, nine representative offices of foreign banks, 13 Microfinance Banks (MFBs), 3 Credit Reference Bureaus (CRBs), 19 Money Remittance Providers (MRPs), eight non-operating bank holding companies, and 70 foreign exchange (forex) bureaus.

Out of the 44 banking institutions, 40 owned privately while the Kenya Government had majority ownership in 3 institutions. Of the 40 privately owned banks, 15 were foreign-owned while 25 locally owned. The twenty-five locally-owned financial institutions compose of one mortgage finance company and twenty-four commercial banks and. Of the fifteen foreign-owned institutions, all are commercial banks, with twelve being local subsidiaries of foreign banks, and three are branches of foreign banks. All licensed forex bureaus, money remittance providers, credit reference

bureaus, microfinance banks, non-operating bank holding companies privately owned (CBK, 2018).

1.2 Statement of the Problem

The financial services ecosystem has changed not only in Kenya but the whole world because of the revolution in computer technology. The current commercial banking industry is faced with stiff competition by financial providers and other non-bank financial services like fintech firms and MNOs (Maina, 2014). As per the CBK annual report for 2018, the banking industry was forecast to remain resilient in 2019. With the various innovations like internet banking, mobile banking, banks need to review their financial delivery channel and business models (CBK, 2018). Mobile network operators have introduced appealing financial products like a mobile: account opening, loans, and saving (Joseph et al., 1999).

Commercial banks have invested in mobile banking, and it assumed that they are going to generate more income and optimize their operations. All these banks must transition to innovations in terms of their processes, services, and products, which will enable them to generate more revenue, minimize cost, and face competition from mobile money providers (Nytathira, 2012). The emergence of digital financial innovators in the finance sector can pose a significant threat to the ancient retail banking model (Dietz et al., 2016). Many commercial banks have introduced mobile banking technology innovation with the view of reducing operational cost, becoming more profitable and efficient (By et al., 2016). This innovation has led to collaboration with MNO like KCB M-PESA, MCo-op Cash by cooperative Bank of Kenya, M-Shwari, for CBA, Eazzy loan, for Equity bank, Timiza for Barclays and HF Whizz for housing finance, and many other (Fin Access, 2019).

The banking industry is drastically changing due to commercial banks' financial innovations, like the recent financial report for the year 2017/2018 statements (CBK 2017). Which is a clear indication that mobile banking innovation and agency model and E-banking are providing convenience, cost-effective, reliable and customer satisfaction services (Hammoud et al., 2018) at a reduced cost leading to banks operational efficiency in Kenya hence attracting more customers and more mobile deposits account opened and loans issued according to the Central Bank of Kenya annual report (CBK, 2017).

Some studies have been done on the effects of mobile banking on commercial banks' operational efficiency. According to Kinyanzui et al. (2018), Mobile credit improves operational efficiency in loan collection and commercial banks' general operational efficiency. This study was specifically on mobile bank credit and not mobile banking. Another survey by Donna 2016 found significant effects on commercial banks' performance by exchanging money via mobile banking and other investment activities. This study covered only the impact of mobile phones on commercial banks' performance and not operational efficiency. Muia (2017) looked at mobile banking's effect on commercial banks' performance and established no significant relationship between mobile banking and commercial bank performance in Kenya. Muiruri and Ngari (2014) concluded that electronic banking had a meaningful positive relationship with ROA. Mobile banking showed a sudden increase in the number of transactions in the year 2010 to 2019. According to Rabiu et al. (2019), Nigeria's banks' operational efficiency improved because of electronic banking compared to the traditional banking business. The study concluded that the internet and mobile banking are statistically

insignificant in Nigeria's operational efficiency. Tuyishime and Memba (2015) concluded that mobile banking and agency banking positively affect mobile saving mobilization in Rwanda. Due to these mixed findings, the researcher will like to investigate if integrated mobile banking affects commercial banks' operational Efficiency in Kenya, which has not been studied by many scholars. Most studies have been done on mobile banking's effect on commercial banks' performance but not on operational efficiency and commercial banks' integrated mobile banking.

Previous studies have produced mixed results. Some conclude that mobile banking financial innovation has some least effect on commercial bank operations, indicating a remarkable contribution to bank operations. It is at the centre of such mixed conclusions that it creates and entails the need to carry out a study from a Kenyan perspective to examine mobile banking's effect on commercial banks' operational efficiency in Kenya. Most commercial banks have introduced these financial innovations. They have invested in the digital innovation strategy to remain competent, maintain a customer base, and improve their operational efficiency. Will these innovations like mobile banking have any effect on commercial banks' operational efficiency?

1.3 Research Objectives

1.3.1 General Objective

To establish the effect of mobile banking on the commercial bank's operational Efficiency in Kenya.

1.3.2 Specific Objective

i. To establish the effect of mobile banking accounts on the operational efficiency of commercial banks in Kenya.
ii. To determine the effect of mobile banking loans on the operational efficiency of commercial banks in Kenya.
iii. To determine the impact of mobile banking deposits on the operational efficiency of commercial banks in Kenya.

1.4 Research Hypotheses

i. H_{01}: There is no significant relationship between mobile banking accounts and commercial banks' operational efficiency in Kenya.
ii. H_{02}: There is no significant relationship between mobile banking loans and commercial banks' operational efficiency in Kenya.
iii. H_{03}: There is no significant relationship between mobile banking deposits and commercial banks' operational efficiency in Kenya.

1.5 Significance of the Study

1.5.1 Banking Industry

This study would be of use in the banking industry sector in Kenya to enable them to identify the right financial innovation processes, products, and services to employ for them to operate efficiently in terms of reduction of operational cost while maximizing their profits, on the other hand satisfying their customer preferences in this digital era.

1.5.2 The Government of Kenya

Kenya's government can use policy development in line with the mobile banking partnership, collaborations between banks and mobile money transfer platforms, and fintech companies. This research study could be used to enforce customer privacy and

cybersecurity laws developments to curb mobile money frauds and mobile bank protection.

1.5.3 Researchers

This research could be used by academic scholars interested in mobile banking financial services and its operational efficiency study. Other students would use this research as a basis for their further study in mobile banking and commercial banks' operational efficiency. It would be very crucial for it to provide them with secondary data.

1.6 Scope of the Study

The research wished to determine if this affects commercial banks' operational efficiency because most banks are introducing mobile banking in their bank operations. This study covered 41 commercial banks in Kenya for nine years, 2010-2018, and it used secondary data from CBK and the individual commercial banks' financial reports.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

Chapter two examines the available literature review by other scholars on mobile banking's effects on commercial banks' operational efficiency. It summarises the knowledge gap that needs a study.

2.2 Theoretical Review

The theoretical review section will review the relevant theories that will lead the research. It comprises of all assumptions governing the commercial banks' operational efficiency in their day to day operations.

2.2.1 Unified Theory of Acceptance and Use of Technology model (UTAUT)

Venkatesh and others formed the (UTAUT) unified theory of acceptance and use of technology model in 2002 by combining the existing eight approaches on acceptance use of technology, the determinants of the purpose, and utilization of information technology. They compared these prototypes empirically, employing longitudinal data within-subjects from four institutions. The conceptual and actual similarities over the eight models devised the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris & Davis, 2003). This theory focuses on advancing more on user's objectives to use information systems in the future. The approach holds on these key constructs: social influence, effort expectancy, performance expectancy, and direct determinants of consumption behavior (facilitating and conditions intention); the first three are the immediate determinants of the plan to use. User behaviour's absolute determinants are age, gender experience, and voluntarism of use predicted to moderate the four essential constructs' effect on utilization behavior and intention.

UTAUT was advanced by Venkatesh and others to forecast user adoption of information technology. UTAUT blended eight theories, including the Technology accepted model (TAM), innovation diffusion theory (IDT), the method of reasoned action (TRA), the motivational model, the method of planned behavior (TPB), a model merging the TAM and TPB, the Model of PC utilization and social cognitive theory (SCT) with empirical analysis, (Venkatesh et al., 2003). These models and approaches have successfully been used as the basis for different innovation and information computer technology adoption branches, such as mobile commerce ecosystem, mobile apps, mobile banking, and electronic financial services adoption by both financial and non-financial institutions (Ukpabi et al., 2019).

Combining all these eight theories makes this theory applicable to implementing many financial innovation products, processes, and services. This has been done in the test if the customers will accept the products like mobile banking. Electronic funds transfer, electronic banking, internet banking like the application of equity mobile banking M-Kesho product by (Njenga, Litondo & Omwnsa, 2016), also the replica of M-Shwari mobile bank banking service by Commercial Bank of Africa (Temenos,2019). Technology acceptance, development in the telecommunication sector, and mobile technology and computer software innovation has led to customer financial services preference. This is due to the ease of use, convenience, speed, social status, change in customer preference behavior, which depends s on the customer reasoning and acceptance of the bank products as indicated by the customer uptake of the equity bank model (Chironga et al., 2017) KCB and M-Pesa, Fuliza other mobile loan services, bill payments, mobile deposit, account balance checking (KCB, 2019).

2.2.2 Technology Accepted Model (TAM)

The technology acceptance model was developed by (Davis, 1989). Davis developed TAM from the theory of reasoned action (TRA) theoretical rationale for identifying the causal linkages between users' attitudes, perceived usefulness, intentions, perceived ease of use, and real utilization behavior (Davis, 1989). Davis (1989) advanced and ratified better forecasting and explaining utilization measures, which crystallized on two theoretical constructs: perceived usefulness and ease of use as the fundamental determinants of system use.

Hence, TAM substitutes determinants of the attitude of TRA with perceived value and perceived ease of use. Perceived usefulness is defined here as "the extent to which a person thinks that utilizing a specific system would increase his or her chore performance within the financial services sector. Technology, like mobile banking, is supposed to make commercial banks staff job performance easy, fast, effective, and cost-effective. The banking system is perceived usefulness if it leads to a good use-execution relationship (Leong & Haung, 2002). Davis defines perceived ease of use as "the level to which a person trusts that using a specific system would be free of effort."

TAM was modified by Davis and Venkatesh (2000) to tam2 to incorporate other determinants that describe the perceived usefulness and utilization intentions of social influence and cognitive instrumental processes. All these switches with usage over time. While experiencing the new system benefits and its usage, and this applies to the bank customers who are using the financial services innovations by banks. It was employed in the M-kesho study in Kenya (Njenga, Litondo & Omwnsa, 2016). The unified theory of acceptance and use of technology models and the technology accepted model will guide this study. These theories are used by financial institutions to test and

implement their innovations like electronic banking, which comprises (EFT) electronic funds transfer, internet banking, and mobile banking. The primary motivation being the perceived ease of utilization of the new system, operational cost saving, financial gain, and operational efficiency.

The perceived ease of use and its usefulness have made many customers accept the TAM in their adoption of agency banking and mobile banking's financial innovation. A study carried out by Mwangi and Wanyoike (2012) on the convenience of agency banking, concluded that customers prefer agency banking because it is easy to operate, saves time and transport costs. It is done at their convenience while using their mobile banking to access the essential financial services while using their mobile phones to access banking services anytime, anywhere.

2.2.3 Theory of Financial Deepening

The theory of financial deepening was formulated and developed by Shaw (1973), and it explains the role played by accessibility to credit on the firm's performance. The theory is premised because financial deepening is a necessary pre-condition for any economy's growth (Bakang, 2015). The method is further premised because financial deepening ensures that credit is available to firms to finance the operations. The theory indicates that sound and efficient commercial sectors result in increased liquidity and mobilization of savings (Mohan, 2006).

In support of these views, Srikanth (2013) indicates that access to credit facilities is a valuable service offered by financial institutions. Since some small businesses are constrained from accessing a large amount of credit from larger financial institutions, mobile banking comes in to bridge the gap by availing customized credit facilities to clients, including small firms (Obafemi, Oburota & Amoke, 2016). The credit is used

for, among other things, expansion of business operations and coming up with projects that generate revenues for the firm. Accessibility to credit facilities has also been associated with increased social protection and production potential (Karimo & Ogbonna, 2017). The theory informs how the adoption of mobile banking has enabled customers to access credit facilities. In return, this increases mobile transaction revenue, many registered mobile users, and the amount of money moved using mobile banking brings customer satisfaction and banking efficiency.

2.3 Empirical Review

2.3.1 Mobile Banking Accounts and Operational Efficiency

Commercial banking is adopting financial innovation technology like electronic banking like mobile, internet, and electronic funds transfer. Most banks have seen exponential growth in their bank account numbers increasing over the years due to the efficient process of account opening, which takes few minutes, without paperwork as the old account opening process, which requires one to physically visit the branch. The customers perceive the usefulness, ease of use, and cost-saving to accept this financial innovation product (KCB, 2019 & CBK, 2017). The number of customers has also increased from 4.4 million to 22.81 million. It has enabled the bank to reduce its operational cost in account opening, account access, loan processing, and turnaround time. It makes customers perceive the bank's new financial innovation as convenient, fast, and secure, attracting more customers (KCB, 2019). This literature was more focused on the KCB bank and not all the commercial banks in Kenya, as intended in this study.

Productive performance in commercial banks' operational efficiency is by looking at the number of human capital resources, which is used in the production of the commercial banks' revenue if it is efficient. We can look at the number of customer accounts and the number of bank staff. According to an annual report (CBK, 2017), on average, in the year 2014, one bank staff was serving 770 client accounts. In contrast with the year 2017, one bank staff was serving 1544. It shows increased customer efficiency, which is due to commercial banks adopting financial innovation technologies. The efficiency score is done by dividing all bank numbers of the deposit account holder by all bank staff. The central bank report covers only two years, 2014 and 2017, and it is an aggregate of all bank accounts, but the study will mainly deal with the mobile loan accounts, the number of deposits, and the mobile accounts, which is not focused on in this review.

According to Kimani (2015), in the effect of mobile banking systems' adoption on commercial banks' operational efficiency in Kenya, the study gathered secondary data, and it uses the census survey method. The study's objective was to examine mobile banking's impact on commercial banks' operational efficiency in Kenya. The research established that there is a significant positive relationship between mobile banking and operational Efficiency in Kenya. The study concluded that the number of registered mobile banking users increased gradually from 2011 to 2014. The coefficient of determination for the number of registered users was 0.32, meaning that the number of registered mobile clients significantly impacts commercial banks' operational efficiency in Kenya. The increase in registered mobile clients indicates that mobile banking services, processes, and products are appealing, and they are meeting customer preferences in the financial market. The commercial banks' increase in registered mobile accounts reduces the operational cost due to 100 percent automation, which

reduces the operating cost, leading to better utilization of the bank assets. This research covered a short period of five years only; now, this study will cover ten years, which will be enough. During this period, mobile banking was emerging compared to 2019 when it had developed wholly and mainly focused on adopting the mobile banking system while this one will be focused on the effect of mobile banking.

According to Kimeu (2018), in the study on mobile money services usage and commercial banks' operational efficiency in Kenya. This study's primary objective was to determine the use of mobile money services and the operational efficiency of commercial banks in Kenya. The descriptive research design was adopted; secondary data from Kenya's central bank for three years 2015-2017 was analyzed. They found out that the number of registered mobile banking increased from 1.649 million to 2.434 in 2017. With the increase in the registered mobile accounts, the mobile transaction volume and value will grow, affecting commercial banks' operational efficiency.

According to the financial report KCB (2019), the KCB M-Pesa is a product that was started by KCB bank to assist its clients in opening and accessing their bank account via a mobile phone Safaricom M-Pesa menu; over 750,000 customers accessed their Bank accounts using this product. The number of mobile loans disbursed by the bank since 2014 has increased exponentially from 0.4 billion to 212.1 billion in 2019. The number of customers has also increased from 4.4 million to 22.81 million. It has enabled the bank to reduce its operational cost in loan processing and turnaround time. It makes customers perceive the bank's new financial innovation as convenient, fast, and secure, attracting more customers. The bank has come up with multiple digital channels to serve their customer needs through mobile banking, agency, merchant POS, branch teller, internet, ATMs. The financial report for 2019 shows a comparison of the number

of transactions in millions per channel. It indicates that mobile banking account access transactions increased from 62.1 million in 2018 to 281.3 million in 2019, a 353% growth. In contrast, the branch teller's traditional banking decreased from 16.2 million in 2018 to 12.5 million in 2019, a 23% decrease.

The bank also collaborated with CBA and M-Pesa to develop a mobile overdraft product called Fuliza in the year 2019, and it has given out loans of 69.4 billion. The product gained its market relevance and significance because of its perceived ease of use, reliability, security, speed, privacy, operational cost, time-saving, and convenience. All these digital transformations are propelled through mobile banking by utilizing mobile phones and smartphones to exploit the internet to download smart banking apps. They have helped in achieving the Profitability of KShs. 25.2 billion in net income through operational cost efficiency and growth in Digital Financial Services. This incorporates mobile banking as a critical player in terms of the number of registered mobile banking accounts, mobile transaction numbers, the amounts transacted, the loans disbursed, deposits made, and other mobile banking-related services that optimize the cost maximizing the profits. The commissions' interest income, fees, and additional revenues increased from76, 175 million in 2015 to 102,521 million in 2019, according to the 2019 financial report.

In the annual report by the Central Bank of Kenya (2016), they noted that the financial services industry is affected by the ever-changing consumer preferences, technological advancement, business sector innovations, and the use of multiple delivery channels. To remain relevant and competitive in the current market, banks and other financial institutions have continued introducing new products, re-engineering the current ones, and adding new delivery channels. Banks will always work to increase clients' access

while distinguishing their services, processes, and products using diversified delivery channels like internet, mobile, agency, and electronic banking. Most customers prefer digital mobile banking channels due to the low transaction cost, convenience, speed, time-saving. According to Chironga et al. (2017), in their study, they suggest that banks adopt these digital strategies: The first is to digitally transform their existing operations to increase their sales and transaction volumes to above 60 to 70 percent each measure. A good example is the equity bank's mobile banking model.

Equity bank partnered with Safaricom in March 2010 to develop Equity M-Kesho mobile banking innovation, which linked the equity customer accounts with M-Pesa, and it provided savings, credit, and insurance products to the customers. It attracted many customers with more than 600000 users. In the first six months, M-Kesho did not continue to scale, due to management issues between the two; it collapses. Equity bank procured a license to start (MVNO), a mobile virtual network operator, a mobile banking model for its customers (Cook & McKay, 2017).

In the year 2015, Equity bank started its Equitel, a mobile banking platform. This platform utilizes SIM overlay technology to permit fast, secure, efficient, and convenient access by each telecommunication mobile service provider's registered users. When comparing the number of transactions per day, Equitel 900,000 transactions means that the customers prefer mobile banking account access. Equity bank agents are doing 300,000, while the bank branches are doing 5000 transactions per day. Customer preferences are evolving each day. Banks need to improve the channels of service delivery to their customers. The bank changed its business model from low volume high margins to high volumes low margins. Based on optimal operational efficiency and cost-effectiveness, technology plays an essential part in

providing these financial products and services (Chironga, Desvaux & Lele, 2019). It has made equity grow in-terms profitability, customer numbers in terms of mobile banking accounts, and optimizing its operations. The study focused on the bank-led model for equity banks and not all the commercial banks with the blended model.

The commercial Bank of Africa has increased the number of customer accounts, which were 2.9 million in the first quarter of the year 2013. It had 9.2 million customers in 2014,12.5 million in 2015 (CBK,2016), and 17.5 million in the year 2016, according to the (CBK, 2017) report. As the KCB Group's annual financial statement (KCB, 2019) summarises, mobile banking has a more significant impact on the company. It has been made possible due to financial innovation and digital transformation by the bank. The bank has collaborated with M-Pesa to develop the KCB M-Pesa product in 2015 (Cook & McKay, 2017).

The study by Lien, Sjöberg, and Vlaar (2011) on the European banks concluded that mobile gadgets would change the way financial services are offered in the banking industry. It indicates that independent retail banks may raise their profits while cutting operational expenses if they implement and make use of mobiles' convenience. Mobile banking innovation can be able to drive electronic commerce, increase customer base, and it can tap the unbanked markets. Some other banks may fail to exploit this opportunity by increasing mobile banking innovation costs if they don't customize their mobile banking services, products, and processes to suit their target market preferences. The research was done on European banks that differ from the Kenyan environment, which creates the need to study in Kenya.

According to Murati et al. (2019), in their report, they noted that as retail banks are moving to the digital era, they must blend their digital channels to meet customer preference. They said that one European Bank could increase its sales by 20% with the Omni channel implementation, a blend of human interaction and digital. They noted that 60% of the active bank customers are using mobile and online banking. Further, they stated that digital channels increase sales by 25% while mobile has 5%. Online banking having 20%. While customers are moving to digital banking, banks realize cost-saving in terms of the physical branches' operational cost.

According to Rabiu et al. (2019a) on E-banking's impact on the Operational Efficiency of banks in Nigeria. The study used a quantitative method, and it used primary data in their research using a questionnaire. They found that electronic banking (internet and mobile) has enhanced commercial banks' efficiency in Nigeria. Through account opening by mobile phone, online account access, mobile money transfer using E-banking, access to the account 24/7, and reduction in time for serving the customer at their convenience using mobile phones. When the variables were analyzed independently, they found out that internet banking has a statistically outstanding outcome on Nigeria's operational efficiency. On the other hand, mobile banking's financial innovation has an insignificant effect on commercial banks' operational efficiency in Nigeria. It was noted by the p-value 0.0514 for mobile banking, which was >0.05. The current study will find out if mobile banking alone affects Kenya's commercial banks' operational efficiency.

2.3.2 Mobile Banking loans and Operational Efficiency

Ntwiga (2019) in the study on fintech and banks collaboration: does it influence the efficiency in the banking sector. The study objective was to establish the influence of fintech on banks' loan allocation ability using (DDM) data development model. Secondary data for ten years from 2009-2018. The study noted a positive effect on the technical efficiency, which observed liquidity ratios, cost of income return on assets, and loan intensity. On the other side, the cost of intermediation and credit risk negatively affected technical efficiency. The study noted that depending on the inputs and the model adopted. Some factors like mobile banking, credit, digital account operations, which lead to the growth of bank accounts, increase in revenue generated by banks through commissions charges on the services they are offering, increase the bank's technical and operational efficiency on the credit allocation. Still, the study concluded that collaboration between banks and fintech does not significantly affect the banking industry's efficiency. The research examined the influence of fintech and banks' collaboration on commercial banks' efficiency, which was not significant and mainly focused on loans. In contrast, this study will be focused on the effect of banking on commercial banks' efficiency.

The partnership strategy between commercial banks and mobile network operators offers digital mobile banking products, services, and processes. A good example is a cooperation between the Commercial Bank of Africa and Safaricom. They developed a mobile loan application product called M-Shwari (Chironga et al., 2017). According to the study by (Cook & McKay, 2017), it was noted that when CBA bank partnered with M-Pesa, the banks have increased the number of customer accounts, deposits, loans. It was indicated that the bank is offering a vast array of products, services, and processes like balance inquiry, interbank transfers, interest loans, mini-statement

requests, interest on deposit savings lock account. M-Shwari product was introduced in the year 2012. It has been a single contributor to the bank's growth. The customers have perceived the product to be convenient, easy to use, secure, and cost less because the cost of withdrawal from an M-Shwari account to M-Pesa is free. Customers can request loans at the click of a button, which does not require paperwork and any guarantor as the traditional banks do. The account opening, loan request, account balance, and loan limit check are automated. This study reviewed the commercial bank of Africa products and services and not all the 41 commercial banks in Kenya, which this study intends to investigate.

According to Temenos (2019), in the success story of the Commercial Bank of Africa M-Shwari, it attained remarkable growth on the initial day of its operation by opening 70000 accounts, with an average of 32000 customers each day, within the next three months. In Kenya, for instance, the bank disburses mobile loans of 60000-70000 on average every day and 90000 during promotions. In 2014, the Commercial Bank of Africa partnered with Vodacom in Tanzania to start M-Pawa services, a replica of M-Shwari. Then, the CBA Bank teamed up with MTN in Uganda to develop and customize the MoKash services for Uganda and Rwanda in 2017, the bank to bank partnership in Côte d'Ivoire to create the MoMoKash mobile service via a partner bank in Côte d'Ivoire in the year 2018. The bank's accounts have grown in the five countries to be forty million. CBA offers the loan product at an interest rate of 7.5percent per month with loans ranging from 100 to 50000, and it uses customer data from the MNO to calculate the customer loan limit. The Bank operations are done efficiently by deploying robust temenos banking software, with a lean team of 20 IT personnel and sixty operational staff. Its services are centralized for the five countries in Nairobi. It makes the mobile banking product to be economically efficient. The report covers the

CBA Mobile loans while this study is intended to cover all the commercial banks, and it will be focusing on Kenya only and not in east Africa, as in this study.

According to the financial report KCB (2019), the number of mobile loans disbursed by the bank since 2014 has increased exponentially from 0.4 billion to 54.4 billion in 2019. It has enabled the bank to reduce its operational cost in loan processing and turnaround time. The customers can request loans using the mobile app, USSD, or M-Pesa sim tool. These loans are processed, approved using customer M-Pesa data analytics and loan logarithms. It makes customers perceive the bank's new financial innovation as convenient, fast, and secure, attracting more customers. The bank has come up with multiple digital channels to serve their customer needs through mobile banking, agency, merchant POS, branch teller, internet, ATMs.

The bank also collaborated with CBA and M-Pesa to develop a mobile overdraft product called Fuliza in the year 2019, and it has given out loans of 69.4 billion. The product gained its market relevance and significance because of its perceived ease of use, reliability, security, speed, privacy, operational cost, time-saving, and convenience. All these digital transformations are propelled through mobile banking by utilizing mobile phones and smartphones to exploit the internet to download smart banking apps. They have helped achieve the Profitability of KShs 25.2 billion in net income through operational cost efficiency and growth in Digital Financial Services. This incorporates mobile banking as a critical player in the number of registered mobile banking accounts, mobile banking loans disbursed, mobile banking deposit made, and other mobile banking-related services, optimizing the cost while maximizing the profits. The commissions' interest income, fees, and additional revenues increased from

76 175 million in 2015 to 102,521 million in 2019, according to the 2019 financial report.

Kinyanzui et al. (2018) analyzed mobile banking credit on commercial banks' operational efficiency in Kenya. The study's objective was to establish the impact of digital loans on commercial banks' operation efficiency in Kenya. The research adopted an experimental research design. The study used both primary and secondary data on mobile phone credit access on the impact of financial institutions' performance. They found out that mobile loans enhanced operational efficiency in commercial banks. Transferable banking credit has improved operational efficiency in loan processing, approval, and debt collection. They noted that the employment of technology in commercial banks is a consumer-driven approach, cost optimization, and revenue maximization. The study used return on asset, non-performing loan proportion, and earnings per share to measure mobile loans' impact on commercial banks' operational efficiency. The research concluded a significant favorable effect between mobile loans and operational effectiveness on commercial banks in Kenya. This study covered five years between 2010-2015, and it used both primary and secondary data, and it used an experimental design, sampled only five banks, but this study will cover ten years between 2010-2019, it will use secondary data, and it will use census survey. It will cover all the commercial banks in Kenya; hence the research will cover the other areas not covered by the study on mobile credit only and operational efficiency.

Mohamed (2019) studied mobile banking's effect on commercial banks' financial performance in Kenya to determine the impact of mobile banking loans on commercial banks' performance. The study focused on commercial banks' performance. It applied descriptive and mixed research design using primary data collected through a structured

questionnaire and secondary data with a sample of 14 banks. The study concluded that mobile banking loans have a fragile positive correlation relationship implying that commercial banks are introducing faster mobile banking loans to their customers. These affect commercial banks' performance gradually as customers adopt them compared to traditional banking. The research in this study will look at all the commercial banks and use secondary data for ten years, which will be enough to overcome the limitations in this study and test if mobile banking loans have been accepted and what impact do they have on the commercial banks' operational efficiency and not performance.

2.3.3 Mobile Banking deposits and Operational Efficiency

Ngigi (2014) looked at mobile banking deposits and noted that since the inception of the mobile phone banking partnership between Africa and Safaricom's commercial bank. It has led to an increase in mobile customer deposits, hitting 24 million after one year of its inception. They noted that M-Shwari mobile banking product average receives KShs 200 million deposits daily from an average of six million M-Shwari customers. This product has enabled the Commercial Bank of Africa to increase its total deposits by 26.2%. The deposits are 86.8 billion, which was attributed to mobile banking products which the bank is offering both the short term and long term mobile banking saving products.

Alushula (2020) noted on the business daily that according to the 2019 Central Bank of Kenya data, he said that customers are shifting from the preference of ATM usage to other modern banking channels like internet banking, mobile banking, and agency banking. Customers can access their banking services through the use of mobile banking. Commercial banks need to adopt cost-effective financial service delivery products, processes, and services. The number of mobile deposit accounts is more than

16 million, around 28.9 % of the total deposit accounts of 55.27 million in the banking sector. These are attributed to financial innovation changes, stiff competition among the commercial banks, and the mobile money network providers, forcing commercial banks to develop integrated mobile banking platforms for easy access, deposit, and transfer of money to the deposit account. This study will fill the gap created by the number of mobile deposit accounts created due to the financial innovation and customer preference for mobile banking. It will try to address whether mobile deposits have any impact on commercial banks' operational efficiency.

Ndirangu (2015) conducted a study on mobile banking on commercial banks' performance in Kenya. The study's primary objective was to establish the specific effect of increased mobile banking usage and adoption. The descriptive research design was applied, and a census survey for the 34 commercial banks out of the 44 was used. The study concluded that mobile banking significantly impacted commercial banks' performance when the study critically examined the variables, especially the total mobile banking deposit with total commercial bank deposits. It indicated that it had a 0.187% effect on the Return On Asset, which is a significant indication that customers are using mobile banking to make their commercial bank deposits. The current study will cover operational efficiency and how it is affected by mobile banking deposits covering all the commercial banks in Kenya compared to commercial banks' performance done by Ndirangu.

Tuyishime and Memba (2015) on their study concerning deposit mobilization on commercial banks in Rwanda, a case study of equity bank Rwanda. They used a census survey study utilizing both secondary and primary data targeting the bank managers. The study concluded that the marketing strategy of incorporating financial innovation

had a positive relationship between deposit mobilization and the commercial bank's performance in Rwanda. Deposit mobilization was enhancing due to the agency and mobile banking, which enable the customers to make their bank deposits at a low cost. The researcher will fill the literature gap by finding out the effect of mobile banking deposits on operational efficiency while investigating if mobile savings enhance the banks' liquidity. This can be used for investments to generate more revenue for the commercial banks while increasing its operational efficiency.

2.4 Conceptual Framework

The current research study intends to determine mobile banking's impact on commercial banks' operational efficiency in Kenya. Fig 2.1 shows the conceptual framework

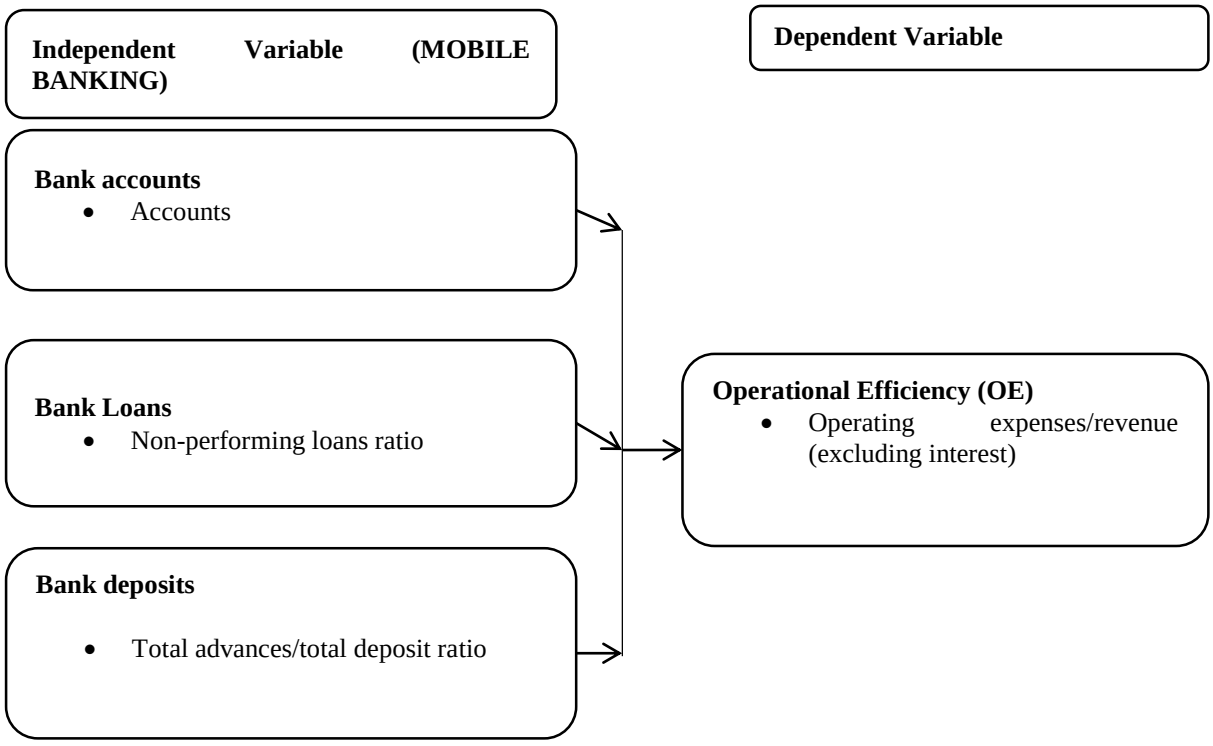

Figure 2. 1: Conceptual Framework

Source: Author (2020)

Technology is helping commercial banks to automate their processes, and it allows banks to reduce operational cost. At the same time, they are optimizing technology to maximize their revenue generation. Electronic banking is one of the innovation banks use in offering their products, processes, and services like account opening using a mobile phone. The growth in the number of registered mobile banking accounts by commercial banks indicates that banks utilize their technological resources efficiently while reducing the time serving the customer and their operational cost. This can also be captured on the mobile loan accounts, which are opened to enable the customers to access the mobile loans which they borrow from the commercial banks.

The number of mobile deposits and the amount of money the customers can deposit to their bank accounts through mobile banking are better indicators of how banks employ technology to serve their customers using mobile banking. It can be done anywhere, without the limit of time like that of the brick and mortar model. The growth in the number of mobile deposit and amount of savings mobilized through mobile banking are the indicators of efficient operational efficiency by banks reducing operating cost in terms of human resources, paperwork, office space, time spent by the customer and the bank staff while serving these customers as compared to the self-service by mobile banking innovation employed by commercial banks. This study will focus on the number of mobile deposits made through mobile banking as a variable factor.

The number of mobile loans or credit and advances offered by the commercial banks serves as a revenue source in terms of loan interest, processing fees, commission, and other related charges. Still, it is the cost incurred to access these loan services while using commercial banks' mobile financial banking services to the customer side. As the

number of bank loans increases, the banks can make more revenue with the reduced operational cost because mobile loans are processed, approved using data analytics algorithms customers prefer mobile loans because they are issued instantly and require no guarantors. All loan processes are digitized with no paperwork as compared to traditional banking. The commercial banks can operate optimally by looking at the ratio of non-performing loans. This is done by dividing the provision for non-performing loans divided by the total amount of loans and other advances issued to the customers. This ratio will be a good indicator of how commercial banking operates on loans issued through mobile banking, which can operate optimally or increase the cost of loan recovery and provision for non-performing loans. Mobile banking and commercial banks' operational efficiency of commercial banks in Kenya. The efficiency ratio will measure the operating effectiveness of commercial banks. The efficiency ratio is the ratio between operational expenses and revenue.

2.5 Operationalisation of Variables

Operationalization of the research variables as per table 2.1.

Table 2.1: Operationalization of Variables

Type of variable	Variable measure	Type of scale	Type of analysis	Level of analysis
Independent Bank accounts	• Accounts	integer	Quantitative	Descriptive analysis Inferential analysis
Independent Mobile Banking Loans	• The ratio of Non-performing to loans to the total number of loans	Ratio	Quantitative	Descriptive analysis Inferential analysis
Independent Banking deposits	• The ratio of total advances/total deposits	Ratio	Quantitative	Descriptive analysis Inferential analysis
Dependent Operational Efficiency	Operating expenses/revenue	Ratio	Quantitative	Descriptive analysis

Source: Author (2020)

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter summarises the research design in this study. Define the target population, the sample size, procedures applied, research instruments, reliability and validity tests, data collection procedures to be used, data analysis, and presentation.

3.2 Research Design

The study used a descriptive research design. According to (Kothari, 2004) research design is the systematic plan on the set criteria for data gathering and analysis of data collected to serve this research's purpose. It constitutes the structure within which the study is anchored, and it is the road map for data collection and analysis. Descriptive design is best suitable to describe the elements as they exist under this study, on the effects of mobile banking on commercial banks' operational efficiency. As Kothari (2004) noted, the descriptive design will precisely narrate the attributes of the phenomena under investigation. The plan also demonstrated the relationship between the dependent variable and independent variables.

3.3 Target Population

The target population for this study was the entire commercial banks in Kenya, which is the 44 banks, according to the central bank of Kenya report (CBK, 2010). By the year 2018, some banks have experienced some financial challenges, and some are under statutory management like Charterhouse Bank Limited. The other two under receivership are Imperial Bank Ltd, and Chase Bank (K) Limited (CBK, 2018) was excluded from the target population. The study targeted 41 commercial banks classified into three tiers (Appendix II), as shown in Table 3.1.

Table 3.1: Target Population

Tier	Number of Banks (Population)
Tier I	6
Tier II	14
Tier III	21
Total	**41**

Source: CBK (2019)

3.4 Sampling and Sampling Procedure

The study used a census survey, and thus all the 41 commercial banks were targeted. According to Krishnaswamy and Satyaprasad (2010), census surveys are the complete coverage of all units or a population and the entire community featured in the study. In this case, the researcher covered all commercial banks under the supervisory of Kenya's central bank from 2010 to 2018, excluding those three banks under receivership or statutory management.

Table 3.2: Sample Size

Tier	Number of Banks (Sample Size)
Tier I	6
Tier II	14
Tier III	21
Total	**41**

Source: CBK (2019)

3.5 Data Collection Instrument

This study collected data through secondary data using a data collection sheet (Appendix II). Data was gathered for a period of nine years, from 2010 to 2018. The period was reasonable and adequate to observe financial trends. Most commercial banks introduced mobile banking innovation to optimize their cost while maximizing their profits and improving operational efficiency. The secondary sources were the central bank of Kenya annual reports, CBK, supervisory reports, commercial banks' yearly financial statements, economic statistical information available on the CBK website, and the commercial banks' websites.

The data collected included mobile banking accounts for ten years, mobile banking loans. The mobile banking deposits, the OE (operational efficiency ratio), was the ratio between operating expense divided by revenue, not including interest every financial year.

3.6 Data Processing and Analysis

The study adopted panel data to analyze the findings using STATA software. Data was modelled into a regression equation that defined the relationship between the independent variables and commercial banks' operational efficiency. STATA software was employed to analyze and give descriptive statistics outputs essential for the study that used descriptive research design.

3.6.1 Panel Data Model Specification

The study adopted panel data methodologies covering nine years (2010-2018) across 41 commercial banks with the model specified as follows:

$$Yi=\beta 0+\beta 1X1it+\beta 2X2it+ \beta 3X3it + \varepsilon$$

Where:

Yi: Operation Efficiency

β0: Constant of the Model;

X1: Accounts

X2: Ratio of Non-performing loans to total loans

X3: Bank deposits

βi: matrix of coefficients;

Ɛ : error term.

3.6.1 Panel data model Specification and Diagnostic Tests

According to Pillai (2016), there are three major panel data analytics models, namely: The constant coefficients (pooled regression) models, (REM) Random effects models, and The (FEM) Fixed effects models.

The constant-coefficient or pooled regression OLS model is applied when data is assumed to have a constant slope and intercept without any regard to the time or the years and the commercial banks. This pooled OLS regression model has no random or fixed effect. It makes use of the ordinary least squares (Park, 2011).

The fixed-effect model was applied to the data collected. It assumed that intercepts vary across individual banks. The slope coefficients are considered to be constant across the respective banks over time while analysing the individual variables' effect. This model is used when the panel is correlated with the predators. Dummy variables are created to create a fixed effect across the commercial banks. The fixed-effect model recognizes that the omitted variables may result in variations in the time series and the cross-sectional data (Sporta, 2018). The least-square dummy variables will be used (LSVD) in determining the fixed effect in the data model. The LSVD furnishes us with a better

way of comprehending the selected product (Oscar, 2007). This model assumes that the differences in the constant term can represent variations over the units.

The random effect model examines how the commercial banks and the time influence the error variance (Park, 2011). The model initiates the uses of the disturbances term U as the consequence of disregarding the dummy variables. The model considers neither the variables as random, meaning they are not treated as fixed nor constant as the other models do. The logic for the REM is that variations across the commercial banks are assumed to be uncorrelated with the independent and predictor variables, and they are random (Sporta, 2018). If you have some basis to believe that differences across the commercial banks will affect the dependent variables, you should use the random effect model.

Diagnostic test

Hausman test

The study conducted a Hausman Test to specify whether to use random effect (RE) or fixed effect (FE) in the panel data. Through the Hausman Test, one can test for the endogenous predictor variables. If the P-value is less than 0.05, then there is endogeneity, therefore ignore the random-effects model and employ the fixed effects model. Hausman test will help to decide on which model is suitable for this study. Table 3.3 will interpret which model will be appropriate for the research.

Table 3.3: Panel Data Model Statistical Test

Fixed Effect vs. Ordinary Least Square H0 = μ1= μ2 = … = μ F or Wald Test	Random Effect vs. Ordinary Least Square H0 = Var(μi) = 0 Breusch-Pagan Test	our Model Pooled
H0 not rejected ⇒ No Fixed Effect	H0 not rejected ⇒ No Random Effect	Pooled OLS
H0 rejected ⇒ Fixed Effect	H0 not rejected ⇒ No Random Effect	Fixed Effect Model
H0 not rejected ⇒ No Fixed Effect	H0 rejected ⇒ Random Effect	Random Effect Model
H0 rejected ⇒ Fixed Effect	H0 rejected ⇒ Random Effect	Choose one based on Hausman test

Multicollinearity Test

Multicollinearity is a situation where there is a high correlation among one or more independent variables within a multiple regression equation (Andren, 2007). Multicollinearity will make it hard to determine the impact of the individual independent variables on the dependent variable. The study used the (VIF) Variance Inflation Factor to test for multicollinearity. Muia (2017) used the VIF less than 10 to mean no multicollinearity problem with a tolerance level of 0.1. Multicollinearity tests would be very significant to measure if the model will hold in this study. It indicates if the mobile loans and mobile deposits variables influence each other if the registered mobile accounts, mobile loans, etc.

Autocorrelation Test

Autocorrelation means that the independent variables are related to each other over some time. This study employed a Wooldridge Drukker test to establish the presence of autocorrelation. If Ɛ =0, there is no serial correlation in idiosyncratic errors.

Heteroskedasticity Test

Heteroskedasticity arises when an error term of a regression model is constant over time as one of the linear regression models' hypotheses. This study adopted the Breusch Pagan Test in testing for heteroscedasticity. If the P-value is less than 0.05, then there is heteroscedasticity.

Normality Test

A normality test determined whether sample data was drawn from a normally distributed population. The normality test was done using the residual PP plot graphs and QQ plot graphs to test whether there is normality.

Table 3.4: Panel Data Diagnostic Test

Test	Test Applied	Conclusions
Random Effect Model OR Fixed Effect Model	Hausman test	If the P-value is less than 0.05, then there is endogeneity, therefore ignore the random-effects model and employ the fixed effects model
Use of Random effect model OR pool OLS	Lagrange multiplier (LM) Breusch-Pagan	If the P-value >0.05 apply pooled OLS model
Autocorrelation Test	Wooldridge Drukker test	If the v P>0.05, no serial correlation
Heteroskedasticity	Breusch Pagan Test	If the P-value is less than 0.05, then there is heteroscedasticity
Normality Test	PP and QQ plots	Check if the residues are normal on the plot graphs

Source: Author (2020)

3.7 Plan for Panel Data Analysis

Panel data was collected, cleaned, and coded appropriately. The study applied three main steps (Sporta, 2018). The exploratory data analysis helped the researcher decide which model to be used by exploring the pool OLS model, the random effect model, and the fixed effect model. The linear regression equation model was used. The research ensured that there was no high correlation between the two variables. The panel data was tested for serial correlation using the Wooldridge Drukker test.

The panel data diagnostic test helped the research decide which model was suitable for the study, between the random effect model, the fixed effect, or the pool OLS model. Hausman test was done to select either the FEM or REM. Lagrange multiplier (LM) Breusch-Pagan was used to choose between the Random effect model or pool OLS model. The testparm test was done to check the time fixed effects.

Lastly, after choosing either the FEM or REM, the other test could be tested for Heteroskedasticity.

3.8 Ethical issues

In conducting this study, the research ensured that all the ethical issues relating to data confidentiality were followed to the dot. Data collected was analyzed truthfully, and all the research instructions were followed as required by the financial institutions and the university.

CHAPTER FOUR: DATA ANALYSIS FINDINGS AND DISCUSSION

4.1 Introduction

Chapter four of this research study presents the research data analysis, discussions, and findings that the research objectives tried to look for. This chapter has a descriptive statistics analysis, regression model analysis, and the research findings.

4.2 Descriptive Statistics

The research study established the relationship between mobile bank loan accounts, mobile bank loans, and mobile bank deposits on commercial banks' operational efficiency in Kenya. The study data were analyzed and presented as shown in table 4.1 below

4.2.1 Operational Efficiency Ratio

The descriptive statistics on the operational efficiency is as presented in the table below

Table 4.1: Panel Data Descriptive Statistics

```
. xtsum OPERATIONALEFFICIENCY ACCOUNTS00000 GROSSNPLTOTALADVANCES TOTALADVANCESTOTALDEPOSITS
```

Variable		Mean	Std. Dev.	Min	Max	Observations	
OPERAT~Y	overall	65.29121	38.10347	17.08	348.16	N =	306
	between		31.43309	22.48333	170.0978	n =	34
	within		22.13031	-27.50657	243.3534	T =	9
AC~00000	overall	8.460308	27.57603	.00134	262.0521	N =	306
	between		22.07741	.0167178	104.7309	n =	34
	within		16.90592	-95.99769	165.7815	T =	9
GROSSN~S	overall	10.59572	9.597902	-.64	47.58	N =	306
	between		6.77409	.3488889	23.73222	n =	34
	within		6.887311	-9.374281	37.54461	T =	9
TOTALA~S	overall	76.3918	21.99041	13.57	147.02	N =	306
	between		18.98661	39.74111	135.5944	n =	34
	within		11.5127	40.0518	129.7085	T =	9

The descriptive statistics results indicate that the commercial banks' maximum operational efficiency ratio since the year 2010 up to the year 2018 is on an overall maximum of 348.16% and a minimum of 17.08% with an overall mean of 65.29%. The operational efficiency of the commercial bank has increased over this period of nine years. This study's standard deviation on the operational efficiency of commercial banks overall is 38.10% with between being 31% and within being 22%. It is prudent to note that the operational efficiency ratio measures how commercial banks utilize technological innovations resources, like mobile banking, to optimize their income while minimizing their operational cost by digitizing their loan application processes, approval, and collection. Account opening allows access to; bank deposits, account balance checking, bill payment, and other mobile banking associated processes, which makes the commercial banks reduce their operational cost and generate more revenue in terms of fees, commissions, and interest on loans. This allows leveraging the mobile banking technology and serving customers in their comfort zone.

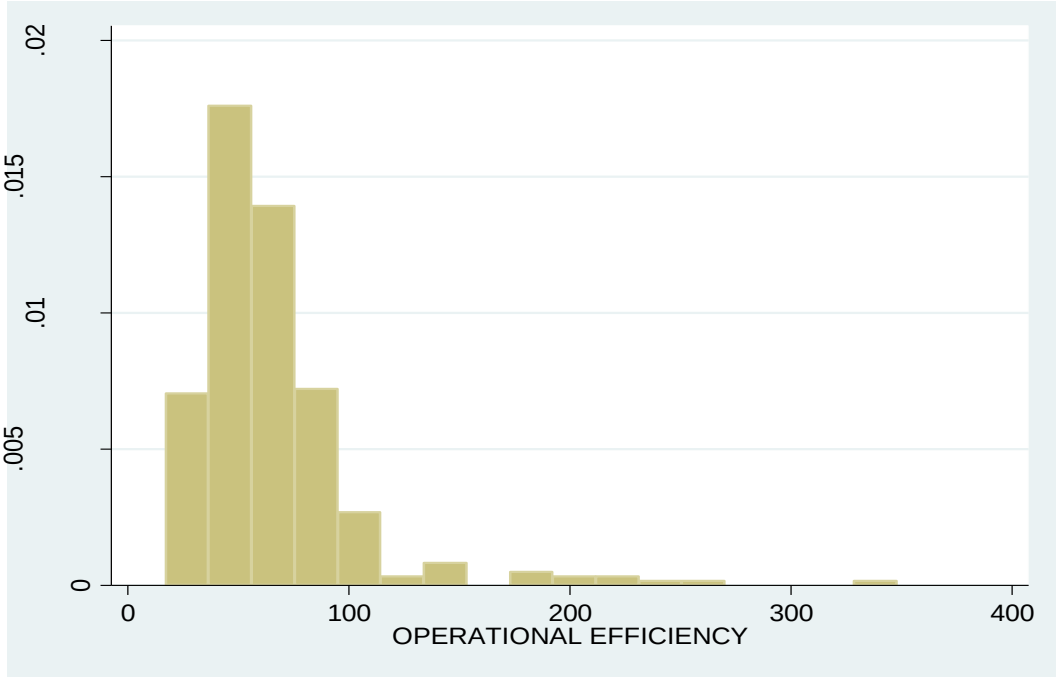

Figure 4.1: Histogram for Operational Efficiency

Figure 4.1 shows the histogram, which depicts the variations of the operational efficiency over time. It shows that the OE Ratio was not generally distributed over nine years under study.

4.2.2 Descriptive statistics for independent variables

The study analyzed and examined the results of the descriptive statistics for the number of bank loan accounts, non-performing loans, and total bank deposits. The result is presented in table 4.2 below

Table 4.2: Descriptive Statistics of Independent Variables

```
. xtsum OPERATIONALEFFICIENCY ACCOUNTS00000 GROSSNPLTOTALADVANCES TOTALADVANCESTOTALDEPOSITS
```

Variable		Mean	Std. Dev.	Min	Max	Observations	
OPERAT~Y	overall	65.29121	38.10347	17.08	348.16	N =	306
	between		31.43309	22.48333	170.0978	n =	34
	within		22.13031	-27.50657	243.3534	T =	9
AC~00000	overall	8.460308	27.57603	.00134	262.0521	N =	306
	between		22.07741	.0167178	104.7309	n =	34
	within		16.90592	-95.99769	165.7815	T =	9
GROSSN~S	overall	10.59572	9.597902	-.64	47.58	N =	306
	between		6.77409	.3488889	23.73222	n =	34
	within		6.887311	-9.374281	37.54461	T =	9
TOTALA~S	overall	76.3918	21.99041	13.57	147.02	N =	306
	between		18.98661	39.74111	135.5944	n =	34
	within		11.5127	40.0518	129.7085	T =	9

Table 4.2 shows that the independent variable of accounts that were opened had a standard deviation of 27 on overall and mean of 8.4 accounts is a greater indicator of mobile banking's effect on the operational efficiency of commercial banks. The effect of mobile loans, which is indicated by the non -performing ratio, has a mean of 10.56 and a standard deviation of 9.5 with the minimum of -0.64 and maximum of 47.58 ratios for the provision of the bad debts, which in turn reduces the revenue generated hence affecting the commercial banks' revenue. It also increases terrible debt provision, which

increases the operational cost. Some of the loans provided in terms of bad debt provision are the mobile loans given without any collateral security. The number of bank deposits has a mean of 76.39% and a standard deviation of 21%, with a minimum of 13.57 % and a maximum of 147% being the variations on the total advances against the total deposits over the study period. Trend analysis for these variables indicates that they affect operational efficiency due to employing mobile banking's financial technology by commercial banks in Kenya.

4. 3 Exploratory Data Analysis

Exploratory data analysis was done using the graphs for each bank over the period, as shown below. We assessed the trend of each commercial bank's operational efficiency over time.

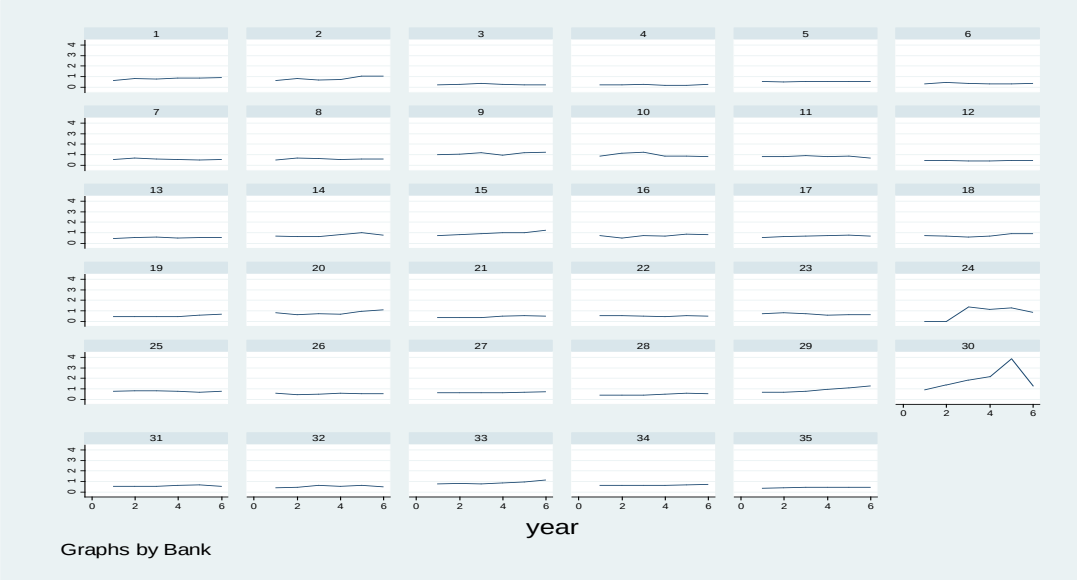

Figure 4.2: Growth plot for each bank

We further examined the overlay operation efficiency plot graphs showing the trend among the commercial banks in terms of operational efficiency. This overlay plot trend indicates that operational efficiency for banks did not change significantly among the commercial banks in Kenya throughout the study.

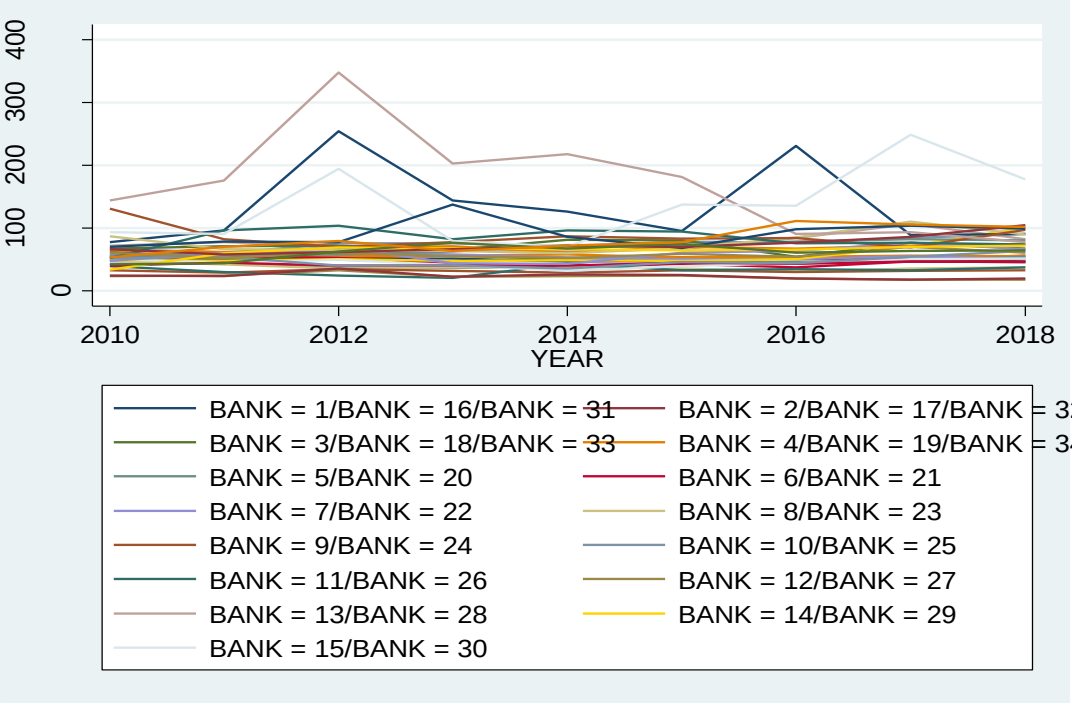

Figure 4.3: Overlay Plot for Operation Efficiency

Figure 4.3 above shows that the slopes of each commercial bank under study were not significantly different. The y-intercept for each bank was different. It can be inferred that the time-related effect is not significant.

4.4 Diagnostic Test

4.4.1 Multicollinearity Test

Pearson correlation among variables

The research study carried out the variables correlation matrix analysis. Table 4.3 represents the analyzed data results from Stata. From the findings, we can conclude that there is no significant correlation among the variables under the study because the highest R-value is 0.2357 has a medium relationship, which is less than 0.5 hence weak correlation relationships among the variables.

Table 4.3: Pearson Correlation

```
. pwcorr ACCOUNTS00000 GROSSNPLTOTALADVANCES TOTALADVANCESTOTALDEPOSITS,sig star(0.05)

             | AC~00000 GROSSN~S TOTALA~S
-------------+---------------------------
ACCOUN~00000 |   1.0000
             |
GROSSNPLTO~S |  -0.1131*  1.0000
             |   0.0481
             |
TOTALADVAN~S |  -0.0084   0.2357*  1.0000
             |   0.8834   0.0000
```

Variance Inflation Factor

The study further tested the model's multicollinearity, and the VIF P-value is 1.05, which is less than 10, therefore no issue of multicollinearity. Muia (2017) used the VIF less than 10 to mean no multicollinearity problem with a tolerance level of 0.1. Multicollinearity tests are significant to measure if the model will hold in this study among the variables, and these variables are not firmly correlated

Table 4. 4: Variance Inflation Factor Test

```
. vif

    Variable |      VIF      1/VIF
-------------+----------------------
GROSSNPLTO~S |     1.07    0.932116
TOTALADVAN~S |     1.06    0.944123
ACCOUN~00000 |     1.01    0.986861
-------------+----------------------
    Mean VIF |     1.05
```

4.4.2 Stationary Test

The stationary unity test was done using Levin-Lin-Chu unit-root to test each variable. If the p-value is less than 0.05 and all the variables are less than 0.05, then the panel data are analyzed, time-series data is non-stationary.

Table 4.5: Unit stationary Test

```
. xtunitroot llc OPERATIONALEFFICIENCY

Levin-Lin-Chu unit-root test for OPERATIONALEFFICIENCY
------------------------------------------------------

Ho: Panels contain unit roots                   Number of panels  =      34
Ha: Panels are stationary                       Number of periods =       9

AR parameter: Common                            Asymptotics: N/T -> 0
Panel means:  Included
Time trend:   Not included

ADF regressions: 1 lag
LR variance:     Bartlett kernel, 6.00 lags average (chosen by LLC)
------------------------------------------------------------------------------
                     Statistic       p-value
------------------------------------------------------------------------------
 Unadjusted t          -9.3847
 Adjusted t*           -3.0018         0.0013
------------------------------------------------------------------------------

. xtunitroot llc ACCOUNTS00000

Levin-Lin-Chu unit-root test for ACCOUNTS00000
----------------------------------------------

Ho: Panels contain unit roots                   Number of panels  =      34
Ha: Panels are stationary                       Number of periods =       9

AR parameter: Common                            Asymptotics: N/T -> 0
Panel means:  Included
Time trend:   Not included

ADF regressions: 1 lag
LR variance:     Bartlett kernel, 6.00 lags average (chosen by LLC)
------------------------------------------------------------------------------
                     Statistic       p-value
------------------------------------------------------------------------------
 Unadjusted t          -2.7605
 Adjusted t*           -0.9616         0.1681
------------------------------------------------------------------------------

. xtunitroot llc GROSSNPLTOTALADVANCES

Levin-Lin-Chu unit-root test for GROSSNPLTOTALADVANCES
------------------------------------------------------

Ho: Panels contain unit roots                   Number of panels  =      34
Ha: Panels are stationary                       Number of periods =       9

AR parameter: Common                            Asymptotics: N/T -> 0
Panel means:  Included
Time trend:   Not included

ADF regressions: 1 lag
LR variance:     Bartlett kernel, 6.00 lags average (chosen by LLC)
------------------------------------------------------------------------------
                     Statistic       p-value
------------------------------------------------------------------------------
 Unadjusted t          -3.7234
 Adjusted t*            7.1262         1.0000
------------------------------------------------------------------------------

. xtunitroot llc TOTALADVANCESTOTALDEPOSITS

Levin-Lin-Chu unit-root test for TOTALADVANCESTOTALDEPOSITS
-----------------------------------------------------------

Ho: Panels contain unit roots                   Number of panels  =      34
Ha: Panels are stationary                       Number of periods =       9

AR parameter: Common                            Asymptotics: N/T -> 0
Panel means:  Included
Time trend:   Not included

ADF regressions: 1 lag
LR variance:     Bartlett kernel, 6.00 lags average (chosen by LLC)
------------------------------------------------------------------------------
                     Statistic       p-value
------------------------------------------------------------------------------
 Unadjusted t          -7.0261
 Adjusted t*           -2.6147         0.0045
------------------------------------------------------------------------------
```

4.4.3 Normality Check

Checking if the residuals are normally distributed so we use PP-plots and/or QQ-plots

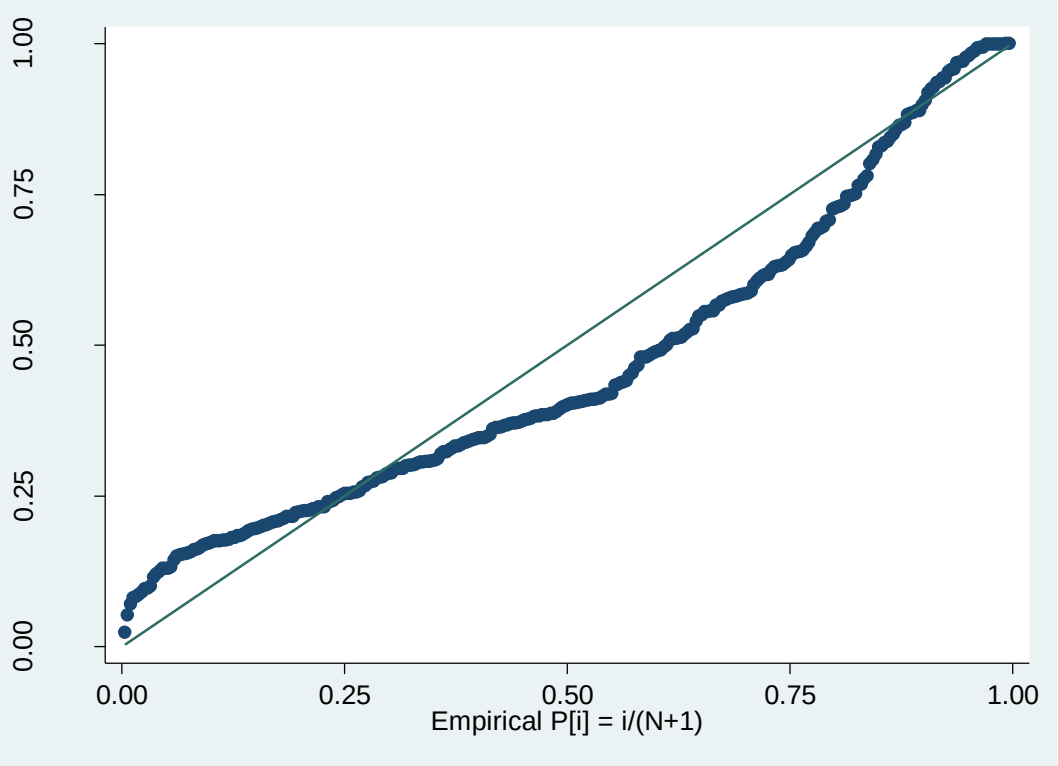

Figure 4.4: Normality Check

From the PP plot graphs and the QQ plot graphs, they indicate that the residuals are normally distributed, so there is no issue of normality

4.4.4 Heteroscedasticity Test

The model selected for this study is the fixed effect model. we test for heteroscedasticity test using the Modified Wald test for group-wise. Heteroskedasticity in fixed effect regression model Prob>chi2 = 0.0000, meaning we do not have the issue of heteroscedasticity.

Table 4.6: Heteroscedasticity Test Table

```
. xttest3

Modified Wald test for groupwise heteroskedasticity
in fixed effect regression model

H0: sigma(i)^2 = sigma^2 for all i

chi2 (34)  =    5.1e+05
Prob>chi2 =      0.0000
```

4.4.5 Testing for Autocorrelation

The study carried out the panel data autocorrelation test using the Wooldridge test, and the result is shown below. The P-value 0.2193 >0.05 meaning there is no serial correlation for the panel data.

Table 4.7: Autocorrelation Test

```
. xtserial ACCOUNTS00000 GROSSNPLTOTALADVANCES TOTALADVANCESTOTALDEPOSITS

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,      33) =      1.568
           Prob > F =      0.2193
```

4.5 Regression Model Analysis

The study carried out the following procedure to measure which regression model will be accepted in this research study, whether the pool OLS, random effect model, or the fixed effect model.

4.5.1 Model Selection

The research study selected panel data analysis, and there was a need for the selection of the best model which can be employed in this study; to do this, the Hausman test needs to be done. It is carried out to determine whether we can use the random effect model or the fixed effect model. Carry out the simple regression model among the variables, the pool model, then carry out the fixed effect model regression by running the regression model. Then, use the fixed-effect model. Run estimate store fixed command to store the fixed effect model.

Table 4.8: Fixed Effect Model

```
. xtreg OPERATIONALEFFICIENCY ACCOUNTS00000 GROSSNPLTOTALADVANCES TOTALADVANCESTOTALDEPOSITS,fe

Fixed-effects (within) regression               Number of obs      =       306
Group variable: BANK                            Number of groups   =        34

R-sq:  within  = 0.0227                         Obs per group: min =         9
       between = 0.2841                                        avg =       9.0
       overall = 0.1411                                        max =         9

                                                F(3,269)           =      2.08
corr(u_i, Xb)  = 0.3228                         Prob > F           =    0.1029
```

OPERATIONALEFFICIENCY	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ACCOUNTS00000	-.0365163	.078994	-0.46	0.644	-.1920414	.1190087
GROSSNPLTOTALADVANCES	.4741755	.1970325	2.41	0.017	.0862537	.8620974
TOTALADVANCESTOTALDEPOSITS	.0152439	.1178401	0.13	0.897	-.2167622	.2472501
_cons	59.41141	8.969801	6.62	0.000	41.75146	77.07135
sigma_u	29.679599					
sigma_e	23.295759					
rho	.61878093	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(33, 269) =    12.66                 Prob > F = 0.0000
```

Run the random effect model regression using Stata software, then run the estimated store random command to store Stata's random effect model. From the random effect table, we can conclude that the loans are significant due to the higher value of T and the lower P-value, which is 0.01<0.05, while the other two variables hive the p>0.05, which are 0.644 and 0.897 respectively, meaning they do not have a significant effect on operational efficiency.

Table 4.9: Random Effect Model

```
. xtreg OPERATIONALEFFICIENCY ACCOUNTS00000 GROSSNPLTOTALADVANCES TOTALADVANCESTOTALDEPOSITS,re

Random-effects GLS regression                   Number of obs      =       306
Group variable: BANK                            Number of groups   =        34

R-sq:  within  = 0.0223                         Obs per group: min =         9
       between = 0.3156                                        avg =       9.0
       overall = 0.1528                                        max =         9

                                                Wald chi2(3)       =     11.87
corr(u_i, X)   = 0 (assumed)                    Prob > chi2        =    0.0078
```

OPERATIONALEFFICIENCY	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
ACCOUNTS00000	-.0599334	.0747444	-0.80	0.423	-.2064297	.0865629
GROSSNPLTOTALADVANCES	.6405523	.1920346	3.34	0.001	.2641715	1.016933
TOTALADVANCESTOTALDEPOSITS	-.0252869	.1078824	-0.23	0.815	-.2367325	.1861588
_cons	60.94286	9.337363	6.53	0.000	42.64197	79.24376
sigma_u	25.465754					
sigma_e	23.295759					
rho	.54441423	(fraction of variance due to u_i)				

```
. estimates store random
```

The random effect model has loans with the highest value of t, which is 3.34 and a P 0.01<0.05, meaning loans are significant while the accounts and bank deposits have a negative t value of –0.8 and-0.23 which are lower than 1.96 while their P values are 0.422and0.815 which are >0.05 hence making them have an insignificant effect on the operational efficiency of commercial banks in Kenya.

After storing all these data, then run the Hausman test with the command Hausman fixed randomly. The thumb of the rule will always apply when choosing between the two models. If the P-value is less than 0.05, then there is endogeneity, therefore ignore the random-effects model and employ the fixed effects model. According to Muia, 2017, The Random effects regression model is explicitly applied where panel specific effects are assumed to be uncorrelated to the predictors and are random. The fixed effect model is best used when panel specific effects correlate with the predictor variable. Additionally, the fixed-effect model brings out the model panel estimation specific effects, but it has the weakness of eliminating the time-invariant variables from the

analysis. The table below shows the Hausman test result for the study as it is done on Stata.

Table 4.10: Hausman Test Result for Model Selection

```
. hausman fixed random

                 ---- Coefficients ----
                |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
                |    fixed        random       Difference          S.E.
----------------+----------------------------------------------------------------
ACCOUN~00000    |  -.0365163    -.0599334        .0234171        .0255602
GROSSNPLTO~S    |   .4741755     .6405523       -.1663768        .0440967
TOTALADVAN~S    |   .0152439    -.0252869        .0405308        .0474096
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       14.63
                Prob>chi2 =      0.0022
```

The chi-square test statistics is 14.63, and the p-value is 0.0022, which is less than 0.05. The decision we can make from the Hausman test is that we can select the fixed effect model because of the P=0.0022<0.05, meaning we reject the random effect model over the fixed effect model.

Breusch and Pagan Lagrangrian multiplier test

We can further test the use of the random effect model and pool OLS by carrying the Breusch and Pagan Lagrangrian multiplier test for random effects. The rule which we can apply to select between the two is If the P-value is more significant than 0.05, apply the pooled OLS model.

Table 4.11: Breusch and Pagan Lagrangian Multiplier Test Result

```
. xttest0

Breusch and Pagan Lagrangian multiplier test for random effects

        OPERATIONALEFFICIENCY[BANK,t] = Xb + u[BANK] + e[BANK,t]

        Estimated results:
                         |        Var     sd = sqrt(Var)
                 ---------+------------------------------
                OPERATI~Y |    1451.874        38.10347
                        e |    542.6924        23.29576
                        u |    648.5046        25.46575

        Test:   Var(u) = 0
                                 chibar2(01) =   316.06
                              Prob > chibar2 =   0.0000
```

The P-value is 0.000<0.005, so we choose the pool OLS model's random effect model because the Lagrangian multiplier (LM) Breusch –Pagan test p-value result is 0.000. We can conclude that this study's best model is the fixed-effect model, which we have selected after following the model selection procedure to get the panel data, appropriate model.

4.5.2 Model Fitting

The study will use the fixed-effect model selected after a comparison was made among the tested three models. Table 4.6 model summary below indicates the fixed regression model on commercial banks' operational efficiency in Kenya. The overall R square adjusted for the model is 14.11%, which explains that the independent variable explains 14.11% of the commercial banks' operational efficiency. The R squared of the model is 2.27%, which means that the variations between the variables explain 2.27% of the variations. In comparison, the adjusted R squared between the model is 28.41%, which can explain 28.41% of the model's variations.

Table 4.12: Regression Model Summary

```
. xtreg OPERATIONALEFFICIENCY ACCOUNTS00000 GROSSNPLTOTALADVANCES TOTALADVANCESTOTALDEPOSITS,fe

Fixed-effects (within) regression               Number of obs      =       306
Group variable: BANK                            Number of groups   =        34

R-sq:  within  = 0.0227                         Obs per group: min =         9
       between = 0.2841                                        avg =       9.0
       overall = 0.1411                                        max =         9

                                                F(3,269)           =      2.08
corr(u_i, Xb)  = 0.3228                         Prob > F           =    0.1029
```

OPERATIONALEFFICIENCY	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ACCOUNTS00000	-.0365163	.078994	-0.46	0.644	-.1920414	.1190087
GROSSNPLTOTALADVANCES	.4741755	.1970325	2.41	0.017	.0862537	.8620974
TOTALADVANCESTOTALDEPOSITS	.0152439	.1178401	0.13	0.897	-.2167622	.2472501
_cons	59.41141	8.969801	6.62	0.000	41.75146	77.07135
sigma_u	29.679599					
sigma_e	23.295759					
rho	.61878093	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(33, 269) =    12.66             Prob > F = 0.0000
```

4.5.3 The Regression Coefficients

The study intended to estimate the regression model coefficients of the multiple regression model. The study model was specified as $\mathbf{Y_i=\beta_0+\beta_1X_{1it}+\beta_2X_{2it}+\beta_3X_{3it}+\varepsilon}$

Where:

$\mathbf{Y_i}$: Operation Efficiency

$\boldsymbol{\beta_0}$: Constant of the model;

$\mathbf{X_1}$: Accounts

$\mathbf{X_2}$: Ratio of Non-performing loans to total loans

$\mathbf{X_3}$: Bank deposits

$\boldsymbol{\beta_i}$: matrix of coefficients;

ε : error term.

Table 4.13: Regression Coefficients

```
. xtreg OPERATIONALEFFICIENCY ACCOUNTS00000 GROSSNPLTOTALADVANCES TOTALADVANCESTOTALDEPOSITS,fe

Fixed-effects (within) regression               Number of obs      =       306
Group variable: BANK                            Number of groups   =        34

R-sq:  within  = 0.0227                         Obs per group: min =         9
       between = 0.2841                                        avg =       9.0
       overall = 0.1411                                        max =         9

                                                F(3,269)           =      2.08
corr(u_i, Xb)  = 0.3228                         Prob > F           =    0.1029
```

OPERATIONALEFFICIENCY	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ACCOUNTS00000	-.0365163	.078994	-0.46	0.644	-.1920414	.1190087
GROSSNPLTOTALADVANCES	.4741755	.1970325	2.41	0.017	.0862537	.8620974
TOTALADVANCESTOTALDEPOSITS	.0152439	.1178401	0.13	0.897	-.2167622	.2472501
_cons	59.41141	8.969801	6.62	0.000	41.75146	77.07135
sigma_u	29.679599					
sigma_e	23.295759					
rho	.61878093	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(33, 269) =    12.66             Prob > F = 0.0000
```

Upon carrying out the data analysis, we can fit the model $\mathbf{Y_i=\beta_0+\beta_1X_{1it}+\beta_2X_{2it}+\beta_3X_{3it}+\varepsilon}$.

$$\mathbf{Y_i=59.41+-0.0365\ X_1+0.474\ X_2+0.0152\ X_3}$$

Where 59.41 is the operational efficiency for commercial banks when all other variables are not present

-0.0365, which will be the decrease in operational efficiency with a unity increase in account numbers.

0.474 is the increase in operational efficiency in response to a unity increase in bank loans.

0.0152 is the increase in operational efficiency concerning a unity increase in the bank deposit.

4.5.4 Hypothesis Test

Table 4.14: Test of Hypothesis

OPERATIONALEFFICIENCY	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ACCOUNTS00000	-.0365163	.078994	-0.46	0.644	-.1920414	.1190087
GROSSNPLTOTALADVANCES	.4741755	.1970325	2.41	0.017	.0862537	.8620974
TOTALADVANCESTOTALDEPOSITS	.0152439	.1178401	0.13	0.897	-.2167622	.2472501
_cons	59.41141	8.969801	6.62	0.000	41.75146	77.07135

The above table 4.8 presents the P-value that will provide the foundation for the research study hypothesis evaluation. The study had three null hypothesis.

The mobile bank accounts and commercial banks operational efficiency in Kenya

The P-value for the mobile bank accounts for this study is 0.644>0.05 hence the null **H_{01}:** There is no significant relationship between mobile banking accounts and commercial banks' operational efficiency in Kenya. We accept the null hypothesis because the P-value of 0.644>0.05 meaning there is no significant relationship between banks accounts and commercial banks operational efficiency.

The mobile loans and commercial banks operational efficiency in Kenya

The P-value for mobile bank loans is 0.017<0.05; hence the null hypothesis **H_{02}:** There is no significant relationship between mobile banking loans and the operational efficiency of commercial banks in Kenya is rejected. This means that the relationship

between mobile bank loans and commercial banks' operational efficiency in Kenya is statistically significant.

The mobile bank deposits and commercial banks operational efficiency in Kenya

The P-value for the mobile bank accounts for this study is 0.897>0.05 hence the null. **H_{03}:** There is no significant relationship between mobile banking deposits and commercial banks' operational efficiency in Kenya. We accept the null hypothesis because the P-value of 0.897> 0.05 meaning there is no significant relationship between banks deposits and commercial banks operational efficiency.

4.5.5 Discussion of Findings

The study found out a negative relationship between the number of mobile banks accounts, which are -0.0365, and the operational efficiency of commercial banks in Kenya. The other variables have a positive relationship, which is indicated by the coefficients of mobile bank loans and bank deposits: 0.474 and 0.0152.

The research study has established a negative relationship between bank accounts and operational efficiency with -0. 03650. It has a P-value of 0.644 > 0.05 hence not significant. The bank accounts enable the customer to get access to their commercial banks. The other factors affect the operational efficiency of commercial banks, which may not be explained by the study model because the model only accounts for an overall adjusted R squared of 14.1 % and a model rho of 61.8%. Rabiu et al., 2019 in their study on the Impact of E-banking on the Operational Efficiency of Banks in Nigeria they conclude that mobile banking was insignificant on the operational efficiency of commercial banks because it had a P-value of 0.0514, which was greater than 0.05.

The study found out that there is a positive relationship between operational efficiency and bank loans. This is due to the introduction of mobile loans introduced by commercial banks to enable the customers to request bank loan, access their loan, and make payments using their mobile phones. The study found out this was the only variable the was significant with the P- value of 0.017, which is less than 0.05; hence, rejected the null hypothesis of the study, which stated that there is no significant relationship between mobile banking loans and operational efficiency of commercial banks in Kenya. The introduction of mobile banks affects commercial banks' operational efficiency. This can be observed in the way the loan request, processing, and approval are made. It takes a few minutes to access your loan due to mobile banking technology, which uses customer data and applies data analytics to approve these loans. The study has found out that bank loans have a significant effect on commercial banks' operational efficiency. The study agrees with Kinyanzui, Achoki, and Kiriri (2018), who carried out a study on mobile credit's effect on commercial banks' operational efficiency in Kenya. They utilized the non-performing loan, which we also used in the study. The study concluded that mobile loans or credit have a significant effect on commercial banks' operational efficiency in Kenya in terms of processing approval and repayment and default management.

The study found a positive relationship between bank deposits and commercial banks' operational efficiency with a coefficiency of 0.015. This indicates that mobile banking has some positive effect on commercial banks' operational efficiency in terms of financial access and financial deepening. Bank deposits enable commercial banks to increase their liquidity position, enabling them to have more liquid capital through the customers' mobile deposits. The implementation of mobile banking enables customers to deposit money, hence reducing time and transport costs. It reduces commercial

banks' operational costs in terms of the human capital resources to attend the customers while making bank deposits. The cost of stationery is reduced since mobile banking enables banking to be done from the customer's comfort zone while using a mobile phone. Commercial banks have also introduced long term and short term loan products to their customers hence attracting customer deposits. Tuyishime and Memba (2015), in their study on the effect of deposit mobilization on commercial banks' financial performance case study of Equity Bank Rwanda. They noted that technology in these case agencies and mobile banking positively impacted commercial banks deposit mobilization from the customer due to the reduction in the operational cost for the bank and the customers. This leads to an increase in the number of customer deposits.

CHAPTER FIVE: SUMMARY, CONCLUSION, AND RECOMMENDATION

5.1 Introduction

This chapter has a summary section with the primary study findings, summary conclusion, and other recommendations for further study

5.2 Major Findings Summary

The research study found out that statistically, the R square was small, which means that the study can expound a small percentage of the study variables; mobile bank accounts, mobile loans and mobile deposits in commercial banks operational efficiency and that these research variables cannot explain a larger percentage of the variations. Further, we can say that a larger proportion can be explained by other factors not covered in this study, which affect commercial banks' operational efficiency in Kenya.

The study carried out multiple regression models. From the selected model, we established that the (OE) operational efficiency for commercial banks in Kenya would be significant when holding all other factors constant. The study also found out that the number of accounts will reduce commercial banks' operational efficiency with a unity increase in account numbers while always holding other factors. There is an increase in operational efficiency in response to a unity increase in the (loans) gross non-performing loans ratio. At the same time, other variables are constant. Finally, bank deposits will increase commercial banks' operational efficiency concerning a unity increase in the bank (deposit) bank deposit ratio while holding other factors constant.

Empirical studies show that mobile loans or credit impact the operational efficiency of commercial banks in Kenya. Mobile credit improves the commercial banks' savings from low-income customers who make several deposits and like mobile loans. The study concluded that the non-performing loans have an impact on commercial banks

operational efficiency first by reducing the revenue generated, increase the cost of loan default management but on the other hand, it has improved the loan repayments, it has increased the number of mobile accounts opened and it has increased the rate at which customers access their financial services leading to improved customer satisfaction hence leading to reduction of operational cost in terms of loan processing and human capital due to the automation of bank processes using mobile banking.

Commercial banks offer mobile banking services like mobile payments, funds transfer, bank loans, and saving products at low cost, with maximum revenue on commissions, which will depend on the transaction number, hence generating more revenue. By introducing new products like CBA M-Shwari product, KCB M-Pesa. This, in turn, improves commercial banks' operational efficiency by minimizing the operational cost while maximizing the revenue generated. This is done by mobile banking, which automates the loan payment, access, request and repayment, bank deposit, account opening, and access to the bank account. This is in line with our study findings, which indicated that the commercial banks' operational efficiency has a positive relationship with some variables. One (loans) variable was significantly affecting the operational efficiency of commercial banks by mobile banking.

5.2.1 Mobile Bank Accounts and Commercial Banks Operational Efficiency

The mobile bank account integrates a mobile line or sim card with the customers' bank account. This is done by a customer opening the bank account access using the USSD code or a bank app or the sim card's embedded menu. Customers have the option of having a mobile phone number registered by the bank as an account without visiting the bank. From our study, we wanted to establish the effect of mobile bank accounts on commercial banks operational efficiency, and we found out that there is a negative

relationship with a p-value which is greater than 0.05 hence accepting the null hypothesis that there is no significant relationship between mobile bank accounts and commercial banks operational efficiency. Although the study has noted from other studies that customers are opening more accounts and the number of account numbers has increased from 2010 to 2018, it helps customers deepen their financial access from commercial banks.

5.2.2 Mobile Loan and Commercial Banks Operational Efficiency

The research study sought to determine the effect of mobile loans on the commercial bank's operational efficiency in Kenya. The analysis result indicated a positive relationship between mobile banking and commercial banks' operational efficiency. The P-value for the study, is less than 0.05. We rejected the null hypothesis, which stated that there is no significant relationship between mobile loans and commercial banks' operational efficiency in Kenya. We accepted the alternative hypothesis, which stated a significant relationship between mobile bank loans and operational efficiency in Kenya. The study established that customers take mobile loans using their mobile phones. This will lead to an increase in the loan amounts issued by commercial banks. This will increase the revenue generated while reducing operational costs like manual loan processing, paperwork, and human resource cost. This has been replaced by mobile banking technology. There is an increase in non-performing loans, which reduces the commercial banks' profits and increases debt management due to some people taking loans and defaulting.

5.2.3 Mobile Bank Deposits and Commercial Banks Operational Efficiency

The research established a positive relationship between mobile deposits and the operational efficiency of commercial banks in Kenya. The study sought to determine whether mobile deposits affect the operational efficiency of commercial banks in Kenya. From the regression model coefficients, we noted that the p-value is more than 0.05 hence accepting the null hypothesis. This concludes that there is no relationship between mobile deposits and commercial banks' operational efficiency in Kenya. Mobile banking deposits, though it is enabling customers to save access to bank accounts, meet their long-term and short-term needs, are not statistically significant to commercial banks' operational efficiency. It is crucial to note that the operational efficiency of commercial banks is measure by other factors which are not included in this study, which account for huger percentage because our adjusted R squared from our model is having a small percentage.

5.3 Conclusions

5.3.1 Mobile Bank Accounts and Operational Efficiency of Commercial Banks

The study can conclude that mobile bank accounts have a negative relationship with commercial banks' operational efficiency. Mobile bank accounts have an insignificant effect on commercial banks' operational efficiency in Kenya for the period under study 2010-2018.

5.3.2 Mobile Bank Loans and Operational Efficiency of Commercial Banks

The study can conclude that bank loans have a positive relationship with commercial banks' operational efficiency in Kenya. This factor was found to have a significant effect on the operational efficiency of commercial banks in Kenya. The mobile loan enables commercial banks to maximize their revenue through interest charges, fees, and

commissions. Even though it is increasing the number of loans and other revenues, it is also increasing the nonperforming loans, which reduces the commercial banks' profits. The financial innovation on mobile banking has improved loan application, access, processing, and approval. It has improved mobile deposit mobilization, which affects the operational efficiency of commercial banks in Kenya.

5.3.3 Mobile Bank Deposits and Operational Efficiency of Commercial Banks

Bank deposit has a positive relationship with the operational efficiency of commercial banks in Kenya. This can be noted from the regression model. The mobile deposits have an insignificant effect on the operational efficiency of commercial banks in Kenya. Although it is helping customers to save and deposit their money while using their mobile banks, our study found out that it is not significant our adjusted R square can attribute this, which is a small percentage while the majority is attributed to other factors not covered by our study variables.

5.4 Limitation of the Study

The study may be limited because some commercial banks' information is classified as confidential and commercial banks and Central Banks of Kenya are unwilling to issue it to people who are carrying out research. This information can give a more detailed analysis that can help the financial institution share information and provide information to enable better financial technology advancement without fear of competition among the commercial banks in Kenya.

5.5 Recommendations

From our study, we can recommend that commercial banks invest more on mobile loans and mobile deposits since the two had a positive relationship with commercial banks' operational efficiency in Kenya. Following the current trends in the adoption of

financial innovation, commercial banks must invest in digital retail banking to improve their operational efficiency. This can be done by channeling more investment resources to a financial channel to optimize the revenue generated while minimizing cost. A good example is a Commercial bank of Africa M-Shwari product, KCB- M-Pesa, Equitel for equity bank, and Fuliza product, a collaboration of Safaricom KCB and Commercial Bank of Africa. Commercial banks can increase their liquidity through mobile saving and generate more revenue on fees commission's charges on other financial services like pay bills, account balance, funds transfer, and mobile loans.

5.6 Suggestions for Further Research

The researcher can recommend the same research to utilize primary data and not secondary data; they can cover the customers and commercial banks' management staff. The study recommends a study to be done on the effect of financial innovations on the operational efficiency of commercial banks in Kenya, not only focusing on mobile banking but other factors like electronic banking, internet banking, ATM and mobile apps banking in Kenya.

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APPENDICES

Appendix I: Data Collection Sheet

Year	Total gross deposit	Total advance deposit	Total gross loans and advances	Gross non-performing loans	Number of customer accounts	Operating expenses	Revenues less interest
2010							
2011							
2012							
2013							
2014							
2015							
2016							
2017							
2018							

Appendix II: List of Commercial Banks in Kenya

Tier I Commercial Banks

1. Standard Chartered Bank
2. Barclays Bank
3. Co-operative Bank of Kenya
4. NCBA
5. Equity Bank
6. Kenya Commercial Bank(KCB)

Tier II Commercial Banks

1. Family Bank
2. I&M Bank
3. Diamond Trust Bank
4. Bank of Africa
5. Housing Finance
6. Ecobank
7. Prime Bank
8. Bank of Baroda
9. CFC Stanbic Bank
10. Citibank
11. Guaranty Trust Bank
12. National Bank
13. Bank of India
14. NIC Bank

Tier III Commercial Banks

1. Fidelity Bank
2. Development Bank
3. Paramount Universal Bank

4. ABC Bank
5. Jamii Bora Bank
6. Consolidated and Development Bank
7. Credit Bank
8. Equatorial Commercial Bank
9. Guardian Bank
10. Victoria Bank
11. Middle East Bank
12. Giro Bank
13. Oriental Commercial Bank
14. Trans-National Bank
15. Habib Bank
16. First Community Bank
17. UBA Bank
18. Gulf Bank
19. Habib A.G Zurich Bank
20. Sidian Bank
21. Consolidated Bank

Source: CBK (2019)

Appendix III: Raw Data

BANK	B	YEAR	OPERATIONAL EFFICIENCY	ACCOUNTS 00000	GROSS NPL TOTAL ADVANCES	TOTAL ADVANCES TOTAL DEPOSITS
1	Kenya Commercial Bank	2010	61.05	13.40964	9.37	75.68
1	Kenya Commercial Bank	2011	52.72	16.53273	5.61	83.71
1	Kenya Commercial Bank	2012	50.52	12.83452	6.23	83.21
1	Kenya Commercial Bank	2013	51.55	17.20807	7.37	84.93
1	Kenya Commercial Bank	2014	46.44	23.24017	5.19	90.16
1	Kenya Commercial Bank	2015	47.34	37.94576	5.95	89.47
1	Kenya Commercial Bank	2016	44.59	45.93721	7.6	95.1
1	Kenya Commercial Bank	2017	46.8	55.85922	8.3	92.43
1	Kenya Commercial Bank	2018	45.09	71.6998	6.91	89.26
2	Co-operative Bank of Kenya	2010	56.83	14.52354	5.44	71.17
2	Co-operative Bank of Kenya	2011	56.7	18.71001	4.56	80.1
2	Co-operative Bank of Kenya	2012	52.97	23.26179	5.07	74.94
2	Co-operative Bank of Kenya	2013	55.91	23.13294	4.36	77.73
2	Co-operative Bank of Kenya	2014	51.45	25.75277	4.4	82.66
2	Co-operative Bank of Kenya	2015	52.74	28.49185	3.85	79.78
2	Co-operative Bank of Kenya	2016	49.81	29.38638	4.67	91.83
2	Co-operative Bank of Kenya	2017	49.82	32.21883	7.23	90.7
2	Co-operative Bank of Kenya	2018	55.4	34.64226	11.24	84.57

3	Equity Bank	2010	52.37	54.05732	5.49	75.94
3	Equity Bank	2011	50.01	65.86499	2.86	86.15
3	Equity Bank	2012	48.84	70.25262	3.2	88.22
3	Equity Bank	2013	46.79	72.92481	5.24	98.48
3	Equity Bank	2014	52.25	83.37018	3.87	95.21
3	Equity Bank	2015	47.09	7.8015	2.98	96.72
3	Equity Bank	2016	44.78	93.16353	6.99	79.72
3	Equity Bank	2017	46.74	101.4183	6.66	74.22
3	Equity Bank	2018	47.23	109.2027	7.39	67.59
4	ABSA Bank Kenya	2010	54.22	8.6214	7.06	74.7
4	ABSA Bank Kenya	2011	52.82	10.20826	5.27	83.65
4	ABSA Bank Kenya	2012	55.04	11.33873	3.51	76.88
4	ABSA Bank Kenya	2013	55.99	12.39618	2.95	77.81
4	ABSA Bank Kenya	2014	57.58	13.73838	4.75	78.3
4	ABSA Bank Kenya	2015	53.03	15.02421	3.49	89.83
4	ABSA Bank Kenya	2016	53.94	16.33376	6.51	97.05
4	ABSA Bank Kenya	2017	55.94	15.31284	7.12	93.62
4	ABSA Bank Kenya	2018	54.65	16.30589	7.44	87.77
5	Standard Chartered Bank	2010	42.34	1.5565	1.97	58.47
5	Standard Chartered Bank	2011	43.66	1.59512	1.06	74.48
5	Standard Chartered Bank	2012	36.36	1.71377	1.92	79.01
5	Standard Chartered Bank	2013	36.02	1.95631	2.92	81.8
5	Standard Chartered Bank	2014	38.61	2.15807	8.35	81.64

5	Standard Chartered Bank	2015	44.72	2.17832	11.96	69.7
5	Standard Chartered Bank	2016	45.21	2.20343	11.35	70.24
5	Standard Chartered Bank	2017	48.35	2.05163	12.64	61.67
5	Standard Chartered Bank	2018	53.73	1.88535	16.27	59.33
6	Commercial Bank of Africa	2010	48.32	0.2729	6.73	59.79
6	Commercial Bank of Africa	2011	55.05	0.34884	6.13	57.96
6	Commercial Bank of Africa	2012	52.24	10.63571	4.56	50.88
6	Commercial Bank of Africa	2013	41.55	56.53488	4.02	55.33
6	Commercial Bank of Africa	2014	37.44	93.5047	4.07	62.14
6	Commercial Bank of Africa	2015	42.4	129.3395	4.39	64.78
6	Commercial Bank of Africa	2016	37	175.0197	7.09	60.72
6	Commercial Bank of Africa	2017	46.51	214.8699	7.29	57.41
6	Commercial Bank of Africa	2018	46.76	262.0521	7.84	63.41
7	Stanbic Bank	2010	65.91	0.65769	2.9	68.41
7	Stanbic Bank	2011	61.45	0.86571	1.6	60.85
7	Stanbic Bank	2012	62.3	0.87606	1.85	68.07
7	Stanbic Bank	2013	57.96	1.0225	2.92	61.08
7	Stanbic Bank	2014	53.04	1.13823	3.75	77.62
7	Stanbic Bank	2015	50.59	1.34301	4.69	73.28
7	Stanbic Bank	2016	50.26	1.38559	5.92	76.55
7	Stanbic Bank	2017	55.17	1.59308	7.65	75.8
7	Stanbic Bank	2018	50.2	1.86421	10.7	73.25
8	Diamond Trust	2010	47.65	0.51329	0.93	76.73

8	Diamond Trust	2011	41.99	0.64174	1.28	84
8	Diamond Trust	2012	35.47	0.9158	1.53	82.8
8	Diamond Trust	2013	37.45	1.70147	1.33	86.31
8	Diamond Trust	2014	37.9	5.82475	1.26	91.8
8	Diamond Trust	2015	35.14	6.55543	2.85	95.45
8	Diamond Trust	2016	30.67	7.93704	3.9	76.29
8	Diamond Trust	2017	35.47	8.44008	7.59	74.95
8	Diamond Trust	2018	37.3	5.51844	7.25	68.98
9	I&M Bank	2010	32.79	0.38747	3.25	77.58
9	I&M Bank	2011	29.09	0.47236	2.11	80.74
9	I&M Bank	2012	34.58	0.58162	1.35	79.56
9	I&M Bank	2013	31.06	0.1587	1.43	96.58
9	I&M Bank	2014	28.36	0.81732	2.1	90.85
9	I&M Bank	2015	32.3	0.98918	4.86	96.96
9	I&M Bank	2016	29.71	1.12551	7.4	92.02
9	I&M Bank	2017	31.38	1.31501	13.91	94.59
9	I&M Bank	2018	32.01	1.50651	14.62	81.49
10	National Bank of Kenya	2010	56.89	3.98442	4.34	44.37
10	National Bank of Kenya	2011	59.76	4.43781	4.13	50.92
10	National Bank of Kenya	2012	75.39	4.74683	7.51	54
10	National Bank of Kenya	2013	75.52	5.22123	10.18	52.48
10	National Bank of Kenya	2014	70.83	5.72033	10.63	62.01
10	National Bank of Kenya	2015	78.5	6.95392	16.15	64.48

10	National Bank of Kenya	2016	76.59	5.20095	44.58	69
10	National Bank of Kenya	2017	83.51	5.97649	40.58	68.04
10	National Bank of Kenya	2018	90.47	6.98051	47.58	62.83
11	Citibank	2010	38.92	0.03639	1.74	49.2
11	Citibank	2011	29.37	0.039	-0.45	54.64
11	Citibank	2012	23.88	0.02007	-0.64	49.75
11	Citibank	2013	20.29	0.01934	1.76	52.04
11	Citibank	2014	42.94	0.04411	3.59	42.66
11	Citibank	2015	32.03	0.02035	6.39	42.71
11	Citibank	2016	33.9	0.02031	2.85	44.47
11	Citibank	2017	32.67	0.01973	4.53	58.17
11	Citibank	2018	36.62	0.01985	3	47.19
12	Bank of Baroda	2010	22.72	0.3241	3.71	51.07
12	Bank of Baroda	2011	23.62	0.34689	3.29	62.85
12	Bank of Baroda	2012	32.12	0.38724	5.34	57.47
12	Bank of Baroda	2013	22.4	0.43915	2.49	54.71
12	Bank of Baroda	2014	23.46	0.4104	3.67	56.08
12	Bank of Baroda	2015	23.73	0.43462	7.33	57.08
12	Bank of Baroda	2016	19.61	0.45856	8.91	56.2
12	Bank of Baroda	2017	17.37	0.47162	6.07	56.56
12	Bank of Baroda	2018	17.32	0.49142	8.99	42.58
13	Family Bank	2010	71.5	7.76945	9.17	68.45
13	Family Bank	2011	77.17	11.50468	10.47	81.27

13	Family Bank	2012	70.49	9.59036	14.04	80.2
13	Family Bank	2013	66.75	13.26402	7.93	83.29
13	Family Bank	2014	62.05	15.37986	6.83	87.94
13	Family Bank	2015	66.38	17.93664	6.06	92.23
13	Family Bank	2016	83.55	20.06843	13.11	126.16
13	Family Bank	2017	106.79	21.12943	20.2	98.53
13	Family Bank	2018	82.4	22.24247	17.31	96.35
14	Housing Finance	2010	48.22	0.50014	7.26	126.85
14	Housing Finance	2011	47	0.51934	6.11	138.39
14	Housing Finance	2012	50.36	0.5407	7.54	134.58
14	Housing Finance	2013	47.74	0.60932	8.93	135.12
14	Housing Finance	2014	47.98	0.68269	9	127.4
14	Housing Finance	2015	47.43	0.74409	7.5	130.41
14	Housing Finance	2016	50.4	1.07681	10.91	146.43
14	Housing Finance	2017	71	0.85605	15.6	142.32
14	Housing Finance	2018	100.73	1.85193	27.09	138.85
15	Prime Bank	2010	49.94	0.14469	3.97	55.57
15	Prime Bank	2011	44.39	0.18649	4.11	61.63
15	Prime Bank	2012	49.1	0.23121	3.56	56.08
15	Prime Bank	2013	40.63	0.26114	2.57	63.72
15	Prime Bank	2014	31.9	0.22968	1.9	74.98
15	Prime Bank	2015	39.16	0.24297	2.38	74.57
15	Prime Bank	2016	43.99	0.29195	4.62	78.68

15	Prime Bank	2017	50.03	0.30395	5.66	67.45
15	Prime Bank	2018	51.05	0.32237	7.39	53.43
16	Ecobank	2010	77.78	0.53342	32.33	62.01
16	Ecobank	2011	95.92	0.34489	18.11	80.91
16	Ecobank	2012	254.31	0.73879	12.1	72.92
16	Ecobank	2013	143.97	1.25213	11	78.67
16	Ecobank	2014	125.61	0.5345	10.2	74.4
16	Ecobank	2015	95.32	0.3938	7.91	89.63
16	Ecobank	2016	230.55	0.59037	19.56	73.41
16	Ecobank	2017	88.35	0.5441	38.62	46.79
16	Ecobank	2018	90.66	1.50576	21.51	31.46
17	Bank of India	2010	23.92	0.12049	2.17	43.9
17	Bank of India	2011	22.88	0.13009	2.31	36.97
17	Bank of India	2012	35.23	0.13555	1.56	49.09
17	Bank of India	2013	22.54	0.1519	1	42.2
17	Bank of India	2014	25.51	0.1622	0.57	44.24
17	Bank of India	2015	25.25	0.16374	2.02	51.72
17	Bank of India	2016	18.95	0.15337	1.41	50.94
17	Bank of India	2017	17.08	0.1578	2.09	46.34
17	Bank of India	2018	19.39	0.1605	7.03	38.88
18	Bank of Africa	2010	66.58	0.18763	1.82	66.04
18	Bank of Africa	2011	70.5	0.26061	1.75	80.2
18	Bank of Africa	2012	71.86	0.36888	2.28	78.64

18	Bank of Africa	2013	65.6	0.44522	4.28	81.97
18	Bank of Africa	2014	81.06	0.55579	6.15	92.74
18	Bank of Africa	2015	80.42	0.82464	23.72	86.47
18	Bank of Africa	2016	53.95	1.08428	28.8	108.64
18	Bank of Africa	2017	76.63	1.19996	31.47	100.76
18	Bank of Africa	2018	67.27	1.06666	36.22	86.99
19	GT Bank Kenya	2010	63.81	0.27975	9.98	59.08
19	GT Bank Kenya	2011	61.15	0.34294	7.82	60.84
19	GT Bank Kenya	2012	68.02	0.41118	5.58	64.9
19	GT Bank Kenya	2013	70.42	0.48654	4.28	56.42
19	GT Bank Kenya	2014	60.74	0.59474	3.67	61.08
19	GT Bank Kenya	2015	69.75	0.68835	4.45	72.74
19	GT Bank Kenya	2016	66.82	0.77985	7.4	72.87
19	GT Bank Kenya	2017	71.99	0.87712	10.34	82.8
19	GT Bank Kenya	2018	74.71	0.97819	18.93	79.6
20	ABC Bank	2010	54.14	0.13935	5.64	66.5
20	ABC Bank	2011	56.7	0.17604	3.85	69.2
20	ABC Bank	2012	57.95	0.18452	4.33	63.15
20	ABC Bank	2013	62.18	0.23686	5.61	68.5
20	ABC Bank	2014	73	0.31296	6.55	80.21
20	ABC Bank	2015	72.8	0.32883	17.23	95.16
20	ABC Bank	2016	78.63	0.35945	18.91	91.47
20	ABC Bank	2017	81.74	0.37172	21.59	81.43

20	ABC Bank	2018	79.86	0.38324	22.73	84.74
21	Victoria Commercial Bank	2010	39.78	0.03153	0	68.82
21	Victoria Commercial Bank	2011	44.23	0.03413	0	67.64
21	Victoria Commercial Bank	2012	40.35	0.03218	0	69.19
21	Victoria Commercial Bank	2013	39.51	0.03293	0	90.81
21	Victoria Commercial Bank	2014	39.6	0.03429	0	84.94
21	Victoria Commercial Bank	2015	44.96	0.0367	0	86.91
21	Victoria Commercial Bank	2016	42.92	0.03875	0	97.43
21	Victoria Commercial Bank	2017	46.17	0.04436	0.09	100
21	Victoria Commercial Bank	2018	45.67	0.04826	3.05	93.72
22	Development Bank of Kenya	2010	47.66	0.01194	13.75	90.29
22	Development Bank of Kenya	2011	59.72	0.0135	18.3	95.45
22	Development Bank of Kenya	2012	70.15	0.01556	15.24	87.71
22	Development Bank of Kenya	2013	43.32	0.01843	13.57	79.26
22	Development Bank of Kenya	2014	42.5	0.01977	14.17	82.52
22	Development Bank of Kenya	2015	60.38	0.01904	20.56	77.71
22	Development Bank of Kenya	2016	63.57	0.01687	25.73	129.58
22	Development Bank of Kenya	2017	76.29	0.01917	21.57	139.72
22	Development Bank of Kenya	2018	66.17	0.01618	28.7	147.02
23	Sidian Bank	2010	86.67	2.53068	20.69	109.56
23	Sidian Bank	2011	66.2	2.70885	12.46	112.2
23	Sidian Bank	2012	64.99	2.10571	13.07	113.59
23	Sidian Bank	2013	63.42	2.30017	8.18	96.97

23	Sidian Bank	2014	59.08	3.42631	6.92	92.95
23	Sidi an Bank	2015	67.95	2.44702	12.07	93.71
23	Sidian Bank	2016	85.1	2.56558	16.97	90.81
23	Sidian Bank	2017	109.92	2.55809	21.05	87.2
23	Sidian Bank	2018	89.66	2.40492	20.85	68.74
24	First Community Bank	2010	130.55	0.30126	7.32	52.2
24	First Community Bank	2011	82.26	0.29863	12.67	54.98
24	First Community Bank	2012	69.51	0.4748	14.19	62.78
24	First Community Bank	2013	77.51	0.75497	7.4	73.8
24	First Community Bank	2014	86.63	1.04199	15.2	74.9
24	First Community Bank	2015	82.88	1.44855	24.08	93.29
24	First Community Bank	2016	83.67	1.23562	32.31	94.23
24	First Community Bank	2017	68.57	2.1447	40	74.37
24	First Community Bank	2018	97.01	1.09363	46.21	68.79
25	Habib A.G. Zurich	2010	51.25	0.07433	4.03	34.35
25	Habib A.G. Zurich	2011	53.61	0.07141	3.58	40.32
25	Habib A.G. Zurich	2012	40.33	0.06594	3.98	31.27
25	Habib A.G. Zurich	2013	39.7	0.06469	3.05	37.4
25	Habib A.G. Zurich	2014	35.64	0.05959	2.43	38.48
25	Habib A.G. Zurich	2015	45.24	0.05592	2.17	52.67
25	Habib A.G. Zurich	2016	43.54	0.05453	2.94	42.64
25	Habib A.G. Zurich	2017	54.09	0.05102	10.43	41.13
25	Habib A.G. Zurich	2018	63.75	0.05041	9.01	39.41

26	Credit Bank	2010	52.24	0.06038	22.65	63.05
26	Credit Bank	2011	95.86	0.09358	13.89	74.5
26	Credit Bank	2012	103.78	0.0864	11.58	65.59
26	Credit Bank	2013	81.9	0.10064	7.61	76.37
26	Credit Bank	2014	96.07	0.12848	9.96	78.06
26	Credit Bank	2015	94.58	0.16817	6.97	84.32
26	Credit Bank	2016	75.03	0.24318	8.08	88.46
26	Credit Bank	2017	76.7	0.30116	8.62	88.56
26	Credit Bank	2018	73.43	0.33753	8.28	93.39
27	Guardian Bank	2010	60.77	0.06821	23.19	79.23
27	Guardian Bank	2011	52.34	0.07538	8.62	86.81
27	Guardian Bank	2012	60.71	0.08026	8.26	74.25
27	Guardian Bank	2013	55.04	0.08948	7.92	82.47
27	Guardian Bank	2014	51.81	0.09557	7.64	81.43
27	Guardian Bank	2015	58.21	0.10462	10.37	79.44
27	Guardian Bank	2016	54.05	0.11855	8.19	78
27	Guardian Bank	2017	70.22	0.1055	10.89	78.53
27	Guardian Bank	2018	60.91	0.09763	9.88	72.85
28	UBA Kenya Bank	2010	143.63	0.01634	0	13.57
28	UBA Kenya Bank	2011	176.02	0.02326	7.17	22.8
28	UBA Kenya Bank	2012	348.16	0.02663	10.9	30.22
28	UBA Kenya Bank	2013	203.13	0.03445	1.94	31.32
28	UBA Kenya Bank	2014	218.01	0.05365	6.65	21.95

28	UBA Kenya Bank	2015	181.36	0.00134	2.07	46.9
28	UBA Kenya Bank	2016	90.07	0.01536	2.19	94.03
28	UBA Kenya Bank	2017	93.2	0.05373	4.58	78.9
28	UBA Kenya Bank	2018	77.3	0.0589	12.76	26.73
29	Paramount Bank	2010	33.24	0.0652	29.23	60.6
29	Paramount Bank	2011	59.45	0.05213	27.46	70.79
29	Paramount Bank	2012	69.27	0.09707	23.82	55.48
29	Paramount Bank	2013	66.83	0.10627	23.4	60.05
29	Paramount Bank	2014	66.11	0.06965	19.72	59.98
29	Paramount Bank	2015	64.6	0.0856	12.56	74.1
29	Paramount Bank	2016	65.53	0.09671	12.47	80.88
29	Paramount Bank	2017	69.38	0.08077	14.64	82.05
29	Paramount Bank	2018	72.03	0.07553	17.32	75.95
30	Spire Bank	2010	93.64	0.07321	23.18	58.13
30	Spire Bank	2011	90.67	0.0819	8.42	61.22
30	Spire Bank	2012	194.78	0.10097	10.02	61.99
30	Spire Bank	2013	79.42	0.18778	14.15	69.92
30	Spire Bank	2014	69.89	0.1228	27.85	73.21
30	Spire Bank	2015	137.25	0.20705	36.15	87.32
30	Spire Bank	2016	135.74	0.23208	15.05	102.81
30	Spire Bank	2017	248.28	0.23574	34.8	98.94
30	Spire Bank	2018	177.12	0.23327	43.97	86.16
31	Consolidated Bank	2010	69.95	0.44534	15.08	80.35

31	Consolidated Bank	2011	77.92	0.36137	10.87	73.79
31	Consolidated Bank	2012	77.45	0.4519	12.41	79.14
31	Consolidated Bank	2013	137.63	0.4525	14.03	91.23
31	Consolidated Bank	2014	85.53	0.48456	26.1	96.34
31	Consolidated Bank	2015	68.39	0.49098	19.27	98.87
31	Consolidated Bank	2016	97.77	0.48147	19.75	107.66
31	Consolidated Bank	2017	103.4	0.51841	25.11	111.6
31	Consolidated Bank	2018	98.72	0.47067	25.32	113.62
32	Trans-National Bank	2010	66.18	0.22773	23.79	73.97
32	Trans-National Bank	2011	57.47	0.29469	10.37	69.39
32	Trans-National Bank	2012	61.46	0.36514	11.02	69.26
32	Trans-National Bank	2013	65.74	0.39441	14.38	62.23
32	Trans-National Bank	2014	70.67	0.46199	8.01	82.37
32	Trans-National Bank	2015	69.81	0.55655	9.98	94.26
32	Trans-National Bank	2016	76.25	0.67947	12.68	86.72
32	Trans-National Bank	2017	86.17	0.85201	21.66	92.64
32	Trans-National Bank	2018	104.08	0.96933	24.2	94.59
33	M Oriental Bank Limited	2010	42.08	0.05406	11.94	80.98
33	M Oriental Bank Limited	2011	43.9	0.05796	12.68	87.21
33	M Oriental Bank Limited	2012	62.19	0.05925	12.81	82.15
33	M Oriental Bank Limited	2013	76.64	0.05831	10.26	82.7
33	M Oriental Bank Limited	2014	67.1	0.05248	10.87	81.49
33	M Oriental Bank Limited	2015	74.33	0.04842	14.89	89.77

33	M Oriental Bank Limited	2016	60.32	0.043	12.04	102.48
33	M Oriental Bank Limited	2017	63.75	0.04284	10.44	103.72
33	M Oriental Bank Limited	2018	63.91	0.04306	9.64	108.28
34	Middle East Bank	2010	52.53	0.01832	1.77	81.34
34	Middle East Bank	2011	69.7	0.01858	2.46	75.05
34	Middle East Bank	2012	79.32	0.01903	2.31	68.52
34	Middle East Bank	2013	63.19	0.02001	17.73	85.63
34	Middle East Bank	2014	71.43	0.018	30	80.29
34	Middle East Bank	2015	77.01	0.01803	27.27	95.46
34	Middle East Bank	2016	110.92	0.01876	29.72	100.47
34	Middle East Bank	2017	104.98	0.0183	44.35	82.97
34	Middle East Bank	2018	101.21	0.01971	40.05	73.88