THE IMPACT OF FINANCIAL TECHNOLOGY ON THE OPERATIONAL EFFICIENCY OF LICENSED COMMERCIAL BANKS IN KENYA

BY

AMAL ABDULKADIR KALIF

A RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE IN FINANCE, SCHOOL OF BUSINESS, UNIVERSITY OF NAIROBI

2020

DECLARATION

This research project is my original work and it has not been presented and submitted to any in university or college for examination.

Signed…… **Date……..**

Amal Abdulkadir Kalif

D63/12256/2018

This research project has been submitted for examination with the authority and approval as the university supervisor.

Signed…… **Date……**

Mr. Odipo Martin Khoya

Lecturer, Department of Finance and Accounting

School of Business, University of Nairobi

DEDICATION

This work is especially dedicated to my beloved Mother Muhubo Mohamed Dirac and my lovely siblings, Maryan , Shukri , Sadia , Ayan , and ,Mohamed .. Mom I know I don't say it enough, because the love we share is more than just words. You are the power in me that made this project possible

ACKNOWLEDGEMENT

I would like to express my gratitude and regard to my project supervisor Mr. Martin Odipo for his guidance , valuable feedback and ideas through the duration of the project.

My sincere gratitude also goes to my aunties Foos Dira , Fahmo Dira and my uncle Mahad Dirac for their encouragement and support in special ways that have made it possible to see this studies come to a logical conclusion

My appreciation finally goes to my colleagues Abdishakur Ahmed , Salim Elmi and Sahro Abdikarim who provided me with logistic and moral support that gave me every reason to work harder and ensure that this study become a success

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACCRONYMS

AI	Artificial Intelligence
CBK	Central Bank of Kenya
FinTech	Financial Technology
KES	Kenya Shillings
NPLS	Non-Performing Loans
NYSE	New York Stock Exchange
P2P	Peer to Peer
ROA	Return on Assets

ABSTRACT

FinTech businesses exhibit high welfare-enhancing capabilities to individuals and the business establishments but disruptive to the banking sector whereby regulation should appropriately adapt so the outcomes of the new technology are achieved without destabilizing the financial market. The outcomes of the new techniques results in lower costs of financial intermediation and product improvements for the consumers. Thus, FinTech involves the development of new products and services or production process that results to effective and efficient operations. The objective of this research was to assess the effect of financial technology on the operational performance of licensed commercial banks in Kenya. In addition, the study specific objectives were to determine the effect of internet banking, mobile banking, mobile loans, and agency banking, on operational performance of licensed Kenyan commercial banks. It also aimed at reviewing the increasing body of theoretical and empirical studies that have endeavoured to examine the range of magnitude and relations between financial technology and operational performance. The target population was all the 42 licensed commercial banks. Secondary sources of data were employed. Panel data was utilized, data was collected for several units of analysis over a varying time periods. The research employed inferential statistics, which included correlation analysis and multiple linear regression analysis so as to establish the effect of financial technology on operational performance. The study findings were that financial technology had a significant effect on operational performance and thus, it can be utilized to significantly predict operational performance. Further findings were that that the FinTech components that include; internet banking, mobile banking, mobile loans, and agency banking have no significant association with operational performance. Final findings were that the only FinTech component that significantly impacted on operational performance of was internet banking which had a significant negative relationship with the operational performance. The rest of the FinTach components did not individually significantly impact on operational performance. Policy recommendations are made to the National Treasury and CBK to direct commercial banks, and by extension other financial institutions, to employ financial technology so as to enhance cost efficiency and consequently financial performance of the financial institutions. Further recommendations were made to the commercial bank practitioners, and by extension, other financial institutions practitioners and consultants to implement and improve on financial technology enhance in order to augment the financial institutions' operational performance. Additional recommendations to the commercial bank practitioners, and by extension other financial institutions practitioners and consultants, were to concentrate mainly on internet banking in order to augment the financial institutions' operational performance. However, the finding that internet banking had a significant negative relationship with the operational performance needs further investigation because most of the empirical literature sight a positive relationship between the two variables.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

The impact of Financial Technology (FinTech) is starting to be felt in capital markets and the banking industry as a whole. FinTech dealings exhibit high welfare- increasing competences to persons together with business establishments but unsettling to the industry of banking whereby guideline should appropriately acclimatize so the outcomes of the present novel technology are achieved without destabilizing the fiscal market (Klingebiel, 2000). According to the Bank for International Settlement (2018), while FinTech may be understood as the automation of financial services with use of innovative information, the emergence of new business models as a result of utilization of big data has given fintech the capacity to disrupt the traditional financial intermediaries such as banks. Big data could be linked with Artificial Intelligence (AI) algorithms, deriving value from advanced computing power, for instance, cloud computing, mobile hardware, and mobile storage via the cloud which facilitates continuous accessibility. The outcomes of the new techniques results in lower costs of financial intermediation and product improvements for the consumers (KPMG, 2017). Thus, FinTech involves the development of new products and services or production process that results to effective and efficient operations (Nofie, 2011).

The main theory anchoring this study is the theory of financial intermediation advocated by Merton (1995). The theory stipulates that it is crucial for the survival of financial intermediaries that rely heavily on the existence of magnified transaction costs, asymmetric information, high monitoring costs and regulation of the financial sector. The other key theory applied in this study is the technology acceptance theory propagated by Rogers (1995). The theory states the diffusion of innovations as “the process by which an innovation is communicated through

certain channels over time among the members of social systems. It is a special type of communication, in that the messages are concerned with new ideas".

According to Mutua (2013), rapid change in technology in the payments sector, has increased financial inclusion thus changing the trend of undertakings of the traditional banking systems. The untapped financial market by the Kenyan banks is still large which occasions the fintech companies to venture into. Globalization, increasing customer needs and the increasing number of industries in the sector has led to higher levels of competition and market share and for Kenyan banks to enhance financial performance and remain competitive; forming collaborations with fintech companies is mandatory. This study sought to analyze the growth and development of FinTech and its effect on structure of the banking sector and strategies of incumbents and future entrants in terms of addressing operational costs.

1.1.1 Financial Technology

Financial Technology comes from two words; finance together with technology. It is elaborated as novel technologies that back fiscal amenities. In the forthcoming years, banks are predicted to offer social network podiums with which customers can allow their mobile gadgets to made benefit of investment prospects courtesy of fiscal technology (Drew, Andrew & Neil, 2017). Financial technologies are also defined as any technological innovation that is impacting the financial sector and its operations. They could also be referred to as a combination of financial services and modern technologies offering internet based and application oriented services which are user friendly, computerised, clear together with effective (European Banking Federation, 2015).

Financial Technologies proposition various technological answers geared towards accomplishing suitability, quicker turnaround times together with operation efficacy. However, numerous academicians have pointed out saying that payments space is the most advance segment among the financial technology (Douglas & Janos, 2015). Financial Technologies have been able to impact on various shareholders in the monetary industry. It has propelled to improvement of property managing services via presenting wealth management facilities to retail clients via basic systems, proposals of algorithms to back the policymaking procedure together with artificial intelligence management of collections via robots. It has in addition impacted the banking sector through monitoring savings, credit scores, spending, tax liability, provision of banking services beyond traditional banking, quicker transactions via distribution ledger technology, mobile transferences, use of crypto currencies and also mobile lending to individuals , and Small and Medium, Enterprises (SMEs) using data analytics (KPMG, 2017).

The current study will analyze FinTech aspects that will include; mobile banking, internet banking, agency banking and mobile lending. Internet banking will be measured by the total transactions carried out in the platform over a specified period. The total number of mobile banking clients registered in a specified period will measure mobile banking. Total number of agencies operating in a given period will measure agency banking. Mobile lending will be measured by total amount lent out using the platform in a given period.

1.1.2 Operational Efficiency

Efficiency in banking has been described and analysed in various perspectives such as; scale efficiency which is the association between the output level and the average cost, operational efficiency which computes the deviation from the cost efficient parameter which represent the maximum output attainable for a given inputs level and scope efficiency which is the association between average production costs of diversified output frontiers. In accordance to

the different definitions, inefficiency is thus a multi-dimensional concept that is defined based on the purpose in which it is being used (Leibenstein, 1966). Thus, operational efficiency represents the management's ability to control costs and utilize the available resources for production of output (Kumbhakar & Sarkar, 2003).

Operational efficiency refers to efficient use of people, material funds, machines, tools and equipment or simply the efficient utilization of human and material resources. Proper utilization of any resource combination increases the output of goods and services and cuts on costs (Das & Ghosh, 2006). Operational efficiency is re-engineering the organization to strike a viable balance between costs and productivity. It pinpoints the untenable processes which contribute to the drainage of the organizations' resources and profits. It also strikes to minimize waste and maximize the resource benefits to increase customer satisfaction (Hauner & Peiris, 2005). Increased competition is good for business as it forces the organization to explore cost costs reduction initiatives such as eliminating internal wastages. Any input that makes no contribution to the production of the final output is considered waste. Operational efficiency refers to producing more goods and services while maintaining the same level of input and maintaining the same output levels using fewer resources (Cihak & Podpiera, 2005).

Operational efficiency is concerned with output to input ratio, thus it is measured on both the input and output frontiers. Most operational efficiency measures however primarily focus on the input side, for instance, the unit production cost or the man-hours needed for production of one unit. Even though vital, input indicators for instance unit production cost should not be treated as the only indicators of operational efficiency (Hirshleifer & Glazer, 1993). The firm should describe, measure, and monitor several performance from both input and output side for successful measurement of operational efficiency (Mahdi & Mehrdad, 2010). Thus, the

indicator for operational efficiency to be adopted for this study will be the ratio of total operating expenses to revenue. The revenue to be considered in this case will be the total interest income, since it is the income derived from the main activity of banks (Kumbhakar & Sarkar, 2003).

1.1.3 Financial Technology and Operational Efficiency

The role of FinTech companies in enhancing operational efficiency through the use financial digital platforms cannot be underestimated. Fintech companies are using new technologies to compete in the market with the traditional financial institutions and act as intermediations in financial service delivery (Venkatesh & Davis, 2000). The Kenyan market contains all the necessary circumstances necessary for the growth of Fintech companies and development of financial systems (Klingebiel, 2000). Fintech companies have cost effective operations and thus a competitive edge since they have fewer regulations compared to the traditional banks and are more cost effective which stretches to enhancing the financial performances of the banking sector (Venkatesh & Davis, 2000).

Schumpeter (1939) argues that whatsoever change that has financial impact circles round novelty, entrepreneurial doings together with power of marketplaces. The concepts and model surrounding FinTech revolution emanate from this argument. Schumpeter (1939) further points out that innovation generate monopoly provisionally after which copycats together with competitors enter the market and as a result do away with the monopoly. Hence, if commercial banks and banks in general are to take advantage of fiscal technology and warrant they make a hedge over existing banks by use of innovative products together with services hence being competitive and consequently impacting on their cost efficiency and consequently impacting on financial performance.

The fast pace at which the sector is growing together with the quantity of infringement and interference released upon the industry by financial technologies. There is a visible acknowledgement by the financial sector players that only those who comprehend what the yet to come looks like and are prepared for it are going to play a winning hand and rise to the top (Venkatesh & Davis, 2000). Some of the key concerns are that banks will be required to implement full digital services together with classic banking doings like deposits and withdrawals, transfers together with expenses, loans (borrowing and repayment type of loans), account together with funds administration, opening bank accounts, and client on boarding are now all conceivable in client self-service mode through electronic means. As a result of the trust of clients in their digital gadgets, this is becoming the ideal mode of using bank services for many clients.

According to Mutua (2013), rapid change in technology in the payments sector, has increased financial inclusion thus changing the trend of undertakings of the traditional banking systems. Globalization, increasing customer needs and the increasing number of industries in the sector has led to higher levels of competition and market share and for Kenyan banks to enhance financial performance and remain competitive; forming collaborations with fintech companies is mandatory.

Technological advancements have eliminated redundant and time-consuming tasks as well as human error associated with particular tasks and extended banking facilities to the unbanked. The use of technology has also increased access to information by customers as most of the information is availed in the platforms making it cheaper and easier to access. Mobile banking enables the customers to undertake non-cash transactions without physically visiting the bank

premises, as it was previously the case. Additionally, the customers enjoy the privilege of transacting at their convenient time from whichever place (Mishkin & Strahan, 2009). Technology accords customers with greater control of their bank accounts (Dabholkar 2009). According to Smith (1987), the initial intention for introduction of technology in banks was to reduce costs by creating an interface between front and back office operations but this has since been developed to serve other different banking functions. However, the current challenge that banks are crumbling with is how maintain satisfactory physical interactions with their clients.

1.1.4 Commercial Banks in Kenya

The Companies Act regulates the Kenyan banking industry, Banking Act together with the Central Bank of Kenya (CBK) The CBK is responsible for making and execution of fiscal policies and developing liquidity, creditworthiness and correct working of the monetary system. Banks are financial establishments that are licensed by the CBK to take deposits and give credit facilities to customers (Githaiga, 2015). There are 41 commercial banks and one mortgage monetary organization in Kenya as at 29th February, 2018. Twenty-nine of them are natively possessed, while thirteen are overseas owned.

In Kenya, there are various fintech companies offering various services which have penetrated the market offering various services. Communications Authority of Kenya (2018) reported that the following companies registered with them carried out mobile money services, Airtel Networks Ltd, Safaricom Plc, Finserve Africa Ltd, Telkom Kenya Ltd, Mobile Pay Ltd and Sema Mobile Services. Other companies carrying out payment services though not registered with regulators include Cellulant, Jambopay, Pesapal, and others. Companies such as Branch, Tala, Micromobile among others offer mobile lending services to individuals while Musoni,

Saidia and Umati Capital loan to business. There are those that offer Peer to Peer (P2P) lending services like Odyssey Capital, and PesaZetu.

The banking sector in Kenya has embraced financial technologies greatly. This is evident via the usage of platforms of mobile banking. According to the KCB (2017) statement report, KCB lent over KES 30bn on their mobile interaction processes with an unprecedented repayment tariff of more than 95%. There exist plans to continue financing the fiscal technologies to remain ahead of the pack. Equity bank in 2017 through their mobile money platform they were able to lend KES 38.5 billion. This represented 86 percent of the total loans borrowed by the banks. Equitel, the mobile arm of Equity, roll out was a huge success leading to complete digitalization of services offered by the bank for single clients and company clients (Equity, 2018). Banks in Kenya have gone ahead and invested in financial technologies. For instance Housing Finance Group in Kenya launching its new mobile application called Whizzapp, Kenya Commercial Bank partnering with Huawei to aim at ensuring at least eight percent (80%) of new transactions on their mobile platform in the near future, and Equity bank launching a new financial technologies arm of the company, Finserve Africa, which will play a key role in digitalizing the banks' financial services. It is without any doubt that financial technologies will shape the future of banking, not only in Kenya but also globally (CBK, 2018).

1.2 Research Problem

The traditional commercial banking is declining with regards to competitiveness which may threaten the banks' financial stability. True disruption to commercial banks has been triggered by the abrupt and large-scale entry of top digital internet firms commonly referred to as FinTech (Demertzis, Merler & Wolff, 2017). Ideally, companies including Branch, Apple, Google, and Amazon are already considered as fintech companies, but have not fully penetrated

into the market. They have a higher potential since they are exposed to large amounts of customer data and can easily interface with them on financial services' matters (Berger, 2003). Fintech lending has been growing steadily and are currently being used by the social media platforms to cross-sell their financial services give more understanding about their customers. Banks have to adopt FinTech in order to survive this cutthroat competition.

Kenya is said to be as per Deloitte (2017), a financial technologies hub amidst the several markets, via M-Pesa. The mobile platform services entail loan platforms, merchant payment services together with a platform where customers can transact by use of mobile money accounts (CBK & FSD Kenya, 2016). Financial Technology firms have in addition invented services around M-Pesa as per Adongo (2015). According to the Kenya Fintech Report (2017), innovative resolutions in fiscal services have encouraged the banks to unceasingly emphasize on policies that capitalize on financial technologies concepts to be able to attain the client's ever-increasing expectations in their respective marketplaces. This is as a result of the rises in innovative solution that have led to implementation of these fiscal technologies by financial services therefore growing their presence in the unbanked populace.

Various studies have been conducted regarding effect of fintech on banking. Globally, Navaretti et al. (2017) conducted a study which opined that China is one leading economies in the adoption of fintech. Through telecommunication companies, people are able to make deposits, which would earn them higher interest as compared to banks as banks have interest rate ceilings. Banks in China have no extensive branch networks, thus fintechs were able to permeate. Vives (2017) study stipulated that in the US, loans provided by fintech companies accounts for a third of total loans provided. Buchak et al. (2017) says that the heavy regulations on banks raising capital requirements and legal scrutiny have caused the growth on fintechs and other shadow banks. This presents a conceptual gap as the studies did not analyze the effect

of the various aspects of FinTech on commercial bank' operational performance. The studies also present a contextual gap as they were not conducted in Kenya.

Locally, Ngigi (2012) concluded that financial innovation in banks was a significant contributor to its profitability. According to Kinuthia (2008), banks are continuously innovating new products but the rate of innovation is determined by the size of the organization, ownership, and duration of operation of the bank. According to CBK (2011), financial innovation has been shown to boost economic growth and enhance fiscal presentation of banks that are commercial in nature. This presents a conceptual gap as the studies focused only on financial innovation and they did not analyze the effect of the various aspects of FinTech on commercial bank' operational performance.

Thus, there exist no research that has been carried out in Kenya to ascertain whether the increasing fintech sector is having an impact on the operational efficacy of the banking sector in Kenya utilizing the FinTech aspects of internet banking, agency banking, mobile banking, and mobile lending. This study therefore addresses this gap. Thus, the objective of the research was to investigate: what is the effect of financial technology on the operational performance of commercial banks in Kenya?

1.3 Research Objectives

1.3.1 General Objective

The broad objective of this research was to assess the effect of financial technology on the operational performance of licensed commercial banks in Kenya.

1.3.2 Specific Objectives

The study specific objectives were;

i. To determine the effect of internet banking on operational performance of licensed Kenyan commercial banks.
ii. To determine the effect of mobile banking on operational performance of licensed Kenyan commercial banks.
iii. To establish the effect of agency banking on operational performance of licensed Kenyan commercial banks.
iv. To determine the impact of mobile lending on operational performance of licensed Kenyan commercial banks.

1.4 Value of the Study

The research's findings will make additions to the existing body of knowledge on operational efficiency as confronted by the impact of the introduction of aspects of fintech as the study variables. The research output will be a source of invaluable literature among the research variables on theories together with strategies that notify them. Theories such as the financial intermediation theory, theory of innovation diffusion, institutional theory and technology acceptance theory will receive additional input on the importance of financial intermediation and for organizations to be innovative and adapt to technology in order to be efficient and retain competitiveness. The study methodology employing inferential statistics that involve multiple linear regression and correlation analysis will be useful to scholars who could be keen on examining complex relationships between the dependent and many independent research variables.

The regulator of commercial banks, the CBK, the government, and policy makers will get useful data on influence of FinTech on banking indusrty operational efficiency. The study will be helpful to the regime in policymaking concerning unruly technologies. Policy makers will as well get to know the trials and loopholes in their present regulatory framework and how it is affecting the operations of the banking sector.

The study is important to banking sector shareholders, consultants, and commercial banks administration as it will contribute to managerial practice on services offered by commercial banks, banks' specific factors and aligning banks to these aspects and managerial practices. Essentially all managerial practice should get to above average and lead to establishment of a proper link between services offered by the fintech firms and bank specific factors to ensure that banks do not lose market share to the former. It would be of importance to banking sector in Kenya and shareholders in comprehending the influence of FinTech, thus improving application procedures to enhance performance of the banks together with service delivery. This in turn upholds client loyalty, attract more customers, improve satisfaction together with increasing revenue. The management would have the capacity to make informed decisions regarding adoption of disruptive technologies

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The focus of this section was to create insights on the theories of financial technology, to help in the comprehension of its concepts, structures, and the empirical literature on how it affects the operational efficiency of commercial banks. The significance of the chapter was to establish the potential knowledge gaps in the studies undertaken previously by scholars on the effect of financial technology on the operational efficiency of banks. A conceptual framework depicting the conceptual relationship between the variables and a summary of cited literature also featured in this chapter.

2.2 Theoretical Foundation

The literature review explores the work conducted by other scholars concerning the impact of financial technology on operational efficiency. The section encompasses the detailed knowledge of related concepts and provides a platform on which the findings will be built upon and also overcome the limitations of the study. Theories are essential in the various sections as they establish the phenomena and principles that relate to the topic. The theoretical framework depicts the interrelationship between different ideologies and provides the guidelines for the project or business endeavour (Lyon, 1977). The study focussed on the technology acceptance theory together with the financial intermediation theory.

2.2.1 Theory of Financial Intermediation

Merton (1995) advocated the Financial Intermediation theory. This theory refers to the transfer of funds from financial systems with surplus amounts to those with insufficiency amounts. The financial intermediation theory advocates for the presence of financial intermediaries who leverage on the existence of exaggerated transaction costs, asymmetric information, magnified

monitoring costs and existence of regulations in the financial sector. The theory draws relevance from the concept of resource allocation and is grounded on the assumption that there exist perfect and complete markets. It further proposes that there exists turbulences in the market such as transaction costs and information asymmetry that are crucial in articulating and upholding financial intermediation. Information asymmetry results to market imperfections, which are attributed to specific forms of monitoring, and transaction costs. Financial institutions mitigate adverse selection through screening. By setting up debtor monitoring structures, they enable the reduction of moral hazards in the financial markets. The theory also states that imperfections in the financial market are often attributed to asymmetric information between the economic units with surplus and those with deficits (Merton, 1995).

The theory's second dimension is the costs associated with a particular transaction. The exploitation of economies of scale enable financial institutions to cut on transaction costs. The third dimension focuses on the regulations put in place to control savings and investments. Regulation could for instance compel financial institutions to uphold liquidity not falling below certain levels and prescribe specific deposit to capital ratios (Andries & Cuza, 2009). The aforementioned theory is important in explaining the relationship between restructuring and characteristics of the financial sector. The theory's asymmetric information attribute alludes that the existence of financial institutions make it easier for financial market participants to access the required information as there is adequate regulation on the provision of the information. This translates to lower transaction costs since the funds would have been diverted to dealing with moral hazard and adverse selection thus reducing the danger of NPLs. Controlled transaction costs would translate to increased managerial competency, increase in size and technology enhancement and hence offering of more financial services at a lower cost (Merton, 1995). The theory has however been criticized on ground that most financial

institutions have accorded various securities imperative for the theory to hold. Nonetheless, this criticism is negated by the existence general equilibrium theory of price determination and the Black and Scholes pricing model. The dynamic trading of financial assets in financial markets that have technologically advanced enables the markets to compete effectively even where there exists limited financial securities and financial institutions.

Financial intermediation services are offered by commercial banks. The banks should leverage on technology and innovation to offer the financial services at reasonable costs, more efficiently and conveniently, hence attaining operational efficiency. Some aspects like mobile loans also face fewer regulations as opposed to the conventional product offerings, thus institutions that offer these digital services enabled by financial technology have a more competitive advantage than the institutions that do not. This survey thus seeks to explore its impact on Kenya's banking sector.

2.2.2 Technology Acceptance Theory

Davis, Warshaw, and Bagozzi (1989) first proposed the Technology Acceptance theory (TAT) and examined the conceptual model of the user's intention or the extent to which the information system. TAT is modelled based on perceived ease and usefulness of the new technology. Perceived usefulness of technology refers to a person's belief to improve the level of job performances through the use of information systems or the emerging technologies. The apparent easiness of new technology refers to how easily an individual learns how to use new…information system and technology (Baker et al., 2015). TAT model has put more stress on the manner new technology is viewed with ease of use directly impacts the technology's perceived usefulness. An external variable for instance environmental factors bordering a person intervene in impacting perceived usefulness and ease of use. Therefore, TAT is founded

on the two important perceptive aspects, which are perceived, ease of use and perceived usefulness. TAT is utilized highly in studies involving Information Technology (IT), Liu and Arnett (2000) delved into the crucial variables to advance a lucrative website based on TAT model.

Luarn and Lin (2003) in their study incorporated TAT and rust to advance a new integrated model, which explains consumer behavior via virtual technology interaction. Pavlou (2003) formulated an e-commerce acceptance framework for online users by insulating together with utilizing investigational survey. Later, Horst, Kuttschreuter, and Gutteling (2007) carried out follow-up researches. The scholars investigated whether or not the Netherlands' government should introduce an electronic platform for its citizens to access government services as it is done in other states do. The research considered TAT factors such as perceived risk, experiences and faith of the citizens. The study's findings portrayed the concept of e-government based on the trust of the people on government establishments and that people largely interact with IT. The study concluded that TAT does not only explain how new technology adopters accept and adopt the new technology but warrants that TAT is effective for the expounding the behavior of the technology of the online user (Pavlou, 2003; Horst, Kuttschreuter & Gutteling, 2007).

TAT is an important theory that informs the present study on impact of FinTech on operational efficiency of Kenyan commercial banks. Just like the acceptance together with growth of the fintech product offerings, it is not just adequate for commercial banks to advance new innovative banking technologies but the technologies should be embraced together with adopted by the commercial banks' customers. TAT is modelled based on the new technologies' perceived usefulness together with ease of use. The technologys perceived usefulness implies

to a person's faith to improve the level of job presentation through a precise information system or new technology. A new technology's perceived ease of use implies to the ease with which a person learns to use or operate new information system or technology (Baker-Eveleth & Stone, 2015).

2.3 Financial Technology Aspects

This section elaborated on the various measures of loan quality. These are: internet banking, agency banking, mobile banking, and mobile lending.

2.3.1 Internet Banking

Internet banking is the service that enables clients to conduct banking transactions via a computer in presence of internet connectivity (Pikkarainen, Pikkarainen, Karjaluoto & Pahnila, 2004). Internet banking also refers to an online internet portal where customers can execute banking transactions such as investment making or payment of bills. This affirms why internet banking has grown to become a crucial global phenomenon and a key and robust tool, which develops, supports, and promotes innovation and heightens competitiveness (Hasan Kunz, Pearson & Mohamed, 2010). Most scholars acknowledge that internet banking is defined to consolidate the establishment of small value together with retail banking services and products via electronic platforms as well as electronic payments for wholesale and other high value commodities (Georgescu, 2005).

The use of internet banking is connected with various benefits which include; reduced costs of transacting business, improved market appearance, extensive market penetration, prompt reaction to market changes and promotion and sale of present products. Some of the benefits

accruing to bank customers include; reduced costs of opening and use of bank services, time saving and free access to accounts at any time, swift completion of transactions, and improved management of funds. Mozie, Mustapha & Ghazali, 2012) stated that although the benefits of internet-banking are evident, banks have for a longer period been delivering electronic services to clients. Banks are considered as early technology adopters and major players in evolution of technological. Electronic fund transfer services such as small payments as well as corporate cash managements systems not forgetting the existence of ATMs for cash withdrawals and are among the global fixtures. Internet banking adoption is informed by different factors. These mainly include the enhancement of client service together with competitive costs, which compel commercial banks to adopt electronic commerce strategies as per Kondabagil (2007).

2.3.2 Agency Banking

Agency banking involves the provision of financial products offered by banks at premises away from the conventional banking premises (Modupe, 2010). Agency banking is the contractual arrangement by which the licensed financial institutions use third parties to serve clients with financial products (CBK, 2010). Banks have agents situated in strategic locations where customers need fund to make purchases or diverse forms of payments. Kumar, Parsons, Nair and Urdapilleta (2006) hold a view that agency banking is not independent from the parent bank implying it cannot offer financial products other than those offered by the parent bank. Agency banking enables the customers to get access to the financial services at their convenient places, therefore curbing barriers of financial inclusion including cost and accessibility.

Agency banking is rapidly developing and its regulation has facilitated its spread. It enhances the access and convenience of bank operations (Ivatury & Lyman, 2006). Many banks and financial services regulations to enhance financial inclusion as well as to promote financial

deepening and innovativeness adopt agency banking. Commercial banks can reach remote areas associated with a high percentage of unbanked people. Agent banking involves distribution channels of financial services, using technologies. Bank agents are required to provide receipts to the customers for all the cash deposit and withdrawal transactions. Additionally the principal institution is expected to place effective ways of identifying agents and receiving feedback from clients, for example sending notification to customers through mobile phones. The pioneering countries in the adoption of agency banking include; Brazil, Kenya, India, Philippines, and South Africa (Modupe, 2010).

2.3.3 Mobile Banking

Muisyo, Musiega, and Alala (2014) define mobile banking as the use of mobile phones or other mobile devices to execute a financial transaction associated with the account of the customer. Mobile banking also means the providing of financial and fiscal services with the aid of mobile telecommunication gadgets. Among these services are; facilities to administer accounts, access to customized information and execute bank and stock markets transactions.

To increase financial inclusion, mobile money services have been taken deeper into the financial sector by mobile phone service providers. This has been through offering a variety of financial services including pay bills, bulk payments, funds transfers and facilitating the deposit and withdrawal of funds from banks using mobile phones. Recently, mobile banking have been used as a competitive tool to increase deposits and issue loans to consumers without necessarily going to the branches. Mobile banking has further expanded the customer base by reaching out to the previously unbanked. Mobile banking has also been leveraged as a security feature as the customers get notified of all the transactions effected on their accounts. Therefore, mobile

banking contributes to the financial soundness of Kenyan commercial banks (Kimenyi & Ndung'u, 2009).

2.3.4 Mobile Lending

Ross (1998) defines mobile lending as the use of a mobile phone to apply for together with get an approval for a loan by a financial institution by a client. The use of a mobile phone basically acts as a channel to conduct transactions. Globally, mobile credit has been embraced more in the developing countries compared to the developed countries. Most developed nations have solid financial credit systems including debit cards and credit cards, which customers use to access credit. Subsequently, mobile credit growth rate in such economies is slower than in advancing nations. Exponential growth in mobile credit has been witnessed in Africa with most nations adopting it to boost the attainment of economic goals as increase credit access (Ching, Chuan, Sim, Kam, & Tan, 2011).

Many Kenyan commercial banks have adopted the mobile lending model and the aim of this is to enhance the delivery of the services minimizing the expenses of operations concerning paper work together with the time used by customers travelling in order to visit their banks. The mobile lending is one important innovation that is increasingly becoming popular among the commercial banks in Kenya (Omondi, 2015).

2.4 Empirical Literature Review

Shu and Strassmanm (2005) did a study on 12 banks in the US between the time frame 1989 and 1997. They found that even though IT has been a fundamental dynamic factor, it cannot improve the earnings of the bank. However, many other studies confirm a positive association between investment in IT and bank performance. Kozak (2005) studied the impact of the

evolution in IT on the cost effectiveness and profitability of the banking sector between the time frame 1992 and 2003. The survey reveals an optimistic association among the executed IT. Brynjolfosson and Hit (1996) documented the positive association between IT on consumer surplus and productivity. However, they found no significant association between IT investment and financial performance. Additionally, Barua, Mukhopadhyay and Kriebel (1995) concluded that IT spending influences intermediate measures for instance inventory turnover but established no proof of its contribution to company performance as measured by ROA. In a survey of banks, Markus and Soh (1993) established that not all banks realized direct financial benefits from IT investments: There was no significant association between IT investment and profitability of small banks; while the returns of large banks declined due to IT spending.

Egland, Nolle, Robertson and Furst (1998) evaluated the number of banks in the US offering electronic banking and explored these bank's structure and performance. The findings revealed no noteworthy differences in the performance between the banks that offered electronic banking services and those that did not in terms of credit quality, efficiency and profitability. However, those banks that offered electronic banking services slightly differed by size.

Furst, Nolle, and Lang (2000a, 2000b, 2002a & 2002b) in a series of studies established that banks in all sizes that have adopted electronic banking were more lucrative and were less dependent on old-fashioned banking operations in compared to those that did not offer electronic banking. However, the new start-ups demonstrated no evidence of superior performance as a result of adoption of electronic banking. The conclusion of the surveys was that internet banking did not significantly affect banks' profitability.

Ongare (2013) undertook a survey on the influenceof electronic banking on Kenyan fiscal performance of commercial banks. The survey applied profit after tax to represent financial performance while number of ATMs, debits together with credit cards dispensed to customers, number of selling points and the adoption levels of internet banking, mobile banking, and electronic transfer of funds, were constituents of electronic banking. Secondary information retrieved from the annual report of commercial banks and CBK. The study used both inferential and descriptive statistics for data analysis. The survey established that electronic banking has a strong and significant impact on the profitability of Kenyan commercial and they have a positive relationship.

Maiyo (2013) delved into the effect of electronic banking on Kenyan commercial banks' financial presentation. The descriptive survey design was adopted for the study. Data was collected using data forms from the bank's employees. The primary information was combined with secondary materials retrieved from published fiscal reports of the commercial banks and the CBK. Descriptive as well as inferential statistics, which entailed multiple regression analysis, was also applied. The survey established that charges from mobile banking, credit cards and debit cards had a significant impact on ROA, whereas commission and charges from internet banking and other charges associated with installation of electronic banking had no significant effect on ROA. The study concluded that adoption of electronic banking has improved the commercial banks' financial performance as a result of improved effectiveness, productivity and efficiency

Gardeva and Rhynea (2011) studied the opportunities and hurdles to financial inclusion and established that branching costs and product cost-structures were ranked 12th and 7th respectively as major hurdles to financial inclusion by the service providers. High branching

costs in rural areas are linked with poor physical infrastructure electricity, roads among others, which branchless banking is able to neutralize. These infrastructural challenges were rated high, at 9th on the obstacles list. Thus, agency banking reduces the costs of setting physical contact points with customers enabling banks, MFIs and reaching out to a wider customer base.

Aduda, Ndwiga and Kiragu (2013) executed a survey on the way agency banking associates with the financial aspects of financial institutions' performance. The descriptive survey design was adopted. Data was collected between the time frame 2010 and 2012. The study established that out of 43 banks, eight have launched the agency banking service with the leading banks, which are; Equity Bank, Co-operative Bank and KCB showing a exemplary performance index. Nonetheless, other banks that have the service in place include; Family Bank, Diamond Trust Bank, Post Ban and ECO Bank, showed no significant performance improvement. The study concluded that agency banking is expanding leading to increased financial performance in the banks that have adopted the model as a result of convenience and low transaction costs.

Mwando (2013) investigated the contribution of agency banking the financial sector. The survey was guided by previous literature based on surveys executed abroad so as to understand the contributions of agency banking on Kenyan commercial banks' financial performance. The descriptive survey design was adopted for the study. The findings were that the regulation of agency banking by the CBK had a positive impact on of Kenyan commercial banks' financial performance. The survey also established that the low transaction costs associated with agency banking positively influenced the financial performance of Kenyan commercial banks. The survey established that the accessibility of financial services by clients through baking agencies positively influenced Kenyan commercial banks' financial performance. Finally, the research revealed that increased market share positively influenced the commercial banks' performance

with many banks stating that enlarged market share enabled the firms to attain increased scale of operations, which increased profitability. The study conclusions were that with greater market share, as a result of agency banking, the commercial banks were able to enhance their operational efficiency and effectiveness.

Frank (2010) conducted a survey on the impact of mobile banking on the financial performance of the firms quoted at the New York Stock Exchange (NYSE) between 2001 and 2008. Secondary data of the companies listed and had adopted mobile banking was analysed using the SPSS software from the sample of 25 companies that were selected. Financial performance ratio were also computed and analysed. The study concluded that the financial performance of the commercial banks quoted at the NYSE greatly improved after mobile banking adoption.

Fatima and Kiran (2011) did a study to assess the impact of mobile banking on financial performance of the commercial banks in Pakistan between 2006 and 2010. Twenty banks were selected from the study. Secondary data from the annual published financial reports were analysed using the SPSS. Financial performance ratio were also computed and analysed. They concluded that the financial performance of the Commercial banks in Pakistan immensely increased after the launch of mobile banking.

Kigen (2010) undertook a survey to assess the effect of mobile banking on transaction costs of 2008 microfinance entities in Kenya between 2008 and 2010. The population of this study was all the microfinance institutions. However, due to financial constraints, 15 microfinance institutions were selected for the study. The research used secondary data in the analysis and linear regression model was adopted for the survey. From his findings, mobile banking improved financial performance.

Omondi (2015) analysed the impact of mobile banking on commercial banks' financial performance quoted at the NSE between 2010 and 2014. The study sampled 11 from 17 commercial banks. The study analysed the secondary data, which was retrieved from the banks websites, and used financial performance assessment ratios to perform a comparative analysis. The study concluded that there was a decline in the commercial bank's performance after mobile banking adoption.

Björkegren and Grissen (2018) investigated effect of mobile usage on credit repayment in South America. The study acknowledged that mobile usage is paramount in creating trust and confidence to key stakeholder and customers especially in banking sector and in keeping them satisfied with the services provided. The study revealed that mobile phones can be used to predict the behaviours and anticipate default of the borrowers without actual financial record being taken.

Ooi and Tan (2016) assessed the interaction between technologies and credit performance. Essentially, the study focused on computerized systems of credit score and its link on management of credit risk. The design was descriptive and it was noted that computerized credit scoring systems significantly yield extensive credit approval rates, which extend to the banks credit defaults. The study recorded that credit scoring was correlated default rates. The study also identified that reducing expenses on computerized small-entity lending systems would increase performance and profitability of the lenders. This therefore offers motivation to the lender to extend even more loans that are uncertain. At the same time, lender-borrower distance significantly affects rates of default among non-credit scoring institutions. The study

recommended that scoring models and technology such as mobile app to be used effectively to help in alleviate the data issues associated with geographically inaccessible borrowers.

In an analysis of the relationship between provision of mobile banking services and financial performance of commercial banks across sub Saharan African countries, Tchouassi (2012) utilized a time series data approach using multiple regression analysis for time series data for the period 2005–2010 for 8 Countries across the Sub Saharan Africa. The study aimed at analyzing the relationship between organization productivity, financial inclusion and financial performance and mobile banking and found that though there existed huge differences in the adoption and use of mobile banking services across the sub Saharan African region, there existed adequate empirical evidence to support a positive association existing between financial performance of commercial banks and use of mobile banking. Tchouassi (2012) noted that despite the intense capital outlays need for roll out of mobile banking, the operational costs were minimal while the incomes increased. Consequently, the commercial banks' financial performance improved.

Ndegwa (2014) analyzed the impact of mobile lending on NPLs of Kenyan commercial banks. The survey attempted to clarify the effect of mobile loans on the level of NPLs, which consequently leads to decreased revenues. The study used the descriptive survey design where data was retrieved from the quoted Kenyan commercial banks. The survey concluded that there exists a negative association between mobile money lending and NPLs.

2.5 Conceptual Framework

Rocco and Plakhotnik (2009) stipulate that a conceptual framework lays the foundation for research objectives and questions by grounding a study in the right knowledge constructs. The

independent variables in this study were the aspects of financial technology, which include; mobile banking, internet banking, agency banking and mobile lending. Operational performance will be the dependent variable.

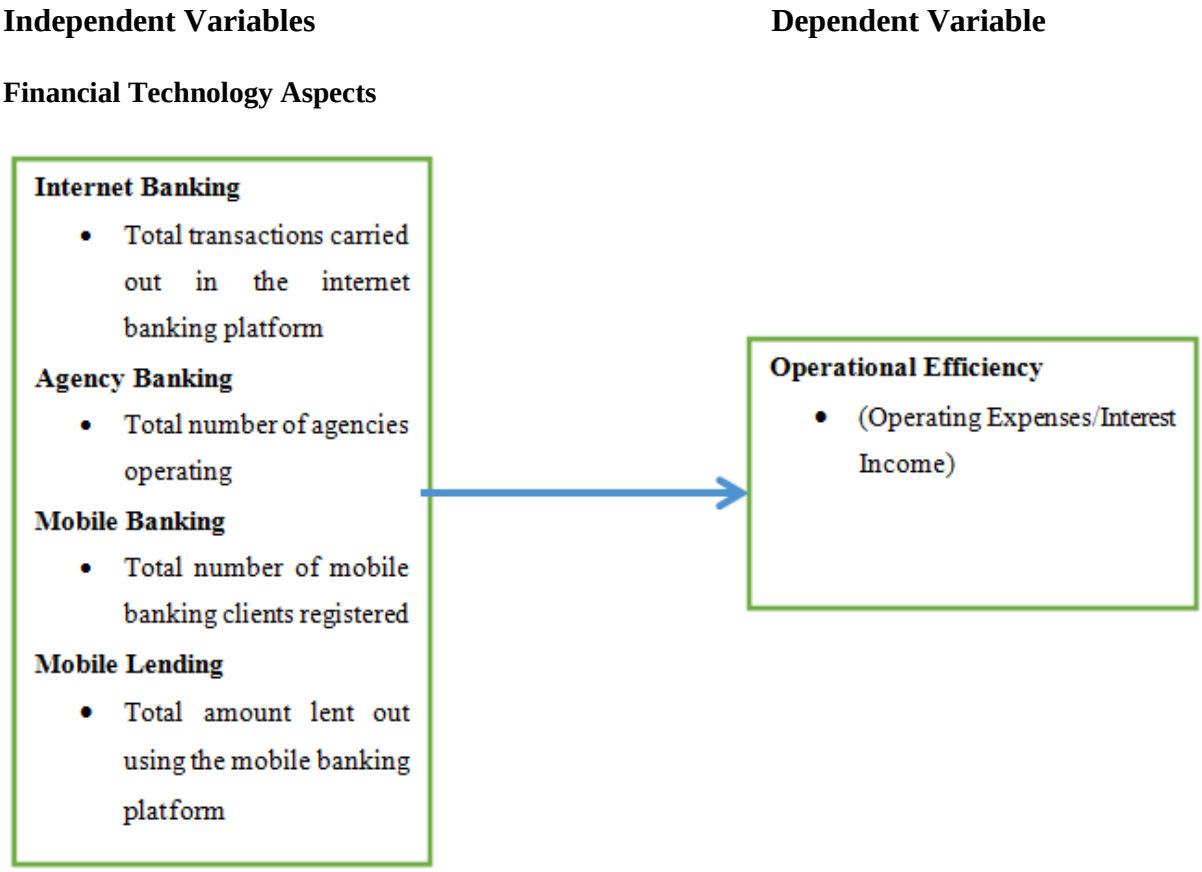

Figure 2.1: Conceptual Framework

2.6 Summary of Literature Review and Research Gaps

There exists a relationship between FinTech and operational performance (Kozak, 2005). Agency banking reduces the cost of establishing physical contact points with customers (Gardeva & Rhynea, 2011) and generally lowers transaction costs (Aduda, Kiragu, & Ndwiga, 2013). Thus, agency banking enables commercial banks to enhance their operational efficiency (Mwando, 2013). Mobile banking greatly reduces transaction costs (Kigen, 2010).

There were various knowledge gaps emanating from the studies reviewed. Studies by Egland et al. (1998), Ongare (2013), and Maiyo (2013) focused on the impact of FinTech on financial performance and not operational efficiency. The studies by Furst, Nolle and Lang, (2000a, 2000b, 2002a & 2002b) focused on the impact of internet banking on profitability of the bank and not operational performance. The study by Gardeva and Rhynea (2011) explored the impact of agency banking on financial inclusion and not on operational efficiency. The studies done by Aduda, Ndwiga and Kiragu (2013) and Mwando (2013) delved into the effect of agency banking on financial inclusion and not on operational efficiency. Studies conducted by Frank (2010), Fatima and Kiran (2011), and Omondi (2015) analyzed the effect of agency banking on financial inclusion and not on operational efficiency. Ooi and Tan (2016) focused on the interaction between financial technologies and credit performance, not on operational efficiency. Björkegren and Grissen (2018) and Ndegwa (2014) explored the impact of mobile banking on credit repayment. Finally, Tchouassi (2012) conducted a study analyzing the impact of mobile banking on financial performance. All these studies therefore, present a conceptual gap.

The global and regional studies reviewed were not conducted in the Kenyan context thus presenting a contextual gap. The studies by Egland et al. (1998), Furst, Lang, and Nolle (2000a, 2000b, 2002a & 2002b), and Omondi (2015) conducted comparative analysis. Studies done by Gardeva and Rhynea (2011) and Aduda, Kiragu, and Ndwiga (2013) conducted descriptive analysis. The study by Mwando (2013) critically reviewed previous literature to present the findings. The study by Maiyo (2013) utilized primary data instead of secondary data, thus also presenting a methodological gap.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

In this section, the research methodology that was applied was laid out. The section looked into research design, population of the study, sample size, sampling approaches, data collection techniques, data analysis, and presentation.

3.2 Research Design

The study applied a causal research design because it sought to determine the cause and effect relationship between the variables. Thus, this design was utilized because it addresses the aim of research in examining the association amongst variables of the research. The study was a formal study because it employed relevant theories and literature to guide it. It was also an ex post facto study because the variables were not be manipulated but simply measured. It was a field setting with the unit of analysis being the country. This design took into account aspects like method of analysis, the variables used in the research, and data gathering methods.

3.3 Target Population

A populace is a set of things or entities with shared observable characteristics (Mugenda & Mugenda, 2013). All the 42 licensed commercial banks, whose list is provided in Appendix I, formed the population in this study. The survey was a census because the entire population was examined.

3.4 Data Collection

The research utilized secondary data. In particular, the investigator relied on data on interest income, operational expenses, total transactions carried out in the internet banking platform, total number of mobile banking clients registered, total number of agencies operating, and total

amount lent out using the mobile banking platform in a given period provided by CBK and the published financial statements of the individual licensed commercial banks. The study gathered quarterly data for a period of seven and a half years, from the second quarter of 2012 to 2019. The study period chosen coincided with the advent of agency banking.

3.5 Data Analysis

Data collected was organized, tabulated and simplified so as to make it easier to analyze, interpret and understand. Data analysis was conducted using SPSS Version 25.0. Correlation analysis was used to show whether and how strongly changes in operational efficiency are related to financial technology while regression analysis was employed to determine the association amongst operational efficiency and financial technology. The quantitative reports obtained from the investigation were presented using tabulations.

The study adopted a confidence interval of 95%. The results were set to be statistically significant at the 0.05 level, which indicates that the significance value should be less than 0.05. A statistical inference technique was used in making conclusions relating to the accuracy of the model in predicting the loan volumes. The model significance was tested using the significance values at 95% confidence. The meaning of the association amongst every predictor variable to the response variable was determined by the significance values. T-test will likewise was undertaken in establishing the significance of individual co-efficient while F-test will similarly was undertaken in establishing the significance of the overall model.

3.5.1 The Model of Analysis

The objectives of the research were attained through use of a multiple linear regression analysis, which tested whether the predictor variables employed in the study have any effect

on operational efficiency. The statistical tests were conducted at 95% significance level meaning that the study allowed for an error of up to 5%. The model is illustrated as shown;

$$\mathbf{Y= \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \epsilon}$$

Where:

Y_{t-1} = Operational Efficiency Ratio

α = Constant

$\beta_1 - \beta_4$ = Beta coefficients

X_1 = Internet Banking

X_2 = Mobile Banking

X_3 = Agency Banking

X_4 = Mobile Lending

ϵ = error term

Table 3.1: Operationalization of the Study Variables

Variable	Measurement
Operational Efficiency	Calculated as; (Operating Expenses/Interest Income). The average operational efficiency of all the banks per quarter was utilized
Internet Banking	Log10 total transactions carried out in the internet banking platform
Mobile Banking	Log10 Total number of mobile banking clients registered
Agency Banking	Log10 total number of agencies operating
Mobile Lending	Log10 total amount lent out using the mobile banking platform

3.5.2 Tests of Significance

The study adopted a confidence interval of 95%. The results were set to be statistically significant at the 0.05 level, which indicates that the significance value should be less than 0.05. A statistical inference technique was used in making conclusions relating to the accuracy of the model in predicting the market capitalization. The model significance was tested using the significance values at 95% confidence. The meaning of the association amongst every predictor variable plus response variable were also determined by the significance values, which illustrated how much standard error indicated that the sample deviates from the tested value.

3.5.3 Diagnostic Tests

For the validity of regression analysis, a number of assumptions are done in conducting linear regression models. These are; no multi-collinearity, observations are sampled randomly, conditional mean ought to be zero, linear regression model is "linear in parameters", spherical errors: there is homoscedasticity and no auto-correlation, and the optional assumption: error terms ought to be distributed normally. According to the Gauss-Markov Theorem, the first 5 assumptions of the linear regression model, the regression OLS estimators, are the Best Linear Unbiased Estimators (Grewal, Levy & Lehmann, 2004). The aforementioned assumptions are of great importance since when any of them is violated would mean the regression estimates will be incorrect and unreliable. Particularly, a violation would bring about incorrect signs of the regression estimates or the difference of the estimates would not be reliable, resulting to confidence intervals that are either too narrow or very wide (Gall, Gall & Borge, 2006).

The diagnostic tests are conducted so as to guarantee that the assumptions are met to attain the Best Linear Unbiased Estimators. Regression diagnostics assess the model assumptions and

probe if there are interpretations with a great, unwarranted effect on the examination or not. Diagnostic examinations on normality, linearity, multicollinearity, and autocorrelation were done on the collected data to establish its suitability in the formulation of linear regression model. The Shapiro Wilk test was used to test normality. Linearity was tested by determining homoscedasticy, which was determined, by the Breuch-Pagan test.

Tests for multicollinearity of data was carried out using variance inflation factors (VIF) and Tolerance statistics to determine whether the predictor variables considered in the research are significantly correlated with each other. According to Grewal Levy & Lehmann (2004) the main sources of multicollinearity are small sample sizes, low explained variable and low measure reliability in the independent variables. Auto-correlation test was carried out through the Durbin-Watson Statistic.

CHAPTER FOUR: DATA ANALYSIS, RESULTS, AND FINDINGS

4.1 Introduction

This chapter entails of the data analysis, interpretation and the discussions of the outcomes. The section hence is fragmented to three sub sections, which entail diagnostic tests, inferential statistics, and interpretation and the discussions regarding the outcomes. Precisely this chapter summarizes the platform for data presentations, analysis, interpretations, and discussions.

4.2 Diagnostic Tests

Diagnostic tests were conducted as a precursor to conducting linear regression so as to ensure Best Linear Unbiased Estimates. Diagnostic tests done in this study included; normality tests, homoscedacity tests, multicollinearity tests, and autocorrelation tests. Normality test was carried out using Shapiro Wilk test, which was supplemented by the Kolmogorov-Smirnov test. The homoscedacity test was conducted through the Breusch-Pagan test. A test on Multicolinearity of data was carried out using VIF and Tolerance tests. The autocorrelation test was done through the Durbin-Watson stastic.

4.2.1 Normality Test

The normality tests for all the variables employed in the study are highlighted in Table 4.1.

Table 4.1: Normality Test

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Operational Performance	.311	30	.000	.690	30	.000
Log10 Internet Banking	.111	30	.200*	.962	30	.342
Log10 Mobile Banking	.094	30	.200*	.944	30	.120
Log10 Mobile Loans	.106	30	.200*	.934	30	.061
Log10 Agency Banking	.186	30	.009	.782	30	.000

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

In testing for normality of the data, the null hypothesis holds that the data has a normal distribution. The level of significance adopted in the study is 5%. The significance values of both tests of internet banking, mobile banking, and mobile are greater than the α (0.05), the null hypothesis is not rejected. Hence, the data series of the variables are normally distributed. The significance values of both tests of operational performance and agency banking are less than the α (0.05), thus the null hypothesis is rejected. Hence, the data series of the variables are not normally distributed.

4.2.2 Test for Homoscedacity

The homoscedacity tests for all the predictor variables employed in the study are enlisted in Table 4.2. The Breusch-Pagan test was applied. There is no direct Breusch-Pagan test of heteroscedasticity in SPSS. However, there is an indirect method of conducting it. The unstandardized and standardized residuals were saved and transformed by squaring them and regressing the resultant variable with all the independent variables included in the study. The resulting output in the Analysis of Variance is the Breusch-Pagan test

Table 4.2: Test for Homoscedacity

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.505	4	.126	2.166	.102[b]
	Residual	1.457	25	.058		
	Total	1.962	29			

a. Dependent Variable: RES_1SQ

b. Predictors: (Constant), Log10 Agency Banking, Log10 Mobile Banking, Log10 Internet Banking, Log10 Mobile Loans

The null hypothesis is that there is homoscedasticity. The level of significance adopted in the study is 5%. Since the significance value obtained in the findings (0.102) is greater than the α

(0.05), the null hypothesis is not rejected. Hence, the data series of all the predictor variables are homoscedastic.

4.2.3 Test for Multicollinearity

Results on Test for Multicolinearity of data carried out using Tolerance and Variance Inflation Factors (VIF) are displayed in Table 4.3.

Table 4.3: Multicollinearity Statistics

Model		Collinearity Statistics	
		Tolerance	VIF
1	Log10 Internet Banking	.027	36.839
	Log10 Mobile Banking	.004	262.614
	Log10 Mobile Loans	.005	214.181
	Log10 Agency Banking	.225	4.452

a. Dependent Variable: Operational Performance

The common rule in statistics is that tolerance values should be greater than 0.1 and VIF values should be less than 10 and greater than 1. The findings indicate that the tolerance value of agency banking exceed 0.1 while the VIF value fall below 10 and greater than 1. Thus, there is no multicollinearity for the predictor variable. However, the findings indicate that the tolerance values of internet banking, mobile banking, and mobile loans do not exceed 0.1 while the VIF values are not within the range of 10 and greater than 1. Thus, there is presence of multicollinearity in the predictor variables enumerated above.

4.2.4 Tests for Autocorrelation

The result on the autocorrelation test carried out using the Durbin-Watson Statistic is presented on Table 4.4.

Table 4.4: Autocorrelation Test

Model	Durbin-Watson
1	.463[a]

a. Predictors: (Constant), Log10 Agency Banking, Log10 Mobile Banking, Log10 Internet Banking, Log10 Mobile Loans

b. Dependent Variable: Operational Performance

The Durbin-Watson statistic ranges from point 0 and point 4. If there exist no correlation between variables, a value of 2 is shown. If the values fall under point 0 up to a point less than 2, this is an indication of a positive autocorrelation and on the contrast a negative autocorrelation exist if the value falls under point more than 2 up to 4. As a common rule in statistics, values falling under the range 1.5 to 2.5 are considered relatively normal whereas values that fall out of the range raise a concern. Field (2009) however, opines that values above 3 and less than 1 are a sure reason for concern. Therefore, the data used in this panel is serially autocorrelated since it meets this threshold having a Durbin-Watson Statistic of 0.463.

4.3 Inferential Statistics

Inferential statistics are used in determining the direction, relationship, and strength of the association between the predictor variables and the response variable. The section entails the inferential statistics employed in the study, which entailed correlation and multiple linear regression analysis.

4.3.1 Correlation Analysis

Correlation analysis establishes whether there exists an association among two variables. The association falls between a perfect positive and a strong negative correlation. The study used Pearson Correlation. This study employed a Confidence Interval of 95% and a two tailed test.

Table 4.5: Correlation Analysis

		Operational Performance	Log10 Internet Banking	Log10 Mobile Banking	Log10 Mobile Loans	Log10 Agency Banking
Operational Performance	Pearson Correlation	1	.247	.297	.294	.240
	Sig. (2-tailed)		.188	.111	.115	.201
Log10 Internet Banking	Pearson Correlation	.247	1	.985**	.979**	.749**
	Sig. (2-tailed)	.188		.000	.000	.000
Log10 Mobile Banking	Pearson Correlation	.297	.985**	1	.995**	.741**
	Sig. (2-tailed)	.111	.000		.000	.000
Log10 Mobile Loans	Pearson Correlation	.294	.979**	.995**	1	.780**
	Sig. (2-tailed)	.115	.000	.000		.000
Log10 Agency Banking	Pearson Correlation	.240	.749**	.741**	.780**	1
	Sig. (2-tailed)	.201	.000	.000	.000	
	N	30	30	30	30	30

**. Correlation is significant at the 0.01 level (2-tailed).

Table 4.5 displays that no FinTech component is significantly correlated at the 5% significance level to operational performance.

4.3.2 Multiple Linear Regression Analysis

The cause and effect relationship between the predictor variables and response variable was evaluated using a multiple linear regression model. The data did not meet all the First-Order conditions to conducting linear regression. The operational performance and agency banking data series did not meet the conditions of normality. The data series of internet banking, mobile banking, and mobile loans did not meet the condition of multicollinearity. The entire data series utilized in the study did not meet the conditions of lack of presence of autocorrelation. The variables that did not meet the conditions of normality and multicollinearity were standardized as a remedy for rectifying both normality and multicollinearity. Because all the data series

employed in the study was serially auto correlated, lagged transformation was applied to the predictor variables as a remedy for autocorrelation.

The regression analysis adopted a 5% significance level. The significance critical value exhibited from the Analysis of Variance (ANOVA) was compared with the critical value obtained in the analysis (α=0.05). Additionally, the F-Value obtained in the study was compared against the critical value. The significance critical value exhibited from the model coefficients was compared with the critical value obtained in the analysis (α=0.05). Furthermore, the t statistic obtained in the study for each model coefficient was compared against the two-tailed critical value. When the various aspects of FinTech were regressed against operational performance, the findings are displayed form Table 4.6 through to Table 4.7.

Table 4.6: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.579[a]	.335	.224	.89638646

a. Predictors: (Constant), Zscore: LAGS(Log10AgencyBanking,1), Zscore: LAGS(Log10MobileBanking,1), Zscore: LAGS(Log10InternetBanking,1), Zscore: LAGS(Log10MobileLoans,1)
b. Dependent Variable: Zscore: Operational Performance

The Co-efficient of Determination (R^2) indicates deviations in response variable as a consequence of variations in the predictor variables. From Table 4.6, the R^2 value is 0.335, a discovery that financial technology causes a 33.5% of the deviations in operational performance. Other factors not incorporated in the model justify for 66.5% of the variations in operational performance.

Table 4.7: Analysis of Variance

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9.703	4	2.426	3.019	.038[b]
	Residual	19.284	24	.804		
	Total	28.987	28			

a. Dependent Variable: Zscore: Operational Performance

b. Predictors: (Constant), Zscore: LAGS(Log10AgencyBanking,1), Zscore: LAGS(Log10MobileBanking,1), Zscore: LAGS(Log10InternetBanking,1), Zscore: LAGS(Log10MobileLoans,1)

The null hypothesis is that financial technology does not significantly influence operational performance. The significance value obtained in the study (0.038) is less than the critical value of 0.05. Consequently, the null hypothesis is rejected. Additionally, the critical F-Value is 2.71407580, and the F-Value obtained in the study (3.019) is less than the critical value. Hence, the null hypothesis is also rejected. Thus, financial technology significantly impacts on operational performance. Therefore, financial technology significantly predicts operational performance.

Table 4.8: Model Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound
1	(Constant)	.004	.166		.023	.982	-.340	.347
	Zscore: LAGS(Log10InternetBanking,1)	-2.929	1.008	-2.879	-2.906	.008	-5.010	-.849
	Zscore: LAGS(Log10MobileBanking,1)	5.381	2.686	5.289	2.003	.057	-.163	10.925
	Zscore: LAGS(Log10MobileLoans,1)	-2.562	2.506	-2.518	-1.023	.317	-7.734	2.609
	Zscore: LAGS(Log10AgencyBanking,1)	.488	.356	.480	1.373	.182	-.246	1.222

a. Dependent Variable: Zscore: Operational Performance

The null hypothesis was that there was no significant relationship between each of the FinTech components and operational performance. The study findings exhibited that only internet banking had a significant relationships with operational performance. This is because the significance value was less than the critical significance value (α) of 0.05. Additionally, the t value obtained for the coefficient did not lie within the range of the t two-tailed test critical value of ±2.04523 obtained in the study. Thus, the null hypothesis is rejected. Therefore, internet banking has a significant negative influence on operational performance. Mobile banking, mobile loans, and agency banking however do not have significant effects on operational performance. This is because their significance values are greater than the critical significance value (α) of 0.05. In addition, the t values obtained for the coefficients did were within the range of the t two-tailed test critical value of ±2.04523 obtained in the study. The following model was thus developed;

$$\mathbf{Y = 0.004 - 2.929X_1}$$

Where;

Y = Operational Performance

X_1 = Internet banking

This implies that when there is no internet banking, the operational performance is 0.004. Subsequently, when internet banking increases by one unit, there is a decrease in operational performance by 2.929 units.

4.4 Interpretation and Discussion of Findings

The study endeavoured to assess the effect of financial technology on the operational performance of licensed commercial banks in Kenya. In addition, the study specifically aimed at to determine the effect of internet banking, mobile banking, mobile loans, and agency banking, on operational performance of licensed Kenyan commercial banks. The data did not meet all the First-Order conditions to conducting linear regression. The operational performance and agency banking data series did not meet the conditions of normality. The data series of internet banking, mobile banking, and mobile loans did not meet the condition of multicollinearity. The entire data series utilized in the study did not meet the conditions of lack of presence of autocorrelation. The variables that did not meet the conditions of normality and multicollinearity were standardized as a remedy for rectifying both normality and multicollinearity. Because all the data series employed in the study was serially auto correlated, lagged transformation was applied to the predictor variables as a remedy for autocorrelation.

The study findings established that the FinTech components that include; internet banking, mobile banking, mobile loans, and agency banking, are not significantly correlated at the 5% significance level to operational performance. Additionally, the study findings revealed that financial technology significantly impacts on operational performance and therefore, it cannot be utilized to significantly predict operational performance. Finally, the study findings also exhibited that only internet banking had a significant effect on operational performance. It had a negative relationship with operational performance. The other FinTech components that entail; mobile banking, mobile loans, and agency banking do not individually significantly impact on operational performance.

The study finding that financial technology significantly impacts on operational performance is congruent to the Financial Intermediation theory advocated by Merton (1995), which posits that banks should leverage on technology and innovation to offer the financial services at reasonable costs, more efficiently and conveniently, hence attaining operational efficiency. The study finding is also in tandem with the assertion by KPMG (2017) that the outcomes of the new techniques results in lower costs of financial intermediation and product improvements for the consumers. The study findings are also similar to the proposition by (Venkatesh & Davis, 2000) that Fintech results to cost effective operations.

The study finding is also congruent to the statement by Schumpeter (1939) that any change that has economic impact revolves around entrepreneurial activities, power of markets and innovation and banks should take advantage of financial technology and ensure they create a hedge over other banks by use of innovative products and services hence being competitive and consequently impacting on their cost efficiency. The study finding is in sync with the findings of a study conducted by Kozak (2005), which studied the impact of the evolution in IT on the cost effectiveness and profitability of the banking sector between 1992 and 2003 and revealed an optimistic association between IT and operational costs.

However, the study finding is not congruent to the study findings in a study conducted by Egland, Nolle, Robertson and Furst (1998), which evaluated the number of banks in the US offering electronic banking and explored these bank's structure and performance. The findings revealed no significant differences in the performance between the banks that offered electronic banking services and those that did not in terms of credit quality, efficiency and profitability.

The study finding that internet banking has a significant negative relationship with operational performance is contradictory to the assertion by Mozie, Mustapha, and Ghazali, (2012) that the use of internet banking is associated with various benefits which include; reduced costs of transacting business and some of the benefits accruing to bank customers include; reduced costs of opening and use of bank services.

The study finding that mobile lending has neither a significant effect nor association with operational performance is not congruent to the findings of the study conducted by Kigen (2010), which was a survey assessing the effect of mobile banking on transaction costs of 2008 microfinance entities in Kenya between 2008 and 2010. The findings were that mobile banking improved operational performance.

The study finding that mobile lending has neither a significant effect nor association with operational performance is not congruent to the statement by Omondi (2015) that many commercial banks have adopted the mobile lending model and the aim of this is to enhance the delivery of the services minimizing the costs of operations in terms of paper work.

The study finding that agency banking neither has a significant association nor relationship with operational performance is not parallel to the findings of the study conducted by Gardeva and Rhynea (2011), which studied the opportunities and hurdles to financial inclusion and established that branching costs and product cost-structures were ranked 12^{th} and 7th respectively as major hurdles to financial inclusion by the service providers. The study further established that agency banking reduces the costs of setting physical contact points with customers enabling banks and other financial institutions to reach out to a wider customer base. The study finding is also not in tandem to the study finding in a study conducted by Aduda,

Ndwiga and Kiragu (2013), which was a survey on the way agency banking associates with the financial aspects of financial institutions' performance. The study concluded that agency banking is expanding leading to increased financial performance in the banks that have adopted the model as a result of convenience and low transaction costs.

The study finding is also dissimilar to the findings of the study conducted by Mwando (2013), which investigated the contribution of agency banking the financial sector. The study established that the low transaction costs associated with agency banking positively influenced the financial performance of Kenyan commercial banks. The study conclusions were that with greater market share, as a result of agency banking, the commercial banks were able to enhance their operational efficiency and effectiveness.

CHAPTER FIVE: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Introduction

This section shows the study findings summary, offered conclusions, and recommendations on the relationship between financial technology on the operational performance of licensed commercial banks in Kenya. Additionally, the research limitations and further research suggestions are also outlined.

5.2 Summary of Findings

The study endeavoured to assess the relationship financial technology and the operational performance of licensed commercial banks in Kenya. The study also sought to establish the effect of each individual FinTech component that entailed; internet banking, mobile banking, mobile loans, and agency banking, on operational performance of licensed Kenyan commercial banks. The study employed the use of correlation and multiple linear regression analyses.

The correlation analysis employed in the study established that the FinTech components that include; internet banking, mobile banking, mobile loans, and agency banking are not significantly correlated at the 5% significance level to the operational performance of licensed Kenyan commercial banks.

The multiple linear regression analysis revealed that financial technology significantly impacts on operational performance. Therefore, financial technology can be utilized to significantly predict the operational performance of commercial banks. Further findings were that the only FinTech component that significantly impacted on operational performance of Kenyan commercial banks was internet banking which had a significant negative relationship with the operational performance of Kenyan commercial banks. The rest of the FinTach components

that entailed; mobile banking, mobile loans, and agency banking, did not individually significantly impact on the operational performance of Kenyan commercial banks.

5.3 Conclusion

In this section, the conclusion of the study is given; the conclusion is affiliated to the study objective, which was to assess the relationship between the relationship financial technology and the operational performance of licensed commercial banks in Kenya. Other specific objectives were to establish the effect of each individual FinTech component that entailed; internet banking, mobile banking, mobile loans, and agency banking, on operational performance of licensed Kenyan commercial banks.

The study concluded that financial technology does significantly impact on operational performance, and therefore, it cannot be utilized to significantly predict operational performance. The study further concluded that that the only FinTech component that significantly impacted on operational performance was internet banking which had a significant negative relationship with the operational performance. The rest of the FinTach components that entailed; mobile banking, mobile loans, and agency banking, did not individually significantly impact on the operational performance.

The study conclusion that financial technology does significantly impact on operational performance is in tandem with the Financial Intermediation theory advocated by Merton (1995), which posits that banks should leverage on technology and innovation to offer the financial services at reasonable costs, more efficiently and conveniently, hence attaining operational efficiency. The study conclusion is also in tandem with the assertion by KPMG (2017) that the outcomes of the new techniques results in lower costs of financial

intermediation and product improvements for the consumers. Finally, the study conclusion is also similar to the proposition by (Venkatesh & Davis, 2000) that Fintech results to cost effective operations.

The study conclusion that the only FinTech component that significantly impacted on operational performance was internet banking which had a significant negative relationship with the operational performance contradicts the assertion by Mozie, Mustapha, and Ghazali, (2012) that the use of internet banking is associated with various benefits which include; reduced costs of transacting business and some of the benefits accruing to bank customers include; reduced costs of opening and use of bank services.

5.4 Recommendations

The study findings will aid in further researches to be conducted on the field of the relations between financial technology and operational performance. Later scholars keen in research on relations between financial technology and operational performance will use the study findings as referral. Policy recommendations are made to the National Treasury and CBK that since it has been established that financial technology does significantly impact on operational performance and thus it can be utilized to significantly predict the operational performance of Kenyan commercial bank, the policy makers should direct commercial banks, and by extension other financial institutions, to employ financial technology so as to enhance cost efficiency and consequently financial performance of the financial institutions. The recommendation will guide government regulators in making policies and practices to boost the financial system and mitigate collapse of banks.

The finding that financial technology does significantly impact on operational performance will guide the commercial bank practitioners, and by extension other financial institutions practitioners and consultants to implement and improve on financial technology enhance in order to augment the financial institutions' operational performance. The study finding that the only FinTech component that significantly impacted on operational performance was internet banking prompts recommendations to the commercial bank practitioners, and by extension other financial institutions practitioners and consultants, to concentrate mainly on internet banking in order to augment the financial institutions' operational performance. However, the finding that internet banking had a significant negative relationship with the operational performance needs further investigation because most of the empirical litearature sight a positive relationship between the two variables.

5.5 Recommendations for Further Study

Exploring the relations between financial technology and operational performance is of great importance the policy makers in the National Treasury and CBK, the practitioners in the banking sector, and consultants Capital Markets. However, the current study was carried out in the commercial banks' context, particularly for sharia compliant banks, the same study could be carried out across other financial institutions to establish if the study findings would hold. The study was only carried out in the Kenyan context, further studies can be conducted out of Kenyan context, they can be conducted in the African or global jurisdictions to establish whether the study findings would hold.

The study only considered the FinTech components that entailed; internet banking, mobile banking, mobile loans, and agency banking as influencing operational performance. A study can be conducted to ascertain if there are other factors that influence operational performance.

Additionally, further studies can be conducted to ascertain if there are factors that moderate on the relationship financial technology and operational performance. This study used secondary data, a subsequent research should be undertaken applying primary data to ascertain if the study findings would hold and either complement or criticize the finding of this study. Multiple linear regression and correlation analysis were applied in the study; other analysis technique for example cluster analysis, discriminant analysis, granger causality and factors should be incorporated in the subsequent researches.

5.6 Limitations of the Study

The study was conducted only in the Kenyan commercial banks' context, particularly on sharia compliant commercial banks, due to time and cost constraints, which does not give clear indication of findings if other financial institutions were also incorporated in the study. More uncertainties would occur if similar studies were replicated in different financial institutions and countries. The study periods was limited to five years due to time and cost limitations, other studies can be done extending the study period to establish if the study findings would hold. Although the research engaged secondary sources of data, there were some major challenges like some of the data being not readily available; especially data on financial technology and it took great lengths and costs to obtain it. The data was not utilized in their raw form and further calculations and manipulations of the data were required. Impending delays were experienced due to data processing and further editing before the compilation by the researcher.

REFERENCES

Adongo, L. E., (2015). *Why FinTech developers should pay attention to the opening of M-Pesa's.* FSD Kenya.

Aduda, J., Kiragu, P., & Ndwiga, J. M. (2013). The relationship between agency banking and financial performance of commercial banks in Kenya. *Journal of Finance and Investment Analysis*, 2(4): 97-117.

Baker-Eveleth, L., & Stone, R. W. (2015). Usability, expectation, confirmation, and continuance intentions to use electronic textbooks. *Behaviour & Information Technology*, 1-13.

Bank for International Settlement, (2013). *Summary description of the L.C.R, Basel Committee on Banking Supervision, January, in Basel Switzerland.* Retrieved on 16th May 2014.

Barua, A., Kriebel, C. & Mukhopadhyay, T. (1995). Information technology and business value: An analytic and empirical investigation. *Information Systems Research, 6(1): 3-23*.

Berger, A. N., (2003). The economic effects of technological progress: Evidence from banking industry. *Journal of Money, Credit and Banking, 35 (2), 141-176.*

Björkegren, D. & Grissen, D. (2018). *Behavior revealed in mobile phone usage predicts loan repayment.* http://dx.doi.org/10.2139/ssrn.2611775.

Buchak, G., Matvos, G., Piskorski, T., & Seru, A. (2017). *Fintech; Regulatory arbitrage and the rise of shadow banks.* NBER Working Paper 23288.

CBK & FSD Kenya, (2016). Survey on bank charges and lending rates, briefing note. http://fsdkenya.org/wp-content/uploads/2015/08/07-08 28_Survey_on_bank_charges.pdf.

Central Bank of Kenya (2011), *Annual Reports.* Central Bank of Kenya, Nairobi.

Central Bank of Kenya, (2010). *Guideline on agent banking.* Nairobi, Government of Kenya Printers, CBK/PG/15.

Central Bank of Kenya, (2018). CBK bank annual supervisory report.

Ching, M.C., Chuan, A.T., Sim, J.J., Kam, H. and Tan, B. (2011). Factors affecting malaysian mobile banking adoption: An empirical analysis. *International Journal of Network and Mobile Technologies, 2: 161-173.*

Chogi, B. F. M. (2006). *The Impact of Mobile Communication Technologies in Medium and Small Enterprises: Case study of Nairobi City.* MSc. Thesis Submitted at the University of Nairobi, School of computing and Informatics.

Cihak, M. & Podpiera, R. (2005). *Bank Behavior in Developing Countries: Evidence From East Africa.* IMF Working Papers.

Communications Authority of Kenya, (2018). *Third Quarter sector statistics report for the financial year 2017/2018.* Nairobi.

Dabholkar, P. A. (2009). *Technology in service delivery: implications for self-service and service support.* Handbook of Service Marketing and Management, Beverly Hills, CA: Sage.

Daniel, E. (1999). Provision of electronic banking in the UK and the Republic of Ireland. *International Journal of Bank Marketing, 17(2), 72-83.*

Das, A. & Ghosh, S. (2004). Determinants of credit risk in Indian state-owned banks: An empirical investigation. *Economic Issues 12. 48-66.*

Deloitte. (2017). *A tale of 44 cities connecting global FinTech: Interim hub review 2017.* https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/Innovation/deloitte.

Demertzis, M., Merler, S., and Wolff, G. (2017). *Capital Markets Union and the Fintech Opportunity.* Bruegel Policy Contribution 22.

Douglas, A. & Janos, B., (2015). *FinTech in Africa: From shadow banking to P2P lending, in banking beyond banks & money.* University of New South Wales Law Research Series.

Drew, D., Andrew P. M., & Neil, W., (2017). *How fast will banks adopt new technology this time?* The Regional Economist, Federal Reserve Bank of St. Louis, 25(4).

Egland, K. L., Furst, K., Nolle, D., E. & Robertson, D. (1998). Banking over the Internet. *Quarterly Journal of Office of Comptroller of the Currency, Journal of Small Business Management,* 17 (4): 23-67.

Equity Bank, (2018). *Annual financial report.* http://www.equitygroup.co.ke/ financials-reports/investor-reports.

European Banking Federation, (2015). The digital transformation of banksand the Digital Single Market. www.ebf.eu.

Fatima, R.N. & Kiran, G.H. (2011).Impact of mobile banking on the financial performance of commercial banks in Pakistan. *The Empirical Evidence Journal of Finance,* 41:28-67.

Frank, M. (2010). Effect of mobile banking on the financial performance of companies listed at the New York Stock Exchange. *The Empirical Evidence Journal of Finance,* 56: 123-145.

Furst, K., Lang, W. W. & Nolle, D. E. (2000a). Who offers internet banking? *Quarterly Journal, Office of the Comptroller of the Currency,* 19(2): 27-46.

Furst, K., Lang, W. W. & Nolle, D. E. (2000b). *Internet banking: Developments and prospects.* Economic and Policy Analysis, Working Paper No. 2000-9, Office of Comptroller of the Currency.

Furst, K., Lang, W. W. & Nolle, D. E. (2002a). *Internet banking: Developments and prospects.* Working Paper, Center for Information Policy Research, Harvard University, New York.

Furst, K., Lang, W. W. & Nolle, D. E. (2002b). Internet banking. *Journal of Financial Services Research,* 22(2): 93-117.

Gall, M.D., Gall, J. P., & Borge, W. R. (2006). *Educational research: An introduction.* (8th Ed.), New York; Pearson.

Gardeva, A., & Rhyne, E. (2011). *Opportunities and obstacles to financial inclusion*. Survey Report, Center for Financial Inclusion.

Githaiga, J. W., (2015). *Effects of credit risk management on the financial performance of Commercial Banks in Kenya.* Unpublished MBA Masters Thesis, University of Nairobi.

Grewal, D., Levy, M., & Lehmann, D. (2004). Retail branding and customer loyalty: An overview. *Journal of Retailing 80 (10): 101-116.*

Hassan, A.H., Kunz, M.B., Pearson, A.W. & Mohamed, F. A. (2006). Conceptualization and measurement of perceived risk in online shopping. *The Marketing Management Journal,* 16(1): 138 –147.

Hauner, D. & Peiris, S. (2005). Bank efficiency and competition in low-income countries: The case of Uganda. *IMF Working Paper, Vol., pp. 1-31, 2005.*

Hirshleifer, J. & Glazer, A. (1993). Price theory and applications. Prentice-Hall, International Editions.

Hitt, L. M., & Brynjolfsson, E. (1996). Productivity, business profitability, and consumer surplus: Three different measures of information technology Value. *MIS Quarterly 20(2): 121-142.*

Horst, M., Kuttschreuter, M. & Gutteling, J. M. (2007). Perceived usefulness, personal experiences, risk perception and trust as determinants of adoption of e-government services in the Netherlands. *Computers in Human Behavior, Vol. 23, No. 4, pp.1838–1852*

Ivatury, G., & Mas, L. (2008). *The early Experience with branchless banking.* Focus Note. 46, Willbehington, D. C: CGAP.

Kenya Commercial Bank, (2017). *Annual financial report.* http://www.kcbgroup.co.ke/ financials-reports/investor-reports.

Kimenyi, S. M. & Ndung'u, S. N. (2009). *Expanding the financial services frontier: Lessons from mobile banking in Kenya.* http://mmublog.org/wp-content/files_mf/1016_mobile_phone_Kenya_Kimenyi.

Kinuthia B. (2010). *An analysis of financial innovations in the Kenyan banking sector*. Unpublished Master of Business Administration Project, University Of Nairobi.

Klingebiel, D. (2000). *Financial restructuring in East Asia.* The World Bank, Washington D.C.

Kozak, S. (2005). The role of information technology in the profit and cost efficiencyimprovements of the banking sector. *Journal of Academy of Business and Economics,* 30(2011): 13-26.

KPMG, (2016). *The Pulse of Fintech, 2015 in Review.* KPMG, London.

Kumar, A., Nair, A., Parsons, A., & Urdapilleta, E. (2006). *Expanding bank outreach through retail partnerships: Correspondent banking in Brazil.* The World Bank, (p. World Bank paper No. 85), Washington, D. C.

Kumbhakar, S. & Sarkar, S. (2003). Deregulation, ownership, and productivity growth in the banking industry: Evidence from India. *Journal of Money, Credit and Banking, 35 (3), 403-24.*

Lee, K.S., Lee, H.S., & Kim, S.Y. (2007). Factors influencing the adoption behaviour of mobile banking: A South Korean perspective. *Journal of Internet Banking and Commerce, 12(2).*

Leibenstein, H. (1966). Allocative efficiency vs. "XEfficiency". *American Economic Association , 392-415.*

Mahdi, S. & Mehrdad, A. (2010). E-Banking in Emerging Economy: Empirical Evidence of Iran. *International Journal of Economics and Finance, 2(1), 201- 209.*

Maiyo, J. (2013). *The effect of electronic banking on financial performance of commercial banks In Kenya.* Unpublished MBA Project, University of Nairobi.

Markus, L. & Soh, C. (1993). *Banking on Information Technology: Converting IT spending into firm performance.* In Banker, R., Kaufmann, R., Mahmood, M.A.(eds.), Strategic Information Technology Management: Perspectives on Organizational Growth and Competitive Advantage, Idea Publishing, Harrisburg, PA.

Merton, R.C. (1995). Financial innovation and the management and regulation of financial institutions. *Journal of Banking and Finance 19(3-4),* 461–481.

Mishkin, M., Frederic, U. & Strahan, P. (2009). What will Technology do to Financial Structure? *NBER working paper 6, 12-59.*

Modupe, L. (2010). *Enhancing financial innovation and access.* Agent Banking Innovation Forum, Nigeria.

Mozie, N. M., Mustapha, R. M. R., & Ghazali, N. (2012). *Perceived trustworthiness and the behavioural intention to use internet banking service among bank users in Shah Alam, Selangor.* Paper presented at the Innovation Management and Technology Research (ICIMTR) International Conference.

Mugenda, O. M., & Mugenda, A. G., (2013). *Social science.* Applied Research & Training Services, Nairobi Kenya.

Muisyo, J. M., Alala, O., & Musiega, D. (2014). the effects of mobile money services on the performance of the banking institution: A case of Kakamega town. *The international Journal of Engineering and Sciences*. 3(4): 16-24.

Mutua, R. W., (2013). *Effects of mobile banking on the financial performance of commercial banks in Kenya.* Unpublished Master's Thesis, University of Nairobi.

Mwando, S. (2013). Contribution of agency banking on financial performance of commercial banks in Kenya. *Journal of Economics and Sustainable Development*, 4(20): 26 -34.

Navaretti, G. B., Calzolari G. & Pozzolo A. F. (2017). *Fintech and banking; Friends or foes?* European Economy – Banks, Regulation, and the Real Sector.

Ndegwa, R. (2014). *Effect of mobile money on non-performing loans of commercial banks in Kenya.* Unpublished Masters Thesis, University of Nairobi.

Ngigi, C. (2012). *Financial innovation and its effect on financial performance of commercial banks in Kenya*. Unpublished Master of Business Administration Project, University of Nairobi.

Nofie, I. (2011). *The diffusion of electronic banking in Indonesia.* Manchester Business School.

Ogare, H. O. (2013). *The effect of electronic banking on the financial performance of commercial banks in Kenya.* Unpublished MBA Project, University of Nairobi.

Omondi, M. (2015). *Effect of mobile banking on the financial performance of commercial banks listed at the Nairobi Securities Exchange.* Unpublished Master of Science in finance Thesis, University of Nairobi.

Ooi, K. B. & Tan, G. W. H. (2016). Mobile technology acceptance model: An investigation using mobile users to explore smartphone credit card. *Expert Systems with Applications,* 59: 33-46.

Pikkarainen, T., Pikkarainen, K., Karjaluoto, H. & Pahnila, S. (2004). Consumer acceptance of online banking: An extension of the Technology Acceptance Model. Internet Researc, 14: 224-235.

Rocco, T., & Plakhotnik, M., (2009). Literature reviews, conceptual frameworks and theoretical frameworks: Terms, functions and Distinctions. *Human Resource Development Review 8(1), 120-130.*

Rogers, E. M., (1995). *Diffusion of innovations.* 4th Edition, the Free Press, New York.

Schumpeter, J. A., (1939). *Business cycles: A theoretical, historical and statistical analysis of the capitalist process.* 2nd Vol, New York: McGraw-Hill.

Shu, W. & Strassmann P.A., (2005). Does information technology provide banks with profit? *Information and Management, 42: 781-787.*

Smith, C. P., (1987). *Retail Banking Technology*. London: International Business Communications.

Tchouassi, G. (2012). Can mobile phones really work to extend banking services to the unbanked? Empirical lessons from selected Sub-Saharan Africa countries. *International Journal of Developing Societies*, 1(2): 70-81.

The Kenya Fintech Report, (2017). *Fintech and emerging digital financial solutions.* Nest and Visa.

Venkatesh, V., & Davis, F., (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. Management Science, 46(2), 186-204.

Vives, X. (2017). The impact of fintech on banking. *Europeye srl via Gregorio VII 368 - 00165 Roma.*

Wagner, C., Kawulich, B. & Garner, M., (2010). *Doing social research: A global context.* Maidenhead, England: McGraw-Hill.

APPENDICES

Appendix 1: List of Commercial Banks in Kenya as at 29th February, 2020

1. Absa Bank Limited
2. African Banking Corp. Ltd
3. Bank of Africa Kenya Ltd
4. Bank of India
5. Bank of Baroda (K) Ltd
6. Stanbic Bank Ltd
7. Chase Bank (K) Ltd (In Receivership)
8. Citibank N.A.
9. Consolidated Bank of Kenya Ltd
10. Co-operative Bank of Kenya Ltd
11. Credit Bank Ltd
12. Development Bank (K) Ltd
13. Diamond Trust Bank (K) Ltd
14. Dubai Bank Ltd (In Receivership)
15. Dubai Islamic Bank (Kenya) Ltd
16. Ecobank Limited
17. Spire Bank
18. Equity Bank Ltd
19. Family Bank Ltd
20. Guaranty Trust Bank
21. First Community Bank Ltd
22. Guardian Bank Ltd
22. Gulf African Bank Ltd

24. Habib Bank A.G. Zurich

25. HFC Ltd

26. Imperial Bank Ltd (In Receivership)

27. I & M Bank Ltd

28. Jamii Bora Bank Ltd

29. KCB Bank Kenya Ltd

30. Mayfair Bank Ltd

31. Middle East Bank (K) Ltd

32. M Oriental Bank Ltd

33. National Bank of Kenya Ltd

34. NCBA Bank Kenya

35. Paramount Universal Bank Ltd

36. Prime Bank Ltd

37. Sidian Bank

38. Standard Chartered Bank (K) Ltd

39. SBM Bank (Kenya) Ltd

40. Transnational Bank Ltd

41. UBA Kenya Bank Ltd

42. Victoria Commercial bank Ltd

Source: Kenya Bankers Association Website (2020)

Appendix II: Data Collection Form

Name of Commercial Bank				
		Data		
Year	**Quarter**	Operating Expenses	Interest Income	**Operational Efficiency**
2012	Q3			
	Q4			
2013	Q1			
	Q2			
	Q3			
	Q4			
2014	Q1			
	Q2			
	Q3			
	Q4			
2015	Q1			
	Q2			
	Q3			
	Q4			
2016	Q1			
	Q2			

	Q3			
	Q4			
2017	Q1			
	Q2			
	Q3			
	Q4			
2018	Q1			
	Q2			
	Q3			
	Q4			
2019	Q1			
	Q2			
	Q3			
	Q4			

Year	**Quarter**	**Log10 Total transactions carried out in the internet banking platform**	**Log10 Total number of mobile banking clients registered**	**Log10 Total number of agencies operating**	**Log10 Total amount lent out using the mobile**

					banking platform
2012	Q3				
	Q4				
2013	Q1				
	Q2				
	Q3				
	Q4				
2014	Q1				
	Q2				
	Q3				
	Q4				
2015	Q1				
	Q2				
	Q3				
	Q4				
2016	Q1				
	Q2				
	Q3				
	Q4				
2017	Q1				
	Q2				
	Q3				
	Q4				

2018	Q1				
	Q2				
	Q3				
	Q4				
2019	Q1				
	Q2				
	Q3				
	Q4				

Appendix III: Research Data

Year	Quarter	Operational Performance	Internet Banking	Log10 Internet Banking	Mobile Banking	Log10 Mobile Banking	Mobile Loans	Log10 Mobile Loans	Agency Banking	Log10 Agency Banking
2012	Q3	0.832457	15223900	7.182526	83184000	7.92004	1.92E+08	8.282871	2314	3.364363
	Q4	0.825372	16446300	7.216068	90475500	7.956531	2.18E+08	8.338323	3650	3.562293
2013	Q1	0.809345	17465300	7.242176	89481000	7.951731	2.41E+08	8.381595	95476	4.979894
	Q2	0.823673	18146900	7.258802	1.04E+08	8.015332	2.73E+08	8.436328	17234	4.236386
	Q3	0.798235	18891600	7.276269	1.16E+08	8.066287	3.16E+08	8.499343	19430	4.288473
	Q4	0.76324	19191000	7.283098	1.23E+08	8.091436	3.4E+08	8.530879	21034	4.322922
2014	Q1	0.754298	19239300	7.284189	1.28E+08	8.106471	3.57E+08	8.552478	21056.8	4.323392
	Q2	0.734676	19795600	7.296569	1.4E+08	8.146723	3.7E+08	8.567947	21135.7	4.325017
	Q3	0.683471	19710000	7.294687	1.48E+08	8.170232	3.91E+08	8.592565	22112.46	4.344637
	Q4	0.634562	21060000	7.323458	1.61E+08	8.20793	4.27E+08	8.630255	25117.35	4.399974
2015	Q1	0.642654	22329200	7.348873	1.59E+08	8.202134	4.18E+08	8.62141	31265.8	4.49507
	Q2	0.621903	23750000	7.375664	1.76E+08	8.246423	4.54E+08	8.65694	31298.34	4.495521
	Q3	0.615872	23970000	7.379668	1.91E+08	8.280692	4.96E+08	8.695876	34567	4.538662
	Q4	0.557311	25326300	7.403572	2.06E+08	8.314094	5.33E+08	8.726731	38297	4.583165
2016	Q1	0.58236	26208000	7.418434	2.07E+08	8.315187	5.44E+08	8.735575	39245	4.593784
	Q2	0.573468	25928400	7.413776	2.21E+08	8.343746	5.75E+08	8.759446	47650	4.678063
	Q3	0.589467	26299500	7.419947	2.35E+08	8.370214	6.14E+08	8.788206	52650	4.721398
	Q4	0.614908	25249200	7.402248	2.49E+08	8.397067	6.39E+08	8.805545	53565	4.728881
2017	Q1	0.89346	25690200	7.409767	2.53E+08	8.402677	6.51E+08	8.813253	55235	4.742214
	Q2	0.95734	26502800	7.423292	2.65E+08	8.424026	6.72E+08	8.827252	57340	4.758458
	Q3	1.492435	27312000	7.436354	2.84E+08	8.453988	7.35E+08	8.866006	60534.56	4.782003
	Q4	2.37565	28644700	7.457044	3.12E+08	8.493486	7.59E+08	8.880384	61290	4.78739
2018	Q1	1.72376	30696000	7.487082	3.04E+08	8.483385	7.73E+08	8.888259	72356	4.859475
	Q2	1.562371	31386000	7.496736	3.2E+08	8.504701	8.19E+08	8.913142	64734.8	4.811138

	Q3	1.26703	33435000	7.524201	3.37E+08	8.52796	8.63E+08	8.93608	62564	4.796325
	Q4	0.771748	34957000	7.543534	3.7E+08	8.567886	9E+08	8.954287	61459	4.788585
2019	Q1	0.72575	33919000	7.530443	3.73E+08	8.571547	8.99E+08	8.953785	61360	4.787885
	Q2	0.714354	34178000	7.533747	3.87E+08	8.587977	9.13E+08	8.960316	60360	4.780749
	Q3	0.709259	35537000	7.550681	3.77E+08	8.57658	8.96E+08	8.952381	60034	4.778397
	Q4	0.695905	37386800	7.572718	4.06E+08	8.608387	9.31E+08	8.968762	59578	4.775086