EFFECT OF FINANCIAL TECHNOLOGY ON OPERATIONAL EFFICIENCY OF COMMERCIAL BANKS IN KENYA

JOHN MUCHOKI KIMOTHO

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DECLARATION

I, the undersigned, declare that this is my original work and has not been presented to any institution or university other than the University of Nairobi for examination.

Signed: __  ____Date: ___16th November, 2022_____

JOHN MUCHOKI KIMOTHO

D63/82554/2015

This research project has been submitted for examination with my approval as the University Supervisor.

Signed:_  _____Date: ____**25/11/2022**_____

MR. JOSEPH BARASA

LECTURER, DEPARTMENT OF FINANCE AND ACCOUNTING

FACULTY OF BUSINESS AND MANAGEMENT SCIENCES

UNIVERSITY OF NAIROBI

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DEDICATION

I wish to dedicate this work to my mother, Anastacia Mwihaki Kimotho, who was my first teacher in nursery school and who taught me how to read and write. She created passion for studies in me. Secondly, I dedicate this work to my wives; Ann Njeri Ndungu, Catherine Wanjiru Wanyoike and Caroline Mugure Waruguru, my daughters; Mercy Mwihaki Muchoki, Talia Wambui Muchoki, Edith Wambui Muchoki, Annette Njoki Muchoki and Janice Wanjiru Muchoki, and my sons Shawn Kimotho Muchoki, Ian Kimotho Muchoki, Hans Ngaruiya Muchoki and Evan Wanyoike Muchoki.

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LIST OF ABBREVIATIONS

ANOVA	Analysis of Variance
ATM	Automated Teller Machine
CBK	Central Bank of Kenya
EFT	Electronic Funds Transfer
ICT	Information and Communication Technology
IT	Information Technology
KCB	Kenya Commercial Bank
NSE	Nairobi Securities Exchange
ROA	Return on Assets
SPSS	Statistical Package for Social Sciences
TAM	Technology Acceptance Model
VIF	Variance Inflation Factors

ABSTRACT

The banking sector has witnessed continuous increase in financial technology in the past five years and there is a necessity to establish the association amongst the developing financial technology and financial institutions operational efficiency in Kenya. The current study sought to investigate how fintech influences the operational efficiency among banks in Kenya as they play a key role in financial intermediation and inclusion. The independent variables for the research were mobile banking, internet banking and agency banking. Asset quality, capital adequacy and bank size were the control variables while the dependent variable was operational efficiency measured as the ratio of interest income to total assets. The study was guided by financial intermediation theory, diffusion of innovation theory and technology acceptance model. Descriptive research design was utilized in this research. The 41 banks in Kenya as at December 2021 served as target population. The study collected secondary data for five years (2017-2021) on an annual basis from CBK and individual banks annual reports. Descriptive, correlation as well as regression analysis were undertaken and outcomes offered in tables followed by pertinent interpretation and discussion. The research conclusions yielded a 0.372 R square value implying that 37.2% of changes in banks operational efficiency can be described by the six variables chosen for this research. The multivariate regression analysis further revealed that individually, mobile banking has a positive and significant effect on operational efficiency of banks (β=0.164, p=0.000). Internet banking and agency banking exhibited a positive but not statistically significant influence on operational efficiency. Asset quality has a negative effect on operational efficiency of banks (β=-0.159, p=0.000). Capital adequacy and firm size exhibited a positive and significant operational efficiency influence as shown by (β=0.741, p=0.000) and (β=0.295, p=0.000) respectively. The study recommends the need for policy makers to provide a conducive environment for banks to undertake mobile banking as this enhances their operational efficiency. The study further recommends that banks should work at enhancing their asset quality as this will contribute to their operational efficiency. Future research ought to focus on other financial institutions in Kenya to corroborate or refute the conclusions of this research.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Financial technology is used by banks so that they can compete in financial markets and therefore improves their performance and maintains their efficiency on market (Woldesenbet-Batiz- Lazo, 2016). Cohen and Morrison (2018) argue that embracing specific invention type will influence operational efficiency positively. They further argued that organizations should add new information to the previous information acquired. Previous experience with a specific invention will further support the same application with information where they had success. Organization inclines towards implementing an invention because they retain information in that invention and thus assimilate new information and create new opportunities to gain efficiency advantage from it (Roberts & Amit, 2013).

This study drew support from the diffusion of innovation theory, the technology adoption model, and the financial intermediation theory. Financial intermediation theory by Diamond (1984) is the anchor theory as it observes that through intermediation, financial institutions may create and provide customized financial solutions to meet the needs of each client. By doing so, the financial intermediaries enhance credit reach and enhance their efficiency. Diffusion of innovation by Rogers (1995) is about the mechanism via which a new thought is disseminated to a particular societal system relies on utilizing a specific preference channel. The Technology Acceptance Model (TAM) provides clarity on how customers incorporate and exploit an innovative concept (Davis, 1989). To learn how financial institutions in Kenya absorb new technologies, TAM was used in this study.

The study focused on commercial banks in Kenya. This is because the last decade has seen banks in Kenya embrace financial technology. Financial technology is available in Kenya in a number of forms, inclusive of mobile phone apps, mobile money wallets, as well as payroll borrowing. The services often involve short-term, high-interest loans. Banks utilize client cell phone information including, social media, transaction history of mobile, short messages record and calls for the evaluation of credit scores and loan amounts (Mohamed, 2018). The most common financial technology services being offered by banks include M-Shwari, KCB MPESA and Fuliza (CBK, 2019). The current study sought to investigate how this influences the operational efficiency among commercial banks.

1.1.1 Financial Technology

Lawrence (2013) opined that financial invention consists of the plan, progress, and the execution of inventive monetary tools, procedures and the invention of resolutions to challenges in finance institutions. According to Sheleg and Kohali (2011), any technical advancement affecting the financial industry and its operations is referred to as financial technology. Financial technology can also refer to businesses that combine financial services with modern technology to provide user-friendly, automated, transparent, and efficient internet-based and application-oriented services (Triki& Faye, 2013). Financial technology, according to Freytag and Fricke (2017), is innovative technology that enables financial services.

Financial technology provides a range of technological options for comfort, faster reaction time and operating efficiencies (Klapper, 2016). Financial technology has affected many financial industry players. As a result, services of asset management have improved by providing retailers wealth management services via streamlined

systems, algorithm proposals to assist decision-making and managed portfolios artificially through robots. The banking sector has also been affected by monitoring tax labiality, spending, credit, saving, bank service provision besides traditional banking, distribution leading technology allows for quicker transaction, mobile transfer, the usage of cryptocurrencies, and data analytics allows for cellular lending to individuals and small businesses (Yang & Liu, 2016).

In regard to operationalization, financial technology are connection between the mobile phone and an employer's or company's bank account, as used nowadays in many financial transactions (Demirguc-Kunt et al., 2018). Financial technology has been operationalized before in terms of mobile banking, internet banking, ATMs, agency banking among others. Internet banking provides financial services via a bank's website. Peer-to-peer financing is a kind of lending that allows people to lend to one another and also loan money which are not used as mediators by a bureaucratic bank. This study attempted to quantify the level of financial technology usage, as defined by the total number of transactions carried out via agency banking, internet banking, and mobile banking.

1.1.2 Operational Efficiency

This refers to a firm’s ability to lower waste while maximizing resource capabilities to give customers goods and services of high quality (Kalluru&Bhat, 2009). It is the identification of resources and processes that impact productivity and profitability of companies. It involves the design of new processes which will have positively impact productivity (Darrab& Khan, 2010). It is also the maximum weighted ratio of outputs to inputs (Cooper & Rhodes, 1978).

Efficiency takes a number of forms. Institutional efficiency describes the relation between organizational goal achievement and resource utilization. It is the magnitude by which output of an entity for specific inputs is different from that of the best company in the specific sector (Kuosmanen& Johnson, 2017). Technical efficiency measures the magnitude by which firms produce selected outputs like such as revenue from specified inputs like costs. It requires adopting technologically efficient processes that will increase outputs from chosen inputs (Arunkumar&Kotreshwar, 2012). Allocative efficiency in turn refers to the degree by which firms use inputs using a number of ratios while considering the latest technology and prices. It can be understood as the maximization of outputs using select technically efficient combinations of inputs. Combining technical and allocative efficiency yields economic or productive efficiency (Hackman, 2018).

Several ratios are utilized in measuring operational efficiency. The ratios include total asset turnover ratio (net sales/average total assets) which is a measure of how a firm generates sales using its total assets. Another ratio is the fixed-asset turnover (net sales/average net fixed assets)which has similarities to the total asset turnover ratio except that it only uses fixed assets. A third ratio used in the measurement of firm efficiency is revenue turnover which shows a company's ability to spend from investments that generate income. It is the ratio of the sum of all outputs to inputs. This ratio indicates the efficiency with which a firm manages inputs which will influence its efficiency (Arunkumar & Kotreshwar, 2012). Data Envelopment Analysis (DEA)and free disposal hull are forms of non-parametric frontier approaches used in the measurement of efficiency which rely on technical efficiency (Rao & Lakew, 2012). The current study used the ratio of interest income to total assets to measure operational efficiency.

1.1.3 Financial Technology and Operational Efficiency

The diffusion of innovation hypothesis says that every economically impactful change centers on entrepreneurship, market power and innovation. From this reasoning come theories about the financial technology revolution. Rogers (1995) believes that invention briefly establishes a monopoly, wherein imitators compete and remove monopolies. Therefore, if financial institutions utilize financial technology and secure hedging other banks using new goods and services, they will certainly have an effect on financial growth.

With the increase in the number of financial technology households, borrowing and savings products are made easy for everyone (Mehotra&Yetman, 2015).Long-term operational efficiency of banks is one of the projected benefits of financial technology (Rasheed, Law, Chin &Habibullah, 2016).Making sure people have simple accessibility to and are able to utilize these services is vital in fostering social growth and sustainable economic, decreasing destitution, and helping to stabilize the financial system (Zins& Weill, 2016).

Financial technology is essential for directing money to efficient purposes and allocation of risk to people who can utilize them, and this boosts operational efficiency (Neaime & Gaysset, 2018). Boot and Thakor (2014) asserted that in general, invention have a substantial influence in increasing monetary performance of firms. Innovation efforts require monitoring, allocating and controlling, since they are vital and limited resources that are to be utilized in a wise manner. A perfect understanding of the nature of inventions might help organizations to prioritize their marketing, production and technology strategies followed by suitable consequent action plan.

1.1.4 Commercial Banks in Kenya

The CBK defines a bank as a business conducting or planning to carry out banking operations in Kenya. Commercial banking includes the activities of deposit acceptance, extending credit, processing financial transactions in addition to offering financial services in other areas. Specifically, the industry contributes significantly to the financial sector, with a special focus on the mobilization of saving and the provision of loans to businesses and consumers. The CBK is the regulating authority in the Kenyan banking industry. The banking sector has 1 mortgage finance company, 38 commercial banks, and 13 microfinance companies in the industry. There are 11 of the 38 listed at the NSE (CBK, 2020).

Many improvements have been made in the banking sector to increase efficiency and the way they operate. Increasing financial provision rivalry, technological innovation and banking consolidation are all examples of these developments. As a result, banks are being compelled to pay more focused emphasis on certain areas that improve performance, for example delivering better products and services and minimizing expenses in banking. With regard to the use of financial technology by banks, it's being used to cut down on expenses in administration, operational efficiency, and competition (CBK, 2020). According to Abdulkadir (2019), financial technology adoption is viewed as a tool that enhances the way financial transactions are conducted. This indicates that the financial functionality of this sector has improved because of the increasing adoption of financial technology.

1.2 Research Problem

The use of financial technology by the financial sector has increased dramatically around the world. Bank processes including trading stocks, offering new products,

handling the internet and electronic payments, and incurring costs have all benefited from the enhancement. As a result, the quality of services provided by banks around the world has improved (Babajide et al., 2015).In the growth process, finances are just as essential as creativity (Kim, Yu & Hassan, 2018).According to evidence, innovation experts are consistently convinced that the financial technology promotion will result in increased revenue for banks.Banks, on the other hand, are likely to miss out on the benefits of enhanced performance if access to financial technology is restricted (Neaime & Gaysset, 2018).

The banking sector has witnessed continuous increase in financial technology in the past five years and there is a necessity to establish the association amongst the developing financial technology and financial institutions operational efficiency in Kenya. Njoroge (2016) noted that there are a variety of banking and financial technology that include emergence of EFT, RTGS, mobile banking, internet banking, telephone banking and servicing of utility bills among others. The current study seeks to contribute knowledge on the effect of financial technology on operational efficiency of commercial banks in Kenya.

Although there have been international studies in this field, they have mostly focused on certain elements of financial technology and how they correlate to performance. Stoica, Mehdian, and Sargu (2015) investigated how internet banking affects Romanian bank performance and E-banking, according to the study, provides affordable and efficient services that help banks operate better. Wadhe and Saluja (2015) investigated how E-banking impacted the profitability of Indian banks from 2006 to 2014. The results showed that e-banking had a favorable relationship with profitability in both private and public sector banks. Hujud and Hashem (2017) examined the connection between Lebanon's financial technologies and profit statuses

of commercial banks and found that financial technology have a positive and significant relation to profitability.All these investigations were conducted in a distinct settingthus, their results cannot be applied to the current situation.

Locally, Mutinda's (2018) study on effect of technology advancements upon the profitability of public commercial banks has found that mobile banking has a significant negative link to Kenya's profitability of public commercial banks. In contrast, Abdulkadir (2019) studied the financial performance of commercial banks in Kenya due to the use of financial technology, concluding that technology in the financial sector has a favorable impact on performance. Kamande (2018) showed the statistically meaningful excellent outcomes of only agency banking with statistically irrelevant, positive financial performance connections among ATM, internet and mobile banking. There is a lack of consensus on how financial technology affects commercial bank profitability among prior empirical research which provides sufficient grounds for additional investigations. Further, most previous research has focused on financial performance which is a different concept from operational efficiency which was the knowledge gap that the current study aimed to fill. This research answered the research question: What is the effect of financial technology on operational efficiency of commercial banks in Kenya?

1.3 Research Objective

The study’s objective was to determine the effect of financial technology on operational efficiency of the commercial banks in Kenya.

1.4 Value of the Study

The conclusions will aid investors as well as practitioners understand the relationship between the two variables, that is important for ensuring strong management team

with diverse viewpoints and competences streamlining operations as well as managing financial technology, as well as for building confidence among corporate stakeholders, which will ultimately optimize operational efficiency.

The study will also be of value to policymaking organizations like governments, the capital markets, central banks and economic bodies that formulate the various polices on financial technology and operational efficiency. The policy making bodies may use the study recommendations to come with effective financial technology strategies to enhance operational efficiency.

Finally, the review will add on to the available theoretical discussion on the financial intermediation theory, technology acceptance model and diffusion of innovation theory. In addition, study contributes to empirical studies on financial technology and operational efficiency. Additional studies may also be carried out based on the recommendation and suggestions for further research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter introduces the study's theoretical foundation as well as summarizes existing research on financial technology and operational efficiency.It includes a theoretical overview, empirical review, literature review summary, research gaps, and a conceptual framework that depicts the study variables' hypothesized relationships.

2.2 Theoretical Framework

This study examines various theories that attempts to explain how financial technology is related to operational efficiency. Diffusion of innovation theory, technological acceptance model and financial intermediation theory are among the theoretical reviews presented.

2.2.1 Financial Intermediation Theory

This theory was proposed by Diamond (1984) and it is the anchor theory. The theory plays a central role in the financial intermediation process particularly among banks to mitigate information asymmetry that lies between borrowers and lenders, hence their constant interaction assists lenders in producing credit worthy information to borrowers. Information that is provided gives creditors and loan officers a strong incentive in assessing and appraising credit to those that require it. Modern theories state that the business of financial intermediation is pegged on economic imperfections from 1970s with limited contributions (Jappelli& Pagano, 2006). The existence of the intermediaries is based on their ability to lower transaction and information costs from asymmetries (Tripe, 2003).

The biggest criticism of the financial intermediation theory is its inability to give recognition to the role of lenders in the process of risk management (Levine et al., 2000). Scholtens and Van Wensveen (2000) stated that they do not recognize credit risk management as an important factor in the financial industry and emphasizing the participation costs concept. They suggested future developments in the financial intermediation theory to understand challenges in the financial sector.

The theory is relevant to the research since boosting the profitability of banks can be accomplished by implementing innovative financial technology that enables simple and convenient banking activities for consumers. Financial intermediaries utilize mobile apps and other digital lending mechanisms that are useful in lowering transactional costs brought about by information asymmetry. They hence play a central role in effective functioning of financial markets. The theory is useful in understanding how financial technology and operational efficiency relate.

2.2.2 Diffusion of Innovation Theory

The pioneer of this idea was Rogers (1962). An innovation is any newly introduced ideas, practices or item into a social structure whereas, on the contrary,, innovation dissemination is the way the new concept is transmitted over a period of time to the social system via a default route. In this regard, this theory attempts to outline how new innovations are accepted and utilized in a social system such as mobile banking and online banking (Clarke, 1995).Rogers (1995) broadened the idea by saying that the study on technological diffusion was insufficient, further explaining that the technology cluster had additional distinctive characteristics that were thought to be fully linked. That is why the advantages and repercussions of embracing or refusing to embrace innovation should be notified to people and societies at large. Rogers (2003)

says plainly that interpersonal connections are necessary because dissemination includes a social process.

Robinson (2009) criticizes the theory for taking a dramatically different view of other theories of change. It is not about attempting to persuade people to change, but about making progress or re-inventing goods and character, so that they can better suit what the person wants or needs. In this idea, people do not change, but innovations have to adapt to the demands of the people.The invention process takes time, as per Sevcik (2004), and it does not happen immediately. He also believes that the spread of innovation and the opposition to changes has the greatest impact on the process of innovation because it delays it down.

Rogers (2003) argues that the perception of these characteristics by an organization affects the degree of breakthrough technology adoption. If an organization realizes the benefits arising from online banking, these innovations will be taken into account when additional technologies are available. Innovation is quicker adopted in companies having internet access and information technology than in those without. The hypothesis is based on the present research, which shows how innovations like financial technology are taken up by banks.

2.2.3Technology Acceptance Model

The technology acceptance model was first conceived by Davis (1989) and is known as Davis model in some citations. The model addresses customers' adoption behavior, which is utilized to select a system that is both beneficial and convenient to them. Moon and Kim (2015) explored the underlying essence of TAMs validity and found that TAMs core construction is not the determining factor of user acceptance—use of technology and other usability facets influence this. Technologies or computer

system's anticipated utility is defined by the theory that it will substantially improve work performance once it is put in place (Davis, 1989).

The simplicity with which a system may be used continues to be prioritized, it is a sign that the user has learned how to run it and employ the new technology. The model focuses on simple use as a means of predicting system utility (Gefen, Karahanna& Straub, 2013).When people believe electronic banking is effective, it's more likely to be used (Potaloglu&Ekin, 2015). Aspects such as perceived usability simplicity and perceived utility are seen as essential to the promotion of e-banking.

Theory of technology acceptance has changed how researchers do their work. Key aspects of the current investigation is to discover benefits and drawbacks of incorporating technology into commercial banks in Kenya and to look at how easy or difficult it is for electronic banking to be used within the commercial banking sector in Kenya.

2.3 Determinants of Operational Efficiency

It is possible to gauge an organization's financial health by considering a number of elements, both internal and external.Within a bank's spectrum of manipulation, internal elements differ from one bank to the next.The five characteristics of financial institutions are deposit liabilities, efficiency of management, quality of management, capital size and labor productivity.Political instability, robustness of monetary policy,inflation, Gross domestic product and the interest rate are the primary elements that influence a bank's overall performance (Athanasoglou et al. 2005).

2.3.1 Financial Technology

Financial technology is a broad term used to represent the use of technological advancements in financial services to provide comprehensive commodity solutions

that have traditionally been handled by banks (Arner 2015).In simple terms, financial technology can be defined as an entirely new kind of money service trade that combines information technology with money services like asset management, transfer and payments (Lee & Kim, 2015).Financial technology are often measured in terms of mobile, agency and internet banking (McAuley, 2015)

The increase in technological capability has resulted in better approaches to conducting enterprises in the current period (Stiroh, 2001). The research team of Ongori and Migiro (2010) found that the introduction of information and communications technology (ICT) has changed banking norms and the delivery of services to clients in the financial sector, according to the study.When launching a global expansion strategy, the aim is to improve the delivery of consumer services, reduce transaction costs, and use new technologies more broadly.Financial technology have a role in spurring productivity and monetary progress at the company's scale (Brynjolfsson&Hitt, 1996).

2.3.2 Capital Adequacy

The ratio equity to total is often known as the ratio of bank capitalization. It illustrates the relationship between equity and total assets. It demonstrates a bank's capacity to stay viable through risk regulation. In a study, Berger and DeYoung (1997) demonstrated a negative link between capital sufficiency and performance. In imperfect financial markets, firms with adequate capital should limit borrowings to support a particular asset class and therefore minimize the expected bankruptcy cost.

A bank with enough capital indicates that a better performance is anticipated on the market. The findings of Athanasoglou et al. (2008) have shown that the capital stocks are favorably associated with bank profitability and indicate a solid financial position

for Greek banks. Berger et al. (1987) also showed a positive causality of the contribution from capital and profitability.

2.3.3 Asset Quality

Asset quality poses a substantial challenge to the firm's solvency since it represents a risk to its existence (Sufi &Qaisar, 2015). It is normally measured as the ratio of NPL to total loans. Lenders provide loans knowing the borrowers would repay without any default, without falling into the non-performing category (Bhattarai, 2016). There will be disastrous consequences for the bank's profits if non-performing loans remain on the books. It is possible that banks have not implemented an effective measure to manage credit risk (Afriyie&Akotey, 2012).

In the banking industry, moral hazards and asymmetric knowledge are associated with credit risk. When it comes to profits of the bank, credit risk has a large impact because a substantial part of a bank's revenue is from loans with interest. However, the threat posed to the financial sector by credit risk is undeniable. Credit risk must be addressed effectively (Bhattarai, 2016). Past research show that bank assets quality is a strong indicator of operational efficiency. Examples of credit risk indicators include non-performing loans, which might potentially destabilize the bank's general credit system and diminish its value (Afriyie&Akotey, 2012).

2.3.4 Bank Size

Firm size determines by how much legal as well as financial elements affect a bank. As big businesses gather cheap capital and generate enormous incomes, the size of the bank is strongly related to enough capital (Amato &Burson, 2007). The book value of the entire assets of the bank typically determines its size. Additionally ROA is positively associated with bank size showing that large banks can accumulate

economies of scale hence reducing operational costs while increasing loan volumes (Amato &Burson, 2007). Bank size is related to capital rations, according to Magweva and Marime (2016), and profitability rises with size.

Burson and Amato (2007) said a company's size depends on the organization's assets. It can be argued that the more the assets owned by a bank the more the investments it can make which generate bigger returns compared to smaller firms with less assets. In addition, a bigger company may have more collateral that may be utilized as safety for more loan facilities than smaller companies (Njoroge, 2014). Lee (2009) argued that the assets being controlled by an entity impacts profitability level of the firm from one period to another.

2.4 Empirical Review

Studies havebeen done both internationally and locally to support the operational efficiency benefit of financial technology, with varying outcomes.

2.4.1 Global Studies

Abor (2013) in assessing the relationships between effect of technological innovations on banking services in Ghana. The dependent variables were financial products and facilities such as Automated Teller Machines (ATMs), Telephone lending, PC-Banking, and Electronic Funds Transfer at Point of Sale (EFTPoS) and the independent variable was the banks performance. The research was dedicated on clienteles with financial institutions that have at least one form of technological invention. The outcome of the research indicated that technological invention has contributed immensely to the facilitation of financial facilities and the development of the Ghanaian financial institution.

Agboola (2014) in his study on ICT in Banking operations in Nigeria using the nature and level of implementation in inventive technologies, level of exploitation of the identified technologies, and the impact of the implementation of ICT devices on banks, found out that technology was the major driving force of competition in the banking industry. During this study he witnessed increased adoption of ATMs, EFT, smart cards, electronic home and office lending and telephone lending. It further indicates that adoption of ICT improves the banks' image and leads to an extensive, quicker and more effective market. The study asserts that it is imperative for financial institutions management to intensify investment in ICT products to facilitate speed, convenience, and accurate services, or otherwise lose out to their competitors.

The study by Wadhe and Saluja (2015) investigated the profitability of Indian banks from 2006 to 2014, focusing on the effects of electronic banking. Data pertaining to the commercial banks in India was used in the study. Multiple regression analysis was performed to determine how banking services and profitability are interconnected. E-banking was shown to be related to increased profitability for both private and public sector banks. This research showed that increasing the number of ATMs increases profitability. While the connections were few, however, some might be established between the financial institutions' profit and the number of branches.

Khamis (2016) has investigated impact of agent banking techniques on customer services of commercial bank in Ghana. Services provided to clients have a significant impact on such elements as decreased banking hall waits times, reduced service costs and personally tailored banking services, leading to the conclusion that the development of excellent financial services and customer service is closely related. In addition, the research showed that bank representatives substantially enhance the overall efficiency and quality of customer service in banks. As a consequence, the

research deemed it essential for financial institutions to develop methods to guarantee their employees are properly motivated and to propose the usage of performance based incentives.

King'ang'ai et al. (2016) examined financial outcome of banks' performance via agents in the Rwandan country of East Africa utilizing four Rwandan commercial bank currently functional by 31 December 2015. The results from the research showed that the regulation of bank agencies, low transaction cost via banking agencies, access to banking-related services through bank agents and general development in the market had a favorable effect on performances in terms of financial position of commercial bank. Findings of linear regression model have created a favorable connection among agency banking effect and performances in terms of financial position of commercial bank.

2.4.2 Local Studies

Using secondary data gathered between 2013 and 2017, Muli (2018) investigated how commercial banks efficiency is influenced by electronic banking. All 41 banks operating in Kenya were sampled. The variable predictor has been chosen as electronic banking based on the value of transactions performed by using ATMs, mobile banking, internet, and agency banking. Performance was utilized as a study response variable. The findings showed that the good and important effects of bank size, liquidity, capital adequacy, ATMs and mobile banking were achieved. Internet banking and agency banking have been identified as statistically negligible factors for efficiency in commercial banks.

The research interests of Wanalo (2018) were focused on investigating whether the usage of technical financial technology had substantial impact on performance

financially, and to do so, examined the performances in terms of financial position of commercial bank. To do this project, the methodology involved in a descriptive research was used. This study took into consideration all commercial banks. This research included a total sample size of 15 individuals and included banks from both the commercial and non-commercial sectors. Additional data was sourced from annual reports provided by commercial banks between 2012 and 2016, along with data gathered from the CBK and from the bank's website. The research utilized panel data analysis. The findings were found using the PraisWinstein regression model. Despite the increased use of ATMs and agency banking, they have little impact on a bank's overall financial health.

Sindani, Muturi and Ngumi (2019) examined the impact of financial channels of distribution evolution on financial inclusion in in Kenya over a period of six years beginning from 2012 to 2017. Secondary data was collected for subsequent analysis. For analysis of the data collected, frequency tables, percentages and means were used to demonstrate the findings of this study. Use of descriptive statistics in this study was meant to present the category sets formed by this research. The mean, standard deviation and variance on the dependent and independent variables function was to describe the variables used for the study. The conclusion from this study is that internet banking has had a beneficial effect on Kenya's financial industry in Kenya because it promotes productivity and efficiency. Also, ATM banking has enhanced financial inclusion in Kenya.

Ogweno (2019) focused on financial technology effects on the financial performance of regulated MFI in Kenya.A total of 13 regulated microfinance institutions (MFIs) currently serve the people of the study's community.The data for the first five years of the project's life was gathered on a yearly basis throughout that time.The association

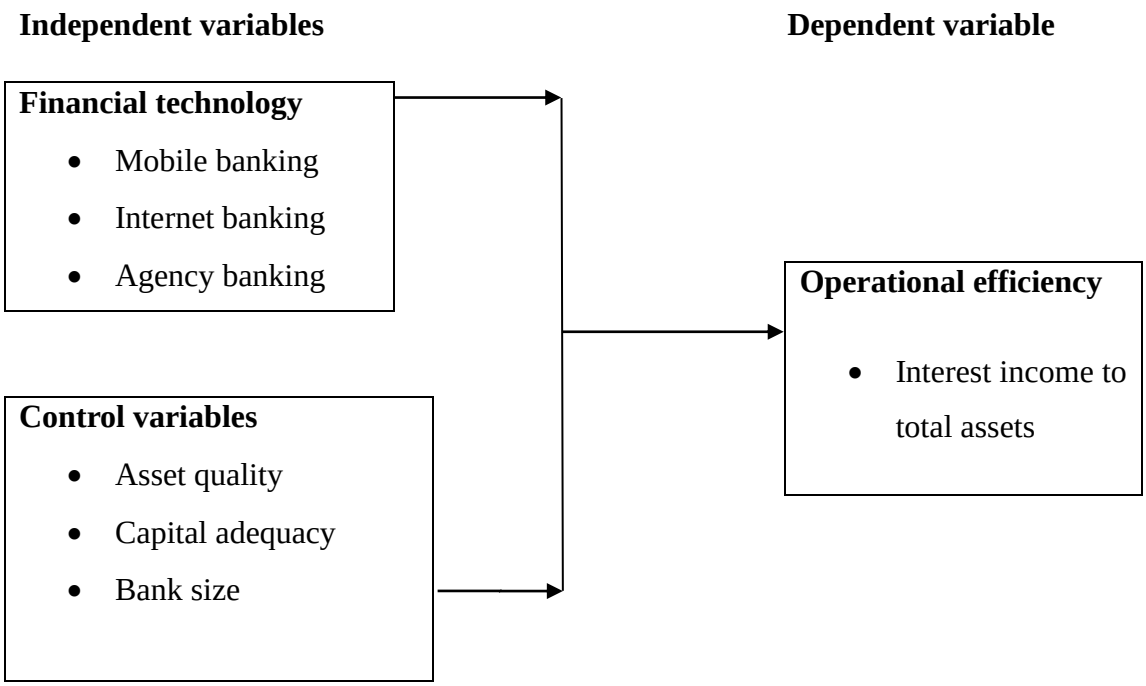
between variables was evaluated using a multiple linear regression model, and the study methodology used was a descriptive cross-sectional design, according to the findings.The findings of the research revealed that deposit, mortgage, and bank size all had a substantial impact on savings account balances and growth. There was no significant correlation found between agency banking, the number of ATMs, and the bank's financial performance.

Abdulkadir (2019) in Kenya performed an in-depth study of the effect of digital payments on the operation of commercial banks.The implementation of digital internet banking was attributed to the volume of transactions conducted through mobile and internet banking.All the data in this case comes from commercial banks.In order to account for the size of the bank, the research utilized financial institution and capital adequacy ratio variables. To gather data on all the commercial banks in Kenya, a descriptive research approach was used. The simple linear connection was created using Pearson correlation. The relationship's dynamics were uncovered by using a regression analysis. The research discovered that the financial technology contributed to financial success.

2.5 Conceptual Framework

The model that follows depicts the expected relationship between the variables. Financial technology, as defined by agency banking, mobile banking, and internet banking, were the predictor variables. Capital adequacy, asset quality and bank size were the control variables. Operational efficiency, as assessed by interest income to total assets, was the dependent variable.

Figure 2.1: The Conceptual Model



Source: Researcher (2021)

2.6 Summary of the Literature Review

Several theoretical frameworks have been proposed to explain the expected relationship between financial technology and operational efficiency. The following theories are discussed in this review: Financial intermediation theory, technological adoption model, and diffusion of innovation theory are among the theories discussed in this paper. Some of the most important operational efficiency determinants have also been examined. Several domestic and international research on financial technology and operational efficiency have been examined.

A good reason to undertake further study is the disagreement among worldwide and local studies on the impact of financial technology on commercial bank operational efficiency. Researchers must conduct comprehensive study on how financial technology impacts commercial bank operational efficiency in the Kenyan environment in order to be considered valid. The conclusions should clearly

demonstrate how financial technology influences commercial bank operational efficiency using valid methodology. This gap in knowledge was filled in this study.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter details the procedures that were followed to reach the study's overarching goal: learning if and how fintech influence banks' operational efficiency. The research emphasizes the design, data collection, as well as analysis specifically.

3.2 Research Design

To ascertain the relationship between fintech and banks' operational efficiency, a descriptive approach was used. This design was suitable since the researcher was particularly interested in the phenomenon nature (Khan, 2008). Additionally, it was adequate for describing how the occurrences are related to one another. Additionally, this design authentically and precisely represented the variables, providing satisfactory responses to the research questions (Cooper & Schindler, 2008).

3.3 Population

The population of this research was made up of Kenya's 41 commercial banks as of December 31, 2021 (see appendix I). Since the population was so small, sampling was not carried out.

3.4 Data Collection

Secondary data was relied on in this investigation which was extracted from annual published financials of the banks from 2017 to 2021 and captured in data collection forms. The reports were extracted from the CBK financial publications of the specific banks and individual bank reports. The specific data collected included net income, total assets, mobile banking transactions, internet banking transactions, agency

banking transactions, total loans, total assets, net operating income, total debt, core capital, risk weighted assets.

3.5 Diagnostic Tests

The linear regression was based on a number of assumptions including linearity, no auto-correlation, no or little multi-collinearity, homoscedasticity and multivariate normality. The diagnostic tests performed are outlined in Table 3.1

Table 3.1: Diagnostic Tests

Test	Meaning	Statistical method	Interpretation	Diagnosis
Autocorrelation	Occurs when the residuals lack independence from each other.	Durbin-Watson statistic	When the test outcomes fall within critical values (1.5<d<2.5) there is no autocorrelation	Correlogram (Auto Correlation Function-ACF plot) Review model specifications
Multicollinearity	How closely related are the independent variables of the study	Variance Inflation Factors (VIF)	VIF less than 10 implies that there is no Multicollinearity	Data that was causing Multicollinearity was adjusted using log transformation
Heteroscedasticity	When data lacks similar variance as assumed by standard linear regression model	Breusch Pagan Test Levene Test Normal P-P plots	Data split into high and low value. If data differ significantly, there is an element of heteroscedasticity	Non-linear transformation
Normality Test	When linear regression analysis for all variables is multivariate normal	Goodness of fit test Shapiro-Wilk test	Kolmogorov-Smirnov test prob.> 0.05. If the test is not substantial, the distribution is possibly normal.	Data that was not normally distributed was adjusted for using log transformation and non-linear log transformation.

Stationarity	a unit-root test to establish if the data was stationary	Levin-Lin Chu unit root test	A p value less than 0.05 implies that the data is stationary	Robust standard errors were used where data failed the test.

3.6 Data Analysis

To evaluate the data, SPSS software version 25 was employed. The results were presented quantitatively in tables and graphs. Measures of central tendency and dispersion were calculated using descriptive statistics, and standard deviation provided for each variable. Correlation and regression were used in inferential statistics. The size of the relationship between the research variables was determined by correlation, and cause and effect relationships between the variables were determined via regression. The link between the dependent and independent variables was established linearly via a multivariate regression.

3.6.1 Analytical Model

A multivariate regression model was used to assess the relative importance of each of the explanatory factors for operational efficiency in Kenya.

The study employed the following multivariate regression model;

$$Y= ß_0+ \beta_1X_1+\beta_2X_2+\beta_3X_3+ \beta_4X_4 + \beta_5X_5 + \beta_6X_6 +\varepsilon$$

Where:

Y operational efficiency given by interest income to total assets

$ß_0$ regression constant (parameter of the function)

$ß_1$, $ß_2$, $ß_3$, $ß_4$, $ß_5$ and $ß_6$ are the coefficients of independent variables

X_1 mobile banking given by Log total value of mobile banking transactions

X_2 internet banking given by Log total value of internet banking transactions

X_3 agency banking given by Log total value of agency banking transactions

X_4 asset quality given by non-performing loans to total loans

X_5 capital adequacy given by core capital to risk weighted assets

X_6 bank size given by log of total assets

έ error term

3.6.2 Tests of Significance

Parametric tests established significance of the general model and variables. ANOVA was used to do the F-test, which established the model significance, and a t-test, which established every variable significance.

CHAPTER FOUR

DATA ANALYSIS RESULTS AND FINDINGS

4.1 Introduction

This chapter presents descriptive statistics and the results and interpretations of various tests namely; test of normality, Multicollinearity, heteroskedasticity tests, autocorrelation and stationarity test. The chapter also presents the results of Pearson correlation and regression analysis.

4.2 Descriptive Statistics

This section presents the descriptive findings from the collected data. The descriptive results include mean and standard deviation for each of the study variables. The analyzed data was obtained from CBK and individual banks annual reports for a period of 5 years (2017 to 2021). The number of observations is 205 (41*5) as 41 banks provided complete data for the 5 year period. The results are as shown in Table 4.1

Table 4.1: Descriptive Results

	N	Minimum	Maximum	Mean	Std. Deviation
Operational efficiency	205	.0015	.3650	.111186	.0861992
Mobile banking	205	.2463	11.3884	4.579899	2.1673997
Internet banking	205	8.4730	17.2928	14.335374	1.5558073
Agency banking	205	8.4730	17.2928	14.265655	1.6104882
Asset quality	205	.0000	.5700	.091332	.0901119
Capital adequacy	205	.0227	1.9617	.261818	.2545613
Bank size	205	6.0724	8.7303	7.773748	.5705492
Valid N (listwise)	205				

Source: Field Data (2022)

4.3 Diagnostic Tests

As rationalised in chapter three, the researcher conducted diagnostic tests to ensure that the assumptions of Classic Linear Regression Model (CLRM) are not violated and to obtain the suitable models for examining in the consequence that the CLRM hypotheses are infringed. Accordingly, before processing regression model pre-approximation and post approximation analyses were carried out. The pre-approximation tests carried out in such cases existed in the multicollinearity test and unit root tests while the post estimation tests are normality test, test for heteroskedasticity and test for autocorrelation. The research obtained these analyses to refrain from factitious regression outcomes.

4.3.1 Normality Test

The normality of data can be tested using a variety of methods. The most commonly used methods include the Shapiro–Wilk test, Kolmogorov–Smirnov test, skewness, kurtosis, histogram, P–P Plot, box plot, Q–Q Plot, mean and standard deviation. The most extensively used normality tests are the Kolmogorov–Smirnov test and the Shapiro–Wilk test. The Shapiro–Wilk test is better for small sample sizes ($n < 50$ samples), while it can also be used on more extensive samples selections, whereas the Kolmogorov–Smirnov test is better for $n > 50$ samples. As a result, the study used the Kolmogorov–Smirnov test as the numerical method of determining normality. For both of the above tests, the null hypothesis says that the data are obtained from a normally distributed population. The null hypothesis is rejected when P-value is less than 0.05, and the data are said to be not normally distributed. If any violation of the assumption of normality was detected, necessary correction measures were applied.

Table 4.2: Test for Normality

	Kolmogorov-Smirnov	P-value
Operational efficiency	0.869	0.178
Mobile banking	0.918	0.202
Internet banking	0.881	0.194
Agency banking	0.874	0.191
Asset quality	0.892	0.201
Capital adequacy	0.923	0.220
Bank size	0.874	0.194

Source: Research Findings (2022)

From Table 4.2 results, all the study variables have a p value more than 0.05 and therefore were normally distributed.

4.3.2 Multicollinearity Test

Multicollinearity occurs when the independent variables in a regression model are significantly linked. Multicollinearity was assessed using the VIF and tolerance indices. When the VIF value is higher than ten and the tolerance score is less than 0.2, multicollinearity is present, and the assumption is broken. The VIF values are less than 10, indicating no problem with multicollinearity.

Table 4.3: Multicollinearity

	Collinearity Statistics	
Variable	**Tolerance**	**VIF**
Mobile banking	0.564	1.773
Internet banking	0.619	1.616
Agency banking	0.528	1.894
Asset quality	0.672	1.488
Capital adequacy	0.598	1.672
Bank size	0.671	1.490

Source: Research Findings (2022)

4.3.3 Heteroskedasticity Test

The residual variance from the model must be constant and unrelated to the independent variable in linear regression models calculated using the Ordinary Least Squares (OLS) method(s). Homoskedasticity refers to constant variance, whereas heteroscedasticity refers to non-constant variance (Field, 2009). The study used the Breusch-Pagan/Cook-Weisberg test to check if the variation was heteroskedastic. The null hypothesis implies constant variance, indicating that the data is homoscedastic. The results are as shown in Table 4.4.

Table 4.4: Heteroskedasticity Results

Breusch-Pagan / Cook-Weisberg test for heteroscedasticity		
chi2(1)	=	0.7392
Prob > chi2	=	0.5381

Source: Research Findings (2022)

Table 4.4 reveals that the null hypothesis was not rejected since the p-value was 0.5381, which was statistically significant (p>0.05). As a result, the dataset had homoskedastic variances. Since the P-values of Breusch-Pagan's test for homogeneity of variances were greater than 0.05. The test therefore confirmed homogeneity of variance. The data can therefore be used to conduct panel regression analysis.

4.3.4 Autocorrelation Test

Serial correlation, also known as autocorrelation, makes the standard errors of coefficients appear to be less than in linear panel data models, resulting in higher R-squared and erroneous hypothesis testing Autocorrelation was tested using Durbin-Watson test. Error terms of regression variables are uncorrelated if Durbin-Watson test is equivalent to 2 (i.e. between 1 and 3). The closer the value to 2 is; the better. The results are as shown in Table 4.5.

Table 4.5: Test of Autocorrelation

Durbin Watson Statistic
2.055

Source: Research Findings (2022)

The results in Table 4.7 show that the Durbin-Watson statistic was 2.055. This shows that the error terms of regression variables are uncorrelated as the Durbin-Watson statistic was close to 2.

4.3.5 Stationarity Test

The research variables were subjected to a panel data unit-root test to establish if the data was stationary. The unit root test was Levin-Lin Chu unit root test. At a standard statistical significance level of 5%, the test was compared to their corresponding p-values. In this test, the null hypothesis is that every panel has a unit root, and the alternative hypothesis is that at least one panel is stationary. Table 4.6 shows Levin-Lin Chu unit root test results.

Table 4.6: Levin-Lin Chu unit-root test

Levin-Lin Chu unit-root test			
Variable	**Statistic**	**p value**	**Verdict**
Operational efficiency	6.4296	0.0000	Stationary
Mobile banking	6.3653	0.0000	Stationary
Internet banking	6.8914	0.0000	Stationary
Agency banking	7.3857	0.0000	Stationary
Asset quality	6.9164	0.0000	Stationary
Capital adequacy	8.0266	0.0000	Stationary
Bank size	6.4806	0.0000	Stationary

Source: Research Findings (2022)

As demonstrated in Table 4.6, this test concludes that the data is stationary at a 5% level of statistical significance since the p-values all fall below 0.05.

4.4 Correlation Results

To determine the degree and direction of link between each predictor variable and the response variable, correlation analysis was carried out. The correlation findings in Table 4.7 display correlation nature between the research variables in relation to magnitude and direction.

Table 4.7: Correlation Results

		Operational efficiency	Mobile banking	Internet banking	Agency banking	Asset quality	Capital adequacy	Bank size
Operational efficiency	Pearson Correlation	1						
	Sig. (2-tailed)							
Mobile banking	Pearson Correlation	.215**	1					
	Sig. (2-tailed)	.000						
Internet banking	Pearson Correlation	.068	-.059	1				
	Sig. (2-tailed)	.229	.398					
Agency banking	Pearson Correlation	.034	-.006	-.068	1			
	Sig. (2-tailed)	.621	.933	.328				
Asset quality	Pearson Correlation	-.477**	-.072	-.025	-.172*	1		
	Sig. (2-tailed)	.000	.300	.724	.013			
Capital adequacy	Pearson Correlation	.440**	.035	-.242**	.151*	-.166*	1	
	Sig. (2-tailed)	.000	.618	.000	.029	.016		
Bank size	Pearson Correlation	.608**	.095	.180**	.011	-.131	.023	1
	Sig. (2-tailed)	.000	.171	.009	.873	.059	.743	

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).
c. Listwise N=205

Source: Research Findings (2022)

The correlation results disclose that mobile banking has a weak positive as well as significant link with operational efficiency of banks in Kenya (r=0.215) at 5 percent significance level while internet banking and agency banking have a positive but not

significant relationship with operational efficiency. The results also disclose that asset quality and operational efficiency have a negative as well as significant correlation (r=-0.477) at 5 % significance level. Both capital adequacy and size had positive as well as significant relation with ROA as depicted by p values below 0.05.

4.5 Regression Results

To determine the extent to which ROA is described by the chosen variables, regression analysis was used. In Table 4.8, the regression's findings are displayed.

Table 4.8: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.610[a]	.372	.357	.137076

a. Predictors: (Constant), Bank size, Agency banking, Mobile banking, Capital adequacy, Asset quality, Internet banking

Source: Research Findings (2022)

From the conclusions as epitomized by the R^2, the studied independent variables explained variations of 0.372 in operational efficiency among banks in Kenya. This suggests that other factors not incorporated in this study account for 62.8% of the variability in operational efficiency among banks in Kenya, while the six variables account for 37.2% of those variations.

Table 4.9: ANOVA Analysis

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.921	6	.487	25.910	.000[b]
	Residual	4.942	198	.019		
	Total	7.863	204			

a. Dependent Variable: Operational efficiency

b. Predictors: (Constant), Bank size, Agency banking, Mobile banking, Capital adequacy, Asset quality, Internet banking

Source: Research Findings (2022)

The data had a 0.000 significance level, according to Table 4.9's ANOVA results, which suggests that the model is the best choice for drawing conclusions about the variables.

Table 4.10: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.474	.052		7.038	.000
	Mobile banking	.164	.013	.114	3.219	.000
	Internet banking	.005	.007	.021	.480	.630
	Agency banking	.012	.017	.026	.610	.540
	Asset quality	-.159	.042	-.150	-3.376	.000
	Capital adequacy	.741	.014	.695	16.630	.000
	Bank size	.295	.006	.286	6.723	.000
a. Dependent Variable: ROA						

Source: Research Findings (2022)

The coefficient of regression model was as below;

$$\mathbf{Y = 0.474+0.164X_1 - 0.159X_2 + 0.741X_3 + 0.295X_4}$$

Where:

Y = ROA; X_1 = Mobile banking; X_2 = Asset quality; X_3= Capital adequacy;

X_4 = Bank size

4.6 Discussion of Research Findings

The objective of this research was to establish the effect of fintech on operational efficiency of banks in Kenya. The study utilized a descriptive design while population was the 41 banks in Kenya. Complete data was obtained from all the 41 banks in Kenya and which were considered adequate for regression analysis. The research utilized secondary data which was gotten from CBK and individual bank annual reports. The specific attributes of fintech considered were; mobile banking, internet banking and agency banking. The control variables were asset quality, firm size and

capital adequacy. Both descriptive as well as inferential statistics were used to analyze the data. The results are discussed in this section.

Multivariate regression results revealed that the R square was 0.372 implying 37.2% of changes in operational efficiency of banks are due to the six variables alterations selected for this study. This means that variables not considered explain 62.8% of changes in operational efficiency. The overall model was also statistically significant as the p value was 0.000 which is less than the significance level of 0.05. This implies that the overall model had the required goodness of fit.

The multivariate regression analysis further revealed that individually, mobile banking has a positive and significant effect on operational efficiency of banks (β=0.164, p=0.000). Internet banking and agency banking exhibited a positive but not statistically significant influence on operational efficiency. Asset quality has a negative effect on operational efficiency of banks s as shown by (β=-0.159, p=0.000). Capital adequacy and firm size exhibited a positive and significant operational efficiency influence as shown by (β=0.741, p=0.000) and (β=0.295, p=0.000) respectively.

These conclusions concur with those of Muli (2018) who investigated how commercial banks efficiency is influenced by fintech. A sample was taken from each of Kenya's 41 banks. The variable predictor has been chosen as fintech based on the value of transactions performed by using ATMs, mobile banking, internet, and agency banking. Performance was utilized as a study response variable. The findings showed that the good and important effects of bank size, liquidity, capital adequacy, ATMs and mobile banking were achieved. Internet banking and agency banking have been identified as statistically negligible factors for efficiency in commercial banks.

The research findings also concur with Ogweno (2019) who looked at the impact of financial innovations on the Kenyan regulated BANK market's financial performance. The population comprised 13 registered microfinance institutions (BANKs). Every year over the first five years of the project's existence, data were collected. The results show that a descriptive cross-sectional design was utilized in the study methodology, and a multiple linear regression model was used to assess the connection between variables. The study's conclusions showed that deposit, mortgage, and bank size all had a significant impact on the growth and balances of savings accounts. The number of ATMs, agency banking, mobile banking and bank financial performance were not significantly correlated.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The key aim of the research was determining how fintech influences the operational efficiency of banks in Kenya. This section includes a summary of the findings from the previous chapter as well as the conclusions and limitations of the study. Additionally, it makes recommendations for potential policy measures. The chapter provides recommendations for further research

5.2 Summary

The objective of this research was to establish the effect of fintech on operational efficiency of banks in Kenya. The study utilized a descriptive design while population was the 41 banks in Kenya. Complete data was obtained from all the 41 banks in Kenya and which were considered adequate for regression analysis. The research utilized secondary data which was gotten from CBK and individual bank annual reports. The specific attributes of fintech considered were; mobile banking, internet banking and agency banking. The control variables were asset quality, firm size and capital adequacy. Both descriptive as well as inferential statistics were used to analyze the data. The results are discussed in this section.

The correlation results disclose that mobile banking has a weak positive as well as significant link with operational efficiency of banks in Kenya while internet banking and agency banking have a positive but not significant relationship with operational efficiency. The results also disclose that asset quality and operational efficiency have a negative as well as significant correlation. Both capital adequacy and size had positive as well as significant relation with operational efficiency.

Multivariate regression results revealed that the R square was 0.372 implying 37.2% of changes in operational efficiency of banks are due to the six variables alterations selected for this study. This means that variables not considered explain 62.8% of changes in operational efficiency. The overall model was also statistically significant as the p value was 0.000 which is less than the significance level of 0.05. This implies that the overall model had the required goodness of fit.

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5.3 Conclusions

The study purpose of the research was to find out the association between fintech and operational efficiency among banks in Kenya. The study results indicated that mobile banking had a positive as well as significant effect on operational efficiency. This may imply that banks which have adopted mobile banking in a large scale are likely to record a high level of operational efficiency compared with banks with less mobile banking adoption.

The findings indicated that asset quality had a negative as well as significant impact on operational efficiency. This may imply that banks with high asset quality have low levels of operational efficiency. Asset quality management is therefore necessarily to

achieve the targeted performance. The study concludes that asset quality affects operational efficiency among banks in Kenya in a negative manner.

The study conclusions revealed that capital adequacy had a positive as well as significant effect on operational efficiency. This may mean that the banks that have adequate capital are able to meet their obligations when they fall due and are also able to take advantage of investment opportunities that might arise in the course of doing business and therefore high levels of operational efficiency compared with firms that has less capital adequacy.

The research outcomes further depicted that bank size possessed a positive as well as significant effect on operational efficiency which might mean that an increase in asset base of a bank leads to enhanced operational efficiency. This can be explained by the fact that bigger banks are likely to have developed structures to monitor the internal operations of a firm leading to better operational efficiency. Bigger banks are also likely to have better governance structure which can also explain the high operational efficiency associated with firm size.

5.4 Recommendations for Policy and Practice

The study findings reveal that mobile banking had a positive and significant effect on operational efficiency. The study therefore recommends that the management of banks in Kenya should work on increasing their scale of mobile banking as this will contribute to enhancement of operational efficiency. The policy makers such as the CBK should create a conducive environment for banks to conduct mobile banking activities.

The research findings reveal that asset quality had a negative as well as significant impact on operational efficiency. The research therefore commends that the

administrators of banks should work on reducing the level of non-performing loans. This can be achieved by coming with effective asset quality management methods that will enable the bank distinguish between good and bad borrowers.

From the study findings, capital adequacy was found to enhance operational efficiency of banks, this study recommends that banks should keep adequate capital levels to sustain their obligations when they fall due whereas simultaneously time enjoying short term investment chances which may arise. The policy makers should set a limit of the capital adequacy level that banks should have as too much capital adequacy is also disadvantageous as it comes with opportunity costs.

5.5 Limitations of the Study

The focus was on various factors which are thought to influence operational efficiency of Kenyan banks. The research focused on six explanatory variables in particular. However, in certainty, there is presence of other variables probable to influence operational efficiency of firms including internal like corporate governance attributes and management efficiency whereas others are beyond the control of the firm like interest rates as well as political stability.

In this study, a five-year period from 2017 to 2021 was selected. There is no proof that comparable results will remain the same across a longer time frame. Moreover, it is impossible to predict if the same outcomes would persist until 2021. Given that additional time contains instances of big economic transitions like recessions and booms, it is more dependable.

The quality of the data was the main restriction for this study. It is impossible to conclusively conclude that the study's findings accurately reflect the current reality. It has been presumed that the data utilized in the study are accurate. Due to the current

conditions, there has also been a great deal of incoherence in the data measurement. The study made use of secondary data rather than primary data. Due to the limited availability of data, only some of the growth drivers have been considered.

The data analysis was performed using regression models. Because of the limitations associated with using the model, like inaccurate or erroneous findings resulting from a change in the variable value, the researchers would not be able to generalize the conclusions precisely. A regression model cannot be performed using the prior model after data is added to it.

5.6 Suggestions for Further Research

This study focused on banks in Kenya. Further studies can focus on a wide scope by covering other financial institutions in Kenya to back or criticize the results of the current study. Further, this study focused on three measures namely; mobile banking, internet banking and agency banking. Future studies should focus on other fintech measures that were not considered in this study.

The current research scope was restricted to five years; more research can be done past five years to determine whether the results might persist. Thus, inherent future studies may use a wider time span, that can either support or criticize the current research conclusions. The scope of the study was additionally constrained in terms of context where banks were examined. Further studies can be extended to other financial firms to establish if they complement or contradict the current study findings. Researchers in the East African region, the rest of Africa, and other global jurisdictions can too perform the research in these jurisdictions to ascertain if the current research conclusions would persist.

The research only used secondary data; alternate research may use primary data sources such in-depth questionnaires and structured interviews given to practitioners and stakeholders. These can then affirm or criticize the results of the current research. This study used multiple linear regression and correlation analysis; future research could use other analytic techniques such factor analysis, cluster analysis, granger causality, discriminant analysis, and descriptive statistics, among others.

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APPENDICES

Appendix I: List of Commercial Banks in Kenya

1. ABSA Bank Kenya Plc
2. Access bank (Kenya) Limited
3. African Banking Corporation Limited
4. Bank of Africa Kenya Limited
5. Bank of Baroda (Kenya) Limited
6. Bank of India
7. Charterhouse Bank Limited (in liquidation)
8. Chase Bank Kenya Limited (in liquidation)
9. Citibank N.A Kenya
10. Consolidated Bank of Kenya Limited
11. Co-operative Bank of Kenya Limited
12. Credit Bank Limited
13. Development Bank of Kenya Limited
14. DIB Bank of Kenya Limited
15. Diamond Trust Bank Kenya Limited
16. Ecobank Kenya Limited
17. Equity Bank Kenya Limited
18. Family Bank Limited
19. First Community Bank Limited
20. Guaranty Trust Bank (Kenya) Limited
21. Guardian Bank Limited
22. Gulf African Bank Limited
23. Habib Bank AG Zurich
24. Imperial Bank Limited (in receivership)
25. I&M Bank Limited
26. Kingdom Bank Limited
27. KCB Bank Kenya Limited
28. Mayfair CIB Bank Limited
29. Middle East Bank Kenya Limited
30. M Oriental Bank Limited
31. National Bank of Kenya Limited

32. NCBA Bank Plc
33. Paramount Bank Limited
34. Prime Bank Limited
35. SBM Bank Kenya Limited
36. Sidian Bank Limited
37. Spire Bank Limited
38. Stanbic Bank Kenya Limited
39. Standard Chartered Bank Kenya Limited
40. UBA Kenya Bank Limited
41. Victoria Commercial Bank Limited

Source: CBK (2021)

Appendix II: Research Data

Bank	Year	Operational efficiency	Mobile banking	Internet banking	Agency banking	Asset quality	Capital adequacy	Bank size
1	2017	0.0826	5.1251	13.4492	9.6530	0.1600	0.1723	8.2162
1	2018	0.1139	4.5563	14.5950	11.2650	0.0600	0.1645	8.2177
1	2019	0.1465	6.7565	14.6453	10.3690	0.1500	0.1528	8.2509
1	2020	0.1945	7.4478	14.8834	9.6263	0.0400	0.1560	8.2695
1	2021	0.1736	7.2316	15.0790	13.4537	0.0500	0.1844	8.3168
2	2017	0.2410	2.7423	14.6052	13.4492	0.1400	0.1592	8.3379
2	2018	0.1590	3.2537	15.9889	14.5950	0.1500	0.1639	8.4239
2	2019	0.0644	2.8869	15.9219	14.6453	0.1200	0.1616	8.4141
2	2020	0.0604	2.9535	15.8584	14.8834	0.0900	0.1578	8.4557
2	2021	0.0310	2.7541	15.7852	15.0790	0.1100	0.1602	8.4859
3	2017	0.0279	6.4279	13.7599	14.6052	0.0100	1.8796	8.2067
3	2018	0.0248	6.6621	14.5768	15.9889	0.0200	1.9617	8.2879
3	2019	0.0139	6.6387	14.9398	15.9219	0.0200	0.3053	8.3768
3	2020	0.0019	6.5259	14.7218	15.8584	0.0400	0.3229	8.4253
3	2021	0.1050	6.3715	15.1152	15.7852	0.0600	0.3466	8.4516
4	2017	0.0840	1.1578	15.3316	13.7599	0.1300	0.1596	7.5576
4	2018	0.1331	1.3225	13.5734	14.5768	0.1200	0.1840	7.6198
4	2019	0.1709	1.6563	14.2855	14.9398	0.1300	0.1786	7.5878
4	2020	0.0574	1.4725	14.4647	14.7218	0.1700	0.1803	7.5652
4	2021	0.1230	1.2701	14.9982	15.1152	0.2200	0.1638	7.5406
5	2017	0.0887	7.0066	11.1449	15.3316	0.0400	0.3941	8.0577
5	2018	0.0937	6.9122	12.7982	13.5734	0.0500	0.4230	8.1238

Bank	Year	Operational efficiency	Mobile banking	Internet banking	Agency banking	Asset quality	Capital adequacy	Bank size
5	2019	0.0986	7.0197	12.5000	14.2855	0.0100	0.4574	8.1659
5	2020	0.0999	6.5030	12.9661	14.4647	0.0100	0.5397	8.2286
5	2021	0.1514	5.3769	14.0891	14.9982	0.0700	0.4392	8.3287
6	2017	0.0609	7.3306	13.2541	11.1449	0.1000	0.2730	8.5767
6	2018	0.2966	6.6133	14.2506	12.7982	0.0800	0.2832	8.6278
6	2019	0.2323	5.9541	13.1748	12.5000	0.0200	0.2637	8.6514
6	2020	0.2298	6.0810	14.1294	12.9661	0.3900	0.2555	8.6986
6	2021	0.1657	5.4965	12.9685	14.0891	0.0600	0.2764	8.7303
7	2017	0.0105	3.8258	15.6607	13.2541	0.0400	0.1791	8.0019
7	2018	0.0572	3.5541	16.2099	14.2506	0.1500	0.1792	8.0506
7	2019	0.0125	4.0251	15.9346	13.1748	0.3100	0.1845	8.0485
7	2020	0.0912	5.7342	16.0608	14.1294	0.0200	0.1732	8.1428
7	2021	0.0185	5.6053	16.0866	12.9685	0.1100	0.1573	8.1599
8	2017	0.1863	2.8898	13.9119	15.6607	0.3500	0.1099	7.9815
8	2018	0.0950	5.5063	13.1426	16.2099	0.1800	0.0939	8.0263
8	2019	0.1526	4.3085	13.8898	15.9346	0.3900	0.0790	8.0767
8	2020	0.1072	7.6511	14.0673	16.0608	0.1900	0.0509	8.1894
8	2021	0.0096	5.8032	14.0719	16.0866	0.0500	0.0280	8.2824
9	2017	0.0175	2.4783	13.0293	13.9119	0.1000	0.1883	8.0201
9	2018	0.0041	2.4053	13.0224	13.1426	0.1100	0.1551	8.0438
9	2019	0.1415	3.5773	13.2537	13.8898	0.1200	0.2285	7.9725
9	2020	0.1548	2.2843	13.5020	14.0673	0.0400	0.1477	7.9744
9	2021	0.1681	2.2110	13.7576	14.0719	0.0500	0.1451	7.9950

Bank	Year	Operational efficiency	Mobile banking	Internet banking	Agency banking	Asset quality	Capital adequacy	Bank size
10	2017	0.0296	5.1441	15.0340	13.0293	0.0200	0.2165	8.1877
10	2018	0.0382	5.2963	15.0109	13.0224	0.0200	0.2126	8.2356
10	2019	0.0419	5.8661	15.5781	13.2537	0.1900	0.2277	8.2709
10	2020	0.0275	6.9341	16.1124	13.5020	0.0200	0.0227	8.3291
10	2021	0.0570	6.0711	16.1330	13.7576	0.0300	0.1618	8.3508
11	2017	0.0402	5.3464	14.3210	15.0340	0.0900	0.2345	8.3898
11	2018	0.0415	5.9238	14.3780	15.0109	0.0900	0.2442	8.4802
11	2019	0.2296	5.0765	14.6360	15.5781	0.1000	0.2508	8.5279
11	2020	0.2144	6.9348	14.4732	16.1124	0.0400	0.2355	8.5719
11	2021	0.1606	7.6295	14.2760	16.1330	0.0200	0.2456	8.6261
12	2017	0.1440	7.9523	14.2875	14.3210	0.0200	0.2291	7.2060
12	2018	0.1219	7.8483	15.2683	14.3780	0.0200	0.1463	7.1988
12	2019	0.0957	6.9704	15.6160	14.6360	0.0300	0.1850	7.2236
12	2020	0.2794	6.6765	16.3843	14.4732	0.0400	0.1901	7.3186
12	2021	0.2788	6.8287	16.3125	14.2760	0.0300	0.2111	7.3549
13	2017	0.1096	3.0733	8.6540	14.2875	0.0600	0.4230	7.7230
13	2018	0.0593	2.2910	8.4730	15.2683	0.1900	0.4574	7.6766
13	2019	0.2438	0.3275	8.7650	15.6160	0.1900	0.5397	7.5374
13	2020	0.1236	8.1011	8.9370	16.3843	0.0200	0.7005	7.4993
13	2021	0.1261	7.4564	8.9819	16.3125	0.0400	0.2990	7.4789
14	2017	0.1169	1.5561	14.5097	8.6540	0.3000	0.3184	7.6874
14	2018	0.0870	1.7376	14.4261	8.4730	0.2400	0.2496	7.7237
14	2019	0.0850	3.3564	15.1980	8.7650	0.2000	0.1944	7.5611

Bank	Year	Operational efficiency	Mobile banking	Internet banking	Agency banking	Asset quality	Capital adequacy	Bank size
14	2020	0.0769	3.2217	15.6354	8.9370	0.1700	0.1599	7.6254
14	2021	0.0621	3.7710	14.6307	8.9819	0.1400	0.1659	7.6188
15	2017	0.0665	3.9301	15.8102	14.5097	0.0000	0.2120	8.2162
15	2018	0.0515	4.4434	15.8072	14.4261	0.2000	0.2018	8.2177
15	2019	0.0227	3.8448	16.6319	15.1980	0.0100	0.1966	8.2509
15	2020	0.0227	3.2752	16.5526	15.6354	0.0200	0.2041	8.2695
15	2021	0.2837	2.6956	16.4875	14.6307	0.1200	0.2041	8.3168
16	2017	0.0015	1.4248	13.9028	15.8102	0.0200	0.2691	7.3921
16	2018	0.0337	1.0373	14.1470	15.8072	0.0300	0.1441	7.3912
16	2019	0.1402	0.9045	15.6077	16.6319	0.1300	0.2078	7.4269
16	2020	0.0819	1.8812	15.9390	16.5526	0.3800	0.1986	7.4953
16	2021	0.3061	2.9505	15.7806	16.4875	0.0100	0.1952	7.6089
17	2017	0.1685	5.8197	14.2011	13.9028	0.0500	0.1125	7.7088
17	2018	0.2919	5.2869	14.7579	14.1470	0.0500	0.1145	7.7925
17	2019	0.2136	5.6893	15.0670	15.6077	0.0700	0.1399	7.7958
17	2020	0.0041	4.6180	15.1934	15.9390	0.0500	0.1534	7.8087
17	2021	0.0041	5.0652	15.2987	15.7806	0.0500	0.0911	7.7387
18	2017	0.1179	4.3657	14.7349	14.2011	0.0700	0.2335	8.1416
18	2018	0.2618	4.6527	14.4013	14.7579	0.0600	0.2649	8.2161
18	2019	0.1030	4.8576	14.5828	15.0670	0.0500	0.2547	8.2482
18	2020	0.1341	4.9525	14.6201	15.1934	0.0400	0.2387	8.2873
18	2021	0.0918	6.1537	14.8757	15.2987	0.0300	0.2597	8.2934
19	2017	0.0045	10.0598	11.6827	14.7349	0.2100	0.1712	7.0270

Bank	Year	Operational efficiency	Mobile banking	Internet banking	Agency banking	Asset quality	Capital adequacy	Bank size
19	2018	0.0527	7.9749	12.5462	14.4013	0.0500	0.1763	6.9998
19	2019	0.0538	9.6619	11.9296	14.5828	0.0500	0.1904	6.9773
19	2020	0.0737	3.6584	12.9837	14.6201	0.0800	0.2022	6.9368
19	2021	0.0201	4.4554	13.0078	14.8757	0.0300	0.2275	6.9339
20	2017	0.0475	4.1929	13.7061	11.6827	0.5700	0.1351	6.8581
20	2018	0.0879	8.6744	14.0772	12.5462	0.5300	0.1577	6.8614
20	2019	0.1244	5.2021	14.2170	11.9296	0.0800	0.1872	6.9607
20	2020	0.0180	4.7512	14.4033	12.9837	0.0600	0.1620	7.0390
20	2021	0.0180	4.6638	13.6780	13.0078	0.0000	0.1866	7.1179
21	2017	0.1605	3.8078	12.4380	13.7061	0.0600	0.2022	8.3379
21	2018	0.1071	3.8256	12.6520	14.0772	0.0700	0.3213	8.4239
21	2019	0.0045	3.9366	13.4776	14.2170	0.0600	0.3911	8.4141
21	2020	0.0225	4.7076	12.3870	14.4033	0.0400	0.1700	8.4557
21	2021	0.0400	2.7861	13.4740	13.6780	0.1200	0.1534	8.4859
22	2017	0.0397	2.8513	14.8357	12.4380	0.1300	0.3909	8.3379
22	2018	0.0421	2.9480	14.6567	12.6520	0.1600	0.1813	8.4239
22	2019	0.1185	2.6592	15.1431	13.4776	0.2000	0.1769	6.7611
22	2020	0.0468	2.7969	15.4955	12.3870	0.2300	0.1700	6.7943
22	2021	0.0662	2.7711	16.1981	13.4740	0.0200	0.1534	8.2879
23	2017	0.1105	2.4030	13.9230	14.8357	0.0600	0.1885	8.2067
23	2018	0.0800	2.6147	14.9697	14.6567	0.0600	0.2020	8.2879
23	2019	0.0468	2.4046	15.1743	15.1431	0.1000	0.1815	8.3768
23	2020	0.0759	2.1650	16.4039	15.4955	0.0800	0.1858	8.4253

Bank	Year	Operational efficiency	Mobile banking	Internet banking	Agency banking	Asset quality	Capital adequacy	Bank size
23	2021	0.2283	8.2018	16.3720	16.1981	0.1200	0.1793	8.4516
24	2017	0.2214	8.8776	13.1488	13.9230	0.1600	0.2610	8.4859
24	2018	0.3650	8.0052	13.1722	14.9697	0.1400	0.1625	8.3379
24	2019	0.0561	8.5523	14.2912	15.1743	0.1100	0.2008	8.4239
24	2020	0.0168	8.6836	13.9164	16.4039	0.1100	0.1933	6.0724
24	2021	0.1243	0.7826	13.7920	16.3720	0.1700	0.1915	6.5049
25	2017	0.1145	0.9095	15.9989	13.1488	0.0500	0.2101	7.5107
25	2018	0.1364	1.4783	16.5515	13.1722	0.0100	0.1536	7.5376
25	2019	0.0400	1.9144	17.1188	14.2912	0.0900	0.1801	7.5084
25	2020	0.0199	2.3880	17.2928	13.9164	0.1000	0.1663	7.6403
25	2021	0.0111	2.6507	17.1680	13.7920	0.0300	0.1955	7.6508
26	2017	0.2872	2.2119	13.1120	15.9989	0.0500	0.1945	8.3898
26	2018	0.0267	2.2886	13.4730	16.5515	0.0100	0.4270	8.4802
26	2019	0.0035	2.5349	13.2621	17.1188	0.0900	0.3933	8.5279
26	2020	0.1599	3.0281	13.1230	17.2928	0.0300	0.5708	8.5719
26	2021	0.1599	2.9394	13.7946	17.1680	0.0500	0.4494	8.6261
27	2017	0.1966	2.8013	13.1780	13.1120	0.0100	0.4576	7.6734
27	2018	0.2632	2.8432	13.2730	13.4730	0.0700	0.3498	7.7973
27	2019	0.0323	3.8223	13.2089	13.2621	0.0900	0.3869	7.6170
27	2020	0.0706	2.8331	13.1657	13.1230	0.0700	0.3316	7.6754
27	2021	0.1038	2.7102	13.4661	13.7946	0.0800	0.3093	7.6856
28	2017	0.1004	2.6740	15.8709	13.1780	0.0100	0.1393	7.1251
28	2018	0.0773	2.3577	15.8396	13.2730	0.0000	0.1399	7.0917

Bank	Year	Operational efficiency	Mobile banking	Internet banking	Agency banking	Asset quality	Capital adequacy	Bank size
28	2019	0.0718	2.4099	16.0799	13.2089	0.0800	0.0715	7.1023
28	2020	0.0745	11.3884	16.5700	13.1657	0.0700	0.0542	7.1695
28	2021	0.0365	9.3893	16.7438	13.4661	0.2500	0.0370	7.1649
29	2017	0.0635	7.2817	14.1168	15.8709	0.1400	0.2104	7.4691
29	2018	0.0277	6.7329	16.1623	15.8396	0.1600	0.2059	7.4211
29	2019	0.0882	5.8688	16.3715	16.0799	0.0000	0.2304	7.4344
29	2020	0.0327	4.7591	16.3834	16.5700	0.0100	0.2227	7.4408
29	2021	0.0327	4.3676	16.4759	16.7438	0.0000	0.1869	7.4577
30	2017	0.2284	3.8762	12.5908	14.1168	0.0300	0.2545	7.1018
30	2018	0.3270	3.4674	12.6277	16.1623	0.0100	0.2412	7.0967
30	2019	0.2227	3.4581	13.0815	16.3715	0.0300	0.2741	7.0904
30	2020	0.2210	3.4841	13.3428	16.3834	0.0400	0.2946	7.1179
30	2021	0.2283	3.4685	13.5197	16.4759	0.0300	0.2853	7.1249
31	2017	0.2175	3.0992	13.0425	12.5908	0.0200	0.1676	7.1984
31	2018	0.2715	3.5693	13.4555	12.6277	0.0400	0.1729	7.2791
31	2019	0.2842	3.6862	14.1686	13.0815	0.0600	0.2216	7.3376
31	2020	0.2461	6.8343	14.4548	13.3428	0.2300	0.2248	7.4162
31	2021	0.2692	6.7928	14.6174	13.5197	0.0300	0.3729	7.4263
32	2017	0.3188	5.9359	13.5625	13.0425	0.0300	0.2056	6.5049
32	2018	0.3282	7.6256	14.2903	13.4555	0.1000	0.2468	7.5107
32	2019	0.3134	7.5373	14.9790	14.1686	0.0300	0.2325	7.5376
32	2020	0.0600	3.6862	14.9697	14.4548	0.0400	0.1646	7.5084
32	2021	0.0642	6.8343	14.7987	14.6174	0.0400	0.1440	7.6403

Bank	Year	Operational efficiency	Mobile banking	Internet banking	Agency banking	Asset quality	Capital adequacy	Bank size
33	2017	0.0383	6.7928	14.3780	13.5625	0.1000	0.1723	7.6508
33	2018	0.0409	9.0631	14.7036	14.2903	0.0000	0.1870	8.3898
33	2019	0.1052	8.8924	14.9574	14.9790	0.0300	0.1812	8.4802
33	2020	0.1249	5.3014	14.8312	14.9697	0.0800	0.1684	8.5279
33	2021	0.1203	5.2639	14.5404	14.7987	0.0300	0.1723	8.5719
34	2017	0.2358	5.3700	16.0002	14.3780	0.0000	0.1982	8.6261
34	2018	0.1874	4.5236	16.2735	14.7036	0.0000	0.2116	7.6734
34	2019	0.1596	4.0286	16.1346	14.9574	0.1100	0.2091	7.7973
34	2020	0.1253	0.4569	16.2419	14.8312	0.1000	0.1852	7.6170
34	2021	0.1372	0.7479	16.4453	14.5404	0.0900	0.1947	7.6754
35	2017	0.0661	0.7480	14.7419	16.0002	0.1600	0.1071	7.6856
35	2018	0.0758	0.8429	14.8352	16.2735	0.1900	0.1745	7.1251
35	2019	0.0722	3.6403	14.0358	16.1346	0.2300	0.1627	7.0917
35	2020	0.0795	5.5968	14.6208	16.2419	0.1900	0.1265	7.1023
35	2021	0.0795	5.2449	14.7272	16.4453	0.2600	0.2201	7.1695
36	2017	0.0868	5.2609	13.1792	14.7419	0.2700	0.2773	7.1649
36	2018	0.0940	5.5477	13.5055	14.8352	0.2300	0.2164	7.4691
36	2019	0.0215	0.2463	13.5092	14.0358	0.2200	0.2230	7.4211
36	2020	0.0961	7.1792	14.2825	14.6208	0.0600	0.2908	7.4344
36	2021	0.0562	7.0968	14.3957	14.7272	0.2300	0.2111	7.4408
37	2017	0.0812	6.3610	10.7413	13.1792	0.1200	0.5862	7.4577
37	2018	0.0910	5.6699	10.8024	13.5055	0.0500	0.2379	7.1018
37	2019	0.0507	4.9121	10.9464	13.5092	0.0600	0.3868	7.0967

Bank	Year	Operational efficiency	Mobile banking	Internet banking	Agency banking	Asset quality	Capital adequacy	Bank size
37	2020	0.0743	4.9245	11.8670	14.2825	0.0500	0.3878	7.0904
37	2021	0.0581	4.4818	12.9946	14.3957	0.0900	0.3316	7.1179
38	2017	0.0650	4.2288	13.2541	11.1449	0.1300	0.2908	7.1249
38	2018	0.0540	4.3671	14.2506	12.7982	0.1700	0.1723	7.1984
38	2019	0.0468	4.8607	13.1748	12.5000	0.1200	0.2545	7.2791
38	2020	0.0138	3.9169	14.1294	12.9661	0.0400	0.2274	7.3376
38	2021	0.0138	2.8042	12.9685	14.0891	0.0300	0.2109	7.4162
39	2017	0.3482	5.2970	15.6607	13.2541	0.0400	0.1592	7.4263
39	2018	0.2536	4.6800	16.2099	14.2506	0.0498	0.1639	8.2161
39	2019	0.0833	4.5000	15.9346	13.1748	0.0389	0.1616	8.2482
39	2020	0.0851	4.4200	16.0608	14.1294	0.0387	0.1578	8.2873
39	2021	0.0991	3.4100	16.0866	12.9685	0.0360	0.1602	8.2934
40	2017	0.2214	2.8300	13.9119	15.6607	0.0284	1.8796	7.0270
40	2018	0.3650	4.0000	13.1426	16.2099	0.0498	1.9617	6.9998
40	2019	0.0561	3.1800	13.8898	15.9346	0.0389	0.3053	6.9773
40	2020	0.0168	3.9900	14.0673	16.0608	0.0387	0.3229	6.9368
40	2021	0.1243	4.0000	14.0719	16.0866	0.0360	0.3466	6.9339
41	2017	0.0912	3.3500	13.0293	13.9119	0.0284	0.1596	6.8581
41	2018	0.1378	3.2600	13.0224	13.1426	0.0449	0.1840	6.8614
41	2019	0.1111	3.3800	13.2537	13.8898	0.0446	0.1786	6.9607
41	2020	0.0781	3.7600	13.5020	14.0673	0.0471	0.1803	7.0390
41	2021	0.0672	3.3700	13.7576	14.0719	0.0278	0.1638	7.1179