Journal of
Accounting
(JACC)

Mobile Banking and Technical Efficiency of Commercial Banks in Kenya

CARI Journals

Journal of Accounting

ISSN: 2520-7466 (Online)

Vol. 6, Issue No. 1, pp 1 - 20, 2023

www.carijournals.org

Mobile Banking and Technical Efficiency of Commercial Banks in Kenya

Joyce Chepkoech Getugi

Graduate School of Business, Catholic University of Eastern Africa

P.O Box 62157 Bogani E Rd, Nairobi, Kenya

Corresponding email: jgetugi28@gmail.com

Dr. Cliff Osoro

Graduate School of Business, Catholic University of Eastern Africa

P.O Box 62157 Bogani E Rd, Nairobi, Kenya

Prof. Allan Kihara

Chandaria School of Business, United States International University - Africa

P. O. Box 14634 – 00800 Nairobi, Kenya, East Africa

Accepted: 21st June 2023 Received in Revised Form: 25th June 2023 Published: 30th June 2023

Abstract

Purpose: The financial sector is being revolutionized as a direct result of technological progress, with banks and other financial institutions embracing new technologies to better serve their customers online. Technological developments in the financial sector are simplifying access to financial services. The study set out to dissect the effects of Fintech on Kenya's commercial banking sector. The general objective was to establish the effect of mobile banking on technical efficiency of commercial banks in Kenya. The study was anchored on Theory of Constraint-Induced Innovation.

Methodology: The entire study relied on collecting empirical data and evaluating hypothesis in a positivist way. A causal-comparative research design was used in this research. The study targeted population of Seventeen Kenyan commercial banks from the first and second tiers. The analysis relied on secondary sources of information. The gathered quantitative data was analyzed using both descriptive and inferential statistics. Numbers, medians, and standard deviations were used to characterize the data, and frequency distributions were used to determine the sample size. Models for analyzing correlations and regressions are inferential statistics. STATA was used for the data analysis.

Findings: The study established that mobile banking has a positive and significant effect on technical efficiency of commercial banks in Kenya.

Unique contribution to theory, practice and policy: Commercial banks in Kenya are recommended to improve their mobile banking services in light of the study's findings.

Key Words: *Mobile Banking, Technical Efficiency and Commercial Banks*

Background to the Study

Technology is slowly but surely reshaping the financial industry (Hurni, Palmié, & Miehé, 2020). Financial institutions are increasingly relying on financial technology (FinTech) platforms in an effort to provide customers with cutting-edge products and services. Traditional financial institutions, especially banks, are threatened by the rise of FinTech, which has been attributed to technological digitalization (Gerlach & Lutz, 2021). As a result of technological advancements, the financial sector has seen dramatic changes in service delivery, making previously inaccessible services readily available to consumers (Chanias, Myers, & Hess, 2019). Fiat currency is being replaced by digital currency, traditional banks are being replaced by mobile, online banking, digital payment systems, and e-finance. Constant advancements are slowly but surely altering the financial industry (Risman, Mulyana, Silvatika, & Sulaeman, 2021). New digital trends are largely responsible for the dramatic rise in demand for FinTech services (Abbasi & Weigand, 2017), as well as for the radical transformation of financial institutions that has accompanied it (Beloke & AP, 2021; Khanboubi, Boulmakoul & Tabaa, 2019). While the incorporation of technology into banking is nothing new, the rapid expansion of Fintech over the past decade has caught the attention of many. Over the next decade, technology developments and shifting consumer tastes are expected to significantly alter bank operations (Koch & Siering, 2017). Because of this, the way services and products are sold, as well as customer interactions and satisfaction, may need to be rethought. Sub-Saharan Africa has made great strides in financial development over the past two decades, but fintech has the ability to speed up and enhance those advances (Thaker, 2019). Fintech's most notable impact has been the improvement of banking sector efficiency through the elimination of informational inequalities. Through financial intermediation and the most efficient allocation of financial resources, economic growth is facilitated by an efficient banking sector (KBA, 2021).

Technology employed in the back offices of banks and other financial institutions is known as "FinTech" (Chauhan, Akhtar, & Gupta, 2022). The meaning of the term has evolved greatly since then. There are now a variety of consumer-facing applications that it supports. Numerous programs have been affected by FinTech for banking, and the way in which customers gain access to their financial information has been completely transformed (Suryawati & Nurdana, 2021). It has far-reaching implications, affecting everything from mobile payment applications to the financial and insurance industries. FinTech's far-reaching effects are both an opportunity and a danger for legacy of financial institutions like banks (Achugamonu, 2020). Customers in today's digital era are less interested in using services offered by the conventional financial services sector in favor of those that are both convenient and secure (Gerlach & Lutz, 2021). Perhaps this is why FinTech is gaining traction and shaking up the banking and financial services industries. Banks and other financial institutions have been quick to embrace FinTech finance technology in response to its increasing popularity and the growing number of services it enables, such as online banking, mobile banking, and mobile payments.

Financial technology companies, or fintechs, provide numerous technological services with the goals of improving efficiency, speed, and ease. According to experts, the payments industry is the most developed part of the financial technology sector as a whole (Douglas & Janos, 2020). The financial services industry has seen the effects of fintech on several fronts. By streamlining processes, proposing algorithms to aid in decision making, and using AI to oversee investment portfolios, it has helped digital financial services for customers (Bagudu, Khan, & Roslan, 2017). It has also influenced the banking sector through innovations such as the ability to keep track of one's finances and the speed with which transactions can be completed due to circulation ledger technological advances, mobile payments, the use of digital currencies, and mobile lending to customers (KPMG, 2020). For the financial institutions that fall under its purview, the Central Bank establishes a regulatory, legal structure and issues prudential rules (CBK, 2020). It issues licenses to financial institutions and conducts regulatory oversight to make sure they follow the rules. The Central Bank of Kenya (CBK) issues regulations and guidelines that banks in Kenya must follow (CBK, 2020). Banking institutions, the people and businesses with whom they deal with benefit from the increased openness made possible by this regulatory framework. Because of the critical role banks play in the national (and worldwide) economy, it is crucial that regulatory bodies keep a tight rein on the industry's standard procedures (CBK, 2020).

Technical Efficiency of Commercial banks

Efficiency is a relative phrase that can be determined by contrasting the actual ratio of outputs to inputs with the optimal ratio (Fried, Lovell, & Schmidt, 2008). Selecting the input set from the optimal input set is a measure of technical efficiency (Tutulmaz, 2014). It's the capacity to select an input mix that minimizes costs, given a range of relative input prices and a set of feasible technologies (Onour & Abdalla, 2010). To be allocatively efficient, a decision-making unit must use a combination of inputs that results in the lowest possible cost, and vice versa. Conversely, if increasing output necessitates decreasing another output or increasing another input, then the production is not technically efficient. One key indicator of a bank's success is the effectiveness with which it uses its resources (Vu & Turnell, 2010). An efficient bank, rather than increasing its worth to shareholders through the abuse of its dominant position in the market, could do it through more ethical means. The likelihood of failure is diminished by a banking industry that is stable, profitable, and efficient. To assess the influence of Fintech on Kenya's banking industry, The study used Data Envelopment Assessment (DEA) on Kenyan banks' technical efficiency. The DEA model was used to derive expected efficiency scores for technical effectiveness (TE), pure technical effectiveness (PTE), and scale effectiveness (SE). Banks have more sway over inputs to the DEA model's input-orientation and intermediation dimension. Reducing inputs as much as feasible while maintaining output levels is the goal of input-orientation (Banker, Charnes, & Cooper, 1984).

Statement of the Problem

The technical efficiency of financial institutions has played a significant role in promoting access financial services as well as financial soundness of the commercial banks which is an integral component of the financial system (Kamau, 2011; Nasieku, 2014). However the evolution of mobile banking has increased competition in the banking industry, thus creating a considerable interest in its efficiency. Given that there is increase in competition in the industry, there has been considerable interest in their efficiency. Despite the growth in digital technology between 2020 to 2021, technical efficiency still indicates stagnation only increasing marginally from 0.735 to 0.756%, thus fintech has failed to make significant contribution to growth in efficiency of commercial banks. This reflects ongoing disparities in Fintech use across numerous groups, including age, education, sex, income, employment, and the rural-urban divide (CBK, 2021). Furthermore, concerns about safety continue to be raised about Fintech's widespread adoption. The protection of users' personal and financial information is the primary concern for any Fintech (KBA, 2021). Many researchers have examined Fintech and the technical efficacy of the financial sector. Ntwiga's (2020) research examined the impact of fintech on technical efficiency in Kenya's banking industry and found a positive correlation. Data Envelopment Analysis was utilized to quantify the impact of Fintech and technical efficiency in the banking sector, whereas the previous study measured technical efficiency before and after the introduction of Fintech. Despite the theoretical link between fintech and technical efficiency the nature of this relationship in context of the Kenyan banking industry still remains an issue of empirical investigation and therefore the motivation of the current study. Several studies have been conducted on Fintech and technical efficiency in the financial market.

The study by Alemu (2016) evaluated the technical efficiency of commercial banks in Ethiopia and established an insignificant relationship. However, the study did not expound on Fintech thus creating a research gap. Thalassinos and Le (2022) study on Fintech transformation on performance of banks and found that the digital transformation has a positive impact on the performance of commercial banks. Noteworthy the banking industry context in Ethiopia is significantly different from the Kenyan banking industry. However, the study adopted performance while the current study adopted a technical efficiency thus creating a conceptual gap. Ngalyuka (2021) study on relationship between Fintech utilization and fraud losses in banks in Kenya found that Fintech had led to a significant increase in fraud. The study focused on administrative issues from Fintech in commercial banks thus creating a contextual gap. The study by Ntwiga (2020) assessed technical efficiency in the Sacco's with the influence of fintech and established a positive relationship, whereas the study used Sacco's and Pre-Post Fintech period to measure the technical efficiency while the current study used commercial banks and a Data Envelopment Analysis technique to estimate the effect of Fintech and efficiency in the banking sector. This study therefore sought to bridge the gap by establishing the effect of mobile banking and technical efficiency of Kenya commercial banks in Kenya.

Research Hypothesis

H_{01}; In Kenya, commercial banks' technological efficacy is not correlated with the use of mobile banking.

Theoretical Review

Theory of Constraint-Induced Innovation

In 1983, Silber put forth his hypothesis of constraint-induced financial innovation. The notion proposes that increasing profits should be a financial institution's overarching goal whenever possible. As stated by Silber (1983), financial institutions' ability to operate profitably and sustainably is hindered by several constraints. The theory of constraint-induced invention is novel and indicative since it examined financial innovation from a microeconomics perspective, but with an excessive focus on "innovation in adversity." Therefore, it fails to provide a satisfactory explanation for the phenomenon of financial innovation within the context of broadening financial liberalism. This concept helped shed light on how the efficiency gains from service efficiency brought about by financial breakthroughs influenced by the bottom line of businesses. According to the constraint-induced financial innovation theory proposed by Silber and developed by (DeYoung, Lang, & Nolle, 2007), the fundamental motivator for implementing a digital strategy is the incentive for improving a firm's income. There are a few disadvantages, including strategy and other external restraints. For instance, a company's internal management and leadership style might have a significant impact on its ability to maximize its own benefits. According to this notion, businesses use technology to break free of the shackles of variable factors like taxes, regulations, and operating costs. The theory also implies that firms increase their returns on capital by using financial technology to address financial challenges that diminish a company's earning potential (Peake, Cooper, Fitzgerald, & Muske, 2017). However, this still suggests that innovations are commercially driven by a desire to mitigate the risks that financial institutions face.

This hypothesis helps explain why commercial banks are constantly developing novel revenue streams to keep up with the market. According to the literature, businesses face both internal and external limitations, and innovations serve as a means of competing in the marketplace and boosting bottom-line results. According to research by Albliwi, Antony, and Lim (2015), financial related organizations work to reduce limits and barriers since they strengthen administration but reduce efficiency. The theory of constraint-induced innovation is representative since it is grounded in microeconomics. However, it places a premium on expansion in trying times while downplaying the significance of expanded development in liberal finance. Tufano (2009) argues that reducing interest rates on loans, cutting costs, and investing in startups are all ways in which individuals and businesses might innovate to overcome such challenges. Budgetary speculating demands were something that innovators set out to meet in a number of ways, including through the reduction of the need for deposits (because of low interest rates) and the promotion of expansion. Critics of the constraint-

induced innovations in finance hypothesis include (Kithinji, 2017) and (Pirson & Lawrence, 2010), who argue that businesses have a broader social mission than simply maximizing profits. In addition to profit, the reason many businesses operate is to improve the lives of their communities by doing things like expanding access to banking services. Since this Fintech functions as a revenue stream to the bank, even those without bank accounts are able to obtain loans through their phones and online, and this is why the Constraint- Induced Financial Innovation hypothesis is linked with mobile banking and online banking. Because of this theory's significance, it is instrumental in seeking to establish the effect of mobile banking and the technical efficiency of Kenya's commercial banks.

Empirical Review

Mobile banking and technical efficiency of Commercial Banks.

The impact of mobile banking on the efficiency of Nigeria's commercial banks was studied by Bagudu, Khan, and Roslan in 2017. The 22 participating commercial banks were chosen at random. The information necessary for this study was gathered by means of a carefully designed survey. The data was presented and interpreted using descriptive statistics and straightforward graphic displays. The study's authors conclude that mobile banking has a favorable and statistically significant effect on the technical effectiveness of Nigeria's commercial banks. Due to the increasing use of mobile devices, the study concluded that commercial banks should continue adopting mobile banking.

Malaquias and Silva (2020) examined the elements that may influence farmers' use of mobile banking in Brazil. Both confirmatory factor analysis and structural equation modeling were used to examine the study's hypotheses and evaluate the components. The most important findings concern three factors fundamental to mobile banking adoption among farmers: perceived convenience of use, perceived utility, and trust. However, a negative correlation was found between social pressure and mobile banking usage. This finding runs counter to what is typically observed in academic papers. Since farmers work in a pertinent economic area, this study expands our knowledge of how IT might improve their daily financial operations.

The effect of online and mobile banking on the efficiency of Kenyan banks was evaluated by Okiro and Ndungu (2019). The purpose of the research was to determine how widespread the use of online and mobile banking is among financial institutions. Thirty banks and credit unions were looked into in the study. According to the research, checking account balances is the most popular internet banking service, while paying bills online is the least popular. The most popular use of mobile banking was to withdraw cash, whereas the least popular usage was to buy goods. Financial institution performance in Kenya was shown to be significantly impacted by mobile and internet-banking.

Ongera and Omagwa (2021) investigated how mobile banking affects the bottom lines of commercial banks. Descriptive research methods were used in this study. The research indicates that the four commercial financial institutions in Kenya are affected by mobile

banking's impact on technical efficiency. The research also shows that commercial bank transaction volumes increase due to mobile banking, clients find it reliable, and thus the bank is able to connect with the most unbanked people with what is affordable and secure, and mobile banking is efficient. According to the research, commercial banks can boost their income and profits by adopting mobile banking due to an increase in transaction volume and a decrease in the per-transaction cost of providing banking services.

Commercial financial institutions in Kenya were evaluated for their responsiveness to mobile banking and overall performance by Lydiah and Kyalo (2021). The research sampled 62 IT professionals and mobile banking officers from a population of 140 at 6 registered commercial banks. The hypothesis's importance was determined by inferential analysis. The study found that 35.4% of the variance in the performance of licensed commercial banks may be attributed to the speed and convenience of mobile banking. According to the findings, bank management should work to foster a culture of collaboration and constant reinvention through the prioritization of technology and a shift in emphasis on the client.

Technical efficiency

Banking sector efficiency enhances economic growth by facilitating the transfer of funds and directing capital where it is needed most. To be technically efficient, a bank needs to generate a predetermined number of results while expending the minimum amount of resources. The financial institutions that are more efficient at what they do are better able to weather economic storms, boost growth, eliminate informational inequalities, and smooth out economic swings (Fried, Lovell, & Schmidt, 2008). Using Japanese data, Homma et al. (2018) examine the aforementioned assumptions to discover that Japanese banks expand in size, and this is consistent with the efficient organization hypothesis. According to the findings (Homma et al., 2018), market concentration reduces bank efficiency, which is consistent with the quiet life theory. However, Yin et al. (2019) discovered that smaller banks, in particular, had a negative link between the number of employees and efficiency. According to Rosman et al. (2019), larger banks are able to lower their input costs because of their dominant market position. Returns to scale from a more specialized workforce and economies of scale from spreading fixed costs across a larger volume of services have been hypothesized to explain the positive correlation between size and productivity (Hauner, 2020). The quiet-life argument, on the other hand, suggests that larger organizations tend to be less productive. Recent research (Al-Gasaymeh, 2016, epková, 2015, and Singh, and Fida, 2015) demonstrate no statistically significant relationship between bank size and TE. In essence, there can be different ways of looking at the question of whether or not size and TE are related.

Sharma (2018) investigates the link between productivity and financial success in the market. Conclusions Statistically significant correlation between operational efficiency and the market performance of Indian banks was confirmed. Additionally, banks with streamlined operations result in more money for their shareholders. In addition, Meles et al. (2016) discover that US banks' financial performance improves when their use of intellectual capital

is optimized. Personnel effectiveness, a subcomponent of IC effectiveness, has also shown to have a greater effect on financial performance. Thus, the advancement of efficient methods of knowledge management, enabling banks to amass the resources necessary to adjust to a dynamic and ever-shifting market. In their 2020 study, Afsharian et al. analyze how efficiency influences the success of European banks that are open to the public. The findings corroborate the hypothesis that technical efficiency is positively related to banks' overall success. Aguenaou et al. (2017) use the CAMEL framework to analyze the financial success of Moroccan banks between 2004 and 2014. The findings demonstrate that the efficiency of banks is positively associated to factors including capital sufficiency, asset quality, profits performance, and liquidity, but it is negatively related to management efficiency.

Adusei (2019) analyzed the factors that affect rural and community banks' technical effectiveness in Ghana. Using the binary logistic regression method and the data envelopment analysis assumption of a variable's return to scale, we have analyzed the data. Only 20 of the sampled rural and community banks met the criteria for technical efficiency. The binary logistic regression study shows that the technical efficiency of rural banks in Ghana is significantly influenced by factors like bank size, profitability, and quality of bank funding. Increasing a rural bank's profitability enhances its technical efficiency, whereas expanding the bank's size or improving its funding quality reduces the bank's technical efficiency. These findings suggest that many rural and community banks in Ghana have poor resource usage and that a rural bank's success in this area can be evaluated by looking at its size, profitability, and financing quality.

Kumar (2018) looked into how the technical efficiency of Indian public sector banks affected their bottom lines. If public sector banks are efficient, they can increase output by 1.13 times relative to the same inputs. Thirteen banks in the "lucky" and "underdog" quadrants of an efficiency-profitability matrix based on effectiveness ratings and Return on Assets (ROA) have a technical effectiveness score below the industry average.

Conceptual Framework

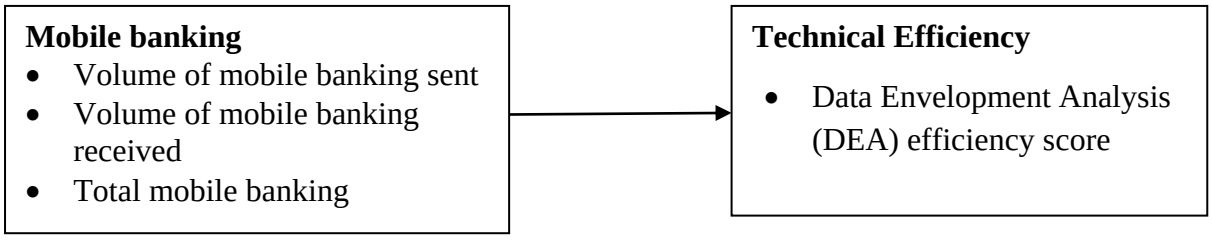

Figure 1: Conceptual Framework

Research Methodology

Research Philosophy

Research philosophies are approaches to studying society with the goal of providing an explanation based on the knowledge gained (Padilla-Daz, 2015). A study's critical assumptions and presuppositions can be traced back to the researcher's underlying research philosophy. Positive (or scientific), realist, and interpretivist phenomenology are the primary research philosophies (McLachlan & Garcia, 2015). Knowledge, according to positivist philosophy (Singh, 2015), is based solely on empirical data, with no room for theoretical speculation or personal bias. The social entity is the starting point for the positivist philosophical approach. Knowledge, according to positivist thought, is based on hard data and objective reality, rather than on theoretical constructs or personal valuations (Alakwe, 2017). Distinction is highlighted by looking at how different things like prescriptions and leading research on individuals compare. Data collection and theoretical development form the basis of this study's methodology (Potrac, Smith, & Nelson, 2017). Therefore, positivism was used in this study because it is centered on collecting data and testing hypotheses. The results of the experiments validated the hypotheses and will be useful for future studies. Since positivism is founded on empirical evidence, the field of statistics arose to analyze it. This study is a deductive inquiry into the impact of mobile banking on the technical efficacy of commercial banks since the researcher examined the premise and established a conclusion. Many believe that the logical method is the only valid one for scientific research.

Research Design

The term "research design" is defined as the "plan or structure" used to address the researcher's issues and inquiries (Malterud, Siersma, & Guassora, 2016). For this study, the researcher took a causal-comparative strategy. This is due to the fact that causal-comparative research designs aim to pinpoint the causes of variation in study outcomes (Rahi, 2017). Because it compared how different types of digital banking services affected the efficiency of commercial banks technically, this research lent itself well to a causal-comparative methodology. Multiple tests were performed on the study's variables to confirm or refute the hypothesis.

Population and Sampling

The study's population consists of all the entities that have enough in common to be either included or excluded. The 17 commercial banks in Kenya make up the number of the study's sample. The banks in Kenya are divided into two different size categories by the Central Bank: big (>5%) and medium (1%-5%) of market share index. Tier 1 and 2 banks were the analyzed unit from 2010 to 2021. To learn about a population as a whole by looking at a small subset of that group is known as sampling (Bryman & Bell, 2013). For the years 2010-2020, this research focused on 17 of Kenya's top and middle tier commercial banks. Since it is throughout these time periods that mobile banking has expanded and evolved, a causal-comparative approach provides the clearest picture.

Data Collection Methods

The study used secondary data for the analysis. The data was acquired from CBK reports and the banks' annual financial reports.

Data Analysis

According to Kothari (2012), data analysis consists of a series of interconnected procedures that are carried out to summarize the gathered data and arrange it so that it answers the research objectives. Data was scrubbed, modified, double-checked, and coded before analysis. The data was analyzed using both inferential and descriptive statistics. Data were described using percentages, averages, and standard deviations, while the sample size was described using frequencies. Correlation and the panel regression model were used as methods of inference. STATA was used for the data analysis.

The impact of Fintech on commercial banks' technical efficiency in Kenya was determined using a panel regression model. This allowed for a more accurate assessment of the correlations between the study's dependent and independent variables. The model of regression was:

$Y = \beta_{01t} + \beta_{1it}X_{1it} + \varepsilon$

Where;

Y = Technical Efficiency

X_1 = Mobile Banking

β_0= Constant Term;

β_1, β_2, β_3, β_4= Beta coefficients;

i= bank

t= time period

ε = Error Term.

Hypotheses was tested at a 0.05 significance level. A null hypothesis was rejected if the P-value >0.05 and not rejected if the P-value <0.05.

Results

Descriptive Statistics

The descriptive statistical analysis of the data gathered for all variables from 2010 to 2021 is presented in this section. The use of descriptive statistics includes indicators of distribution (skewedness and kurtosis) as well as measures of central tendency, such as the mean and standard deviation, as well as measures of dispersion and minimum and maximum observations. Online banking (shillings) and technological efficiency (ratio) were used to offer descriptive data. The analysis helps make it possible to display and visualize raw data meaningfully. The outcomes are shown in Table 1. The results shows that the The overall

volume of online banking transactions has been calculated to be 231,116,678 (the mean of the data). Spreading out from the mean, as shown by the standard deviation value of 108,361,300. As far as the data goes, the lowest value we have is 90,404,233. However, the greatest value in the data is 379,568,198. A skewness of -0.05 implies a relatively symmetrical data distribution, with just a hint of left skew. This indicates that there are more observations to the right of the average than to the left. With a kurtosis of -1.85, the data appears to have a platykurtic shape, characterized by a more rounded peak and narrower tails than would be seen in a normal distribution. This suggests that there are fewer extreme values in the data compared to a normal distribution.

The median number of mobile banking transactions was 141,555,713 transactions. In addition, the data was extremely dispersed, with a standard deviation of 63,664,643. There are also minimal and maximum values given for mobile banking use: 70,065,530 and 218,888,550, respectively. These numbers are useful for putting the wide variety of mobile banking usage in perspective. The data has a tiny negative skew, as measured by a skewness of -0.07. This suggests that there is a little leftward tilt in the data, with a greater concentration of high-use cases of mobile banking. Finally, a kurtosis of -1.95 suggests that the data follow a platykurtic distribution. This indicates that there are fewer outlying values than would be found in a normally distributed sample. Mean mobile banking usage in the dataset is roughly 59,844,154, as indicated by the mean value of the mobile banking data received, which is approximately 59,844,154. The data points are separated from the mean by a large amount, as indicated by the standard deviation value of roughly 50,463,631. This could be an indication of outliers or extremely high or low results. As for the smallest number in the data set, it would be 968,108. The greatest value ever reported was $193,490,377. The range of values in the information can be better appreciated with the help of these figures. With a skewness of 1.08, the information is positively skewed, meaning that while there are more low values than high ones, there are also some outliers. When compared to a normal distribution, the data does not have a dramatic peak or heavy tails, as indicated by the kurtosis score of 0.01.

The average amount of money transferred via mobile banking accounts for 201,399,867 as calculated by taking the mean of the entire volume. There is a lot of scatter in the information, with some transactions significantly higher or lower than the mean (as indicated by the standard deviation figure of 102,751,642). The lowest number of 80,452,976 is the smallest amount of money transferred via mobile banking, and the highest value of 379,749,538 represents a transfer nearly four times more than the mean value. This indicates that a small percentage of mobile banking transactions are exceptionally substantial. A skewness value of 0.21 indicates a rightward bias in the data, suggesting that there are a small number of very large transactions that significantly impact the total volume of mobile banking. This data is platykurtic, with a kurtosis of -1.55 indicating a flatter distribution and fewer extreme values than would be found in a normal distribution.

The provided information under technical efficiency relates to banks' technical efficiency as measured by three metrics: variable return to scale efficiency (VRSE), constant return to scale efficiency (CRTE), and SCALE. The median VRSE score is 0.693, which indicates that banks are, on average, only using around 70% of their potential in their day-to-day operations. With a standard deviation of only 0.080, we can infer that most banks' VRSE values fall within a small band. Some banks are far less efficient than others, as shown by the least VRSE value of 0.510, and others are highly efficient, as shown by the maximum VRSE value of 0.820. When output is held constant, the mean CRTE value of 0.700 is slightly higher than the VRSE value of 0.650, showing that banks, on average, are slightly more efficient. As with VRSE, the standard deviation of 0.080 for CRTE suggests that there is not much in the way of diversity amongst different financial institutions. The range of CRTE values is also extremely small, with maximum and minimum values that are very close to those of VRSE. Finally, SCALE indicates whether or not a financial institution is performing at its maximum potential. According to the median size value of 0.733, financial institutions are typically performing at about 73% of their potential size. There is more variance in scale between different banks, as indicated by the standard deviation value of 0.118, which is more than that of VRSE and CRTE. If a bank's SCALE score is below 0.500, it is running well below its optimal scale; if it is above 0.920, it is functioning extremely close to its optimal scale. It appears from the data that most banks are working at a comparable degree of technical efficiency, while there is considerable variation. Nonetheless, there is greater diversity in the amount to which banks are functioning at their optimal scale of manufacturing, with some banks operating considerably below or above this level.

Table 1 Descriptive Statistics

		Mean	Std. D	Minimum	Maximum	Skew	Kurts
Mobile Banking	Volume of mobile banking sent	141,555,713	63,664,643	70,065,530	218,888,550	-0.07	-1.95
	Volume of mobile banking received	59,844,154	50,463,631	968,108	193,490,377	1.08	0.01
	Total mobile banking	201,399,867	102,751,642	80,452,976	379,749,538	0.21	-1.55
Technical Efficiency	VRSE	0.693	0.080	0.510	0.820	-0.56	-0.41
	CRTE	0.700	0.780	0.520	0.820	-0.57	-0.40
	SCALE	0.733	0.118	0.500	0.920	-0.28	-0.94

Trend Analysis on Mobile Banking

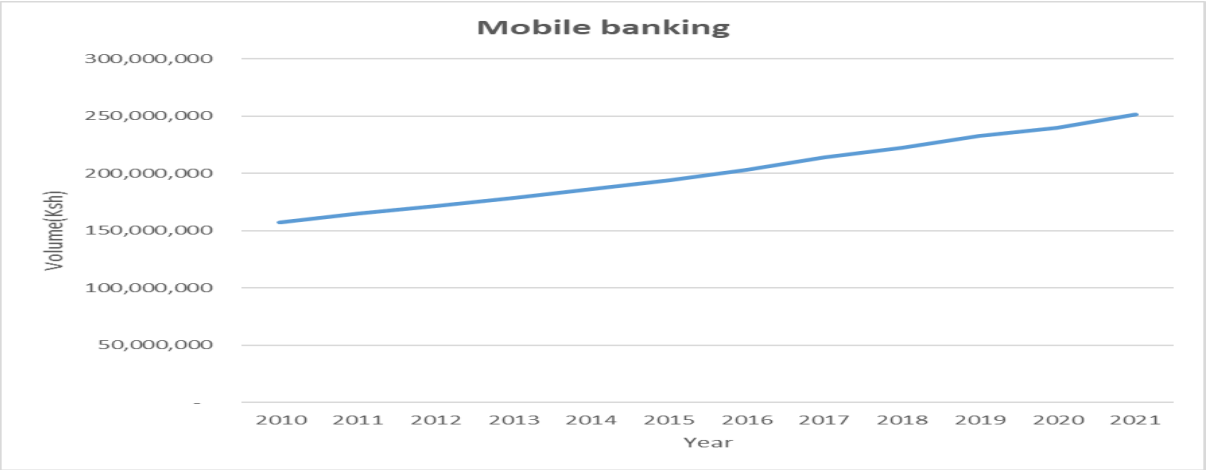

Figure 2: Trend Analysis on Mobile Banking

The research of trends indicates that the number of people who use mobile banking has increased annually. There were 157,285,685 people who used a mobile banking service in 2010. With a rise of 4.8% from 2010 to 2011, this figure reached 164,812,749 in 2011. Over the next four years, the growth rate was consistent, with the number of mobile banking customers increasing by roughly 4.2% year on average. The number of people using mobile banking increased by 36.2% from 2010 to 2017 (from 157,285,685 to 214,322,651). The pace of expansion picked up slightly in the years that followed, with an annualized rate of about 6.5% expected between 2017 and 2021. There were 251,592,202 mobile banking customers in 2021, up 17.3 percent from the previous year. The overall trend analysis shows that more and more people are choosing to utilize their mobile devices to access financial services, indicating that mobile banking has become more prevalent over the years. There have been ups and downs in the growth rate, but on the whole, mobile banking is becoming increasingly popular as a result of its accessibility and ease of use.

Trend analysis for Technical Efficiency

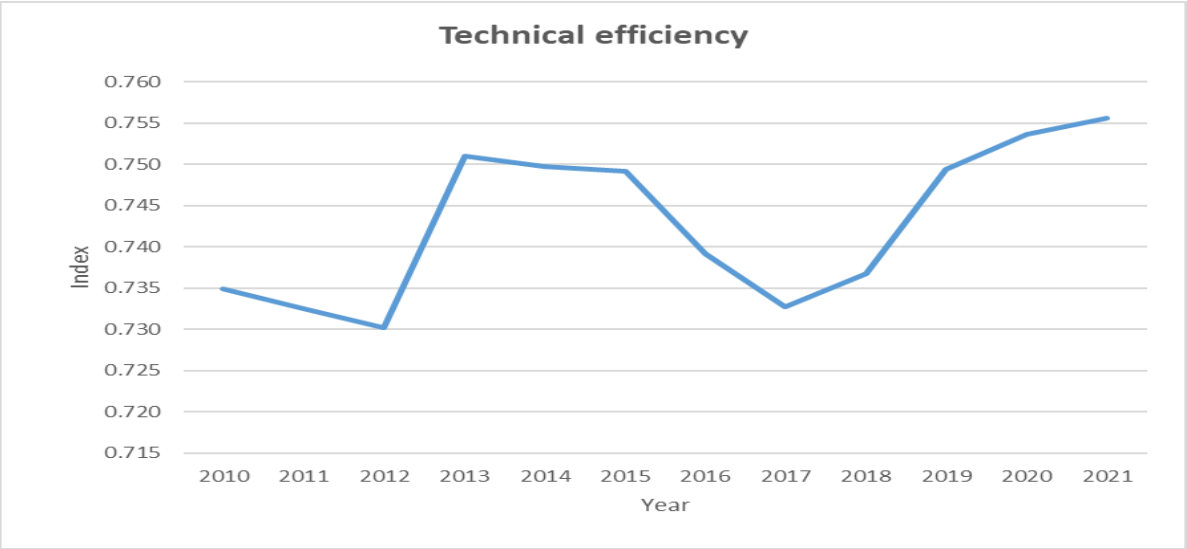

Figure 3: Trend Analysis on Technical Efficiency

The graph shows the technical effectiveness of Kenyan banks from 2010 to 2021 on a scale from 0 to 1, with 1 indicating the most efficient performance possible. The trend analysis indicates that the technical effectiveness of banks in Kenya has varied over time, but has improved steadily on the whole. Kenyan banks have a mean technical efficiency of about 0.744, with a standard deviation of about 0.010. Banks in Kenya saw a gradual deterioration in their technical efficiency from 2010 to 2012, with that number falling from 0.735 to 0.730. The technical effectiveness increased dramatically in 2013, reaching 0.751, and then remained constant for the following two years, at 0.750 and 0.749, respectively. Technical efficiency dropped to 0.739 in 2016 and continued its slow fall to 0.733 in 2017. In 2018, however, things turned around as the technical effectiveness rose to 0.737. The level of technical efficiency has increased steadily from 2019 to 2021, rising to 0.749 in 2019, 0.754 in 2020, and 0.756 in 2021. There appears to have been some variation in the technical effectiveness of Kenyan banks over the years, with efficiency dropping between 2010 and 2012 and then rising again between 2013 and 2018. Banks in Kenya are getting more technically efficient over the course of 2019–2021, a trend that bodes well for the country as a whole. This development bodes well for Kenya's economy as a whole, as it indicates that the country's banking system is evolving toward a more viable and effective model.

Correlation Analysis

The researchers looked for a connection between the variables by conducting a correlation analysis. Pearson's correlation was used to determine the mean score for each independent variable. A statistically significant correlation has a p-value of less than or equal to 0.05. However, a correlation that has a p-value of more than 0.05 is not considered to be statistically important (Statistics Solution, 2018). There is a positive correlation between the

two variables when both are growing, and a negative correlation when both are shrinking. Table 2 shows the outcomes of the correlation study.

Table 2: Correlation Results

	Technical Efficiency	Mobile Banking
Technical Efficiency	1.000	
Mobile Banking	0.720	1.000
	0.000	

The results shows that mobile banking have a positive and significant relationship with technological efficiency (r= 0.720*, p=0.000.05).). This indicated a correlation of 72% between using a mobile banking app and having a technically efficient bank. With such a strong positive correlation, it's clear that mobile banking systems are highly efficient technically.

Regression Analysis

Using regression analysis, the study looked for a statistically significant relationship between independent and dependent variables. Mobile banking was used as independent variable while Technical Efficiency was taken as the dependent variable. The results are shown in Table 3.

Table 3 Regression Outputs

Technical Efficiency	Coef.	Std. Err.	z	P>|z|
Mobile Banking	0.0255	0.0063	4.0300	0.000
_cons	0.1512	0.0492	3.0700	0.002
F-statistic	238.63			
Prob > chi2	0.000			
Rsquared	0.6297			

The results shows existence of a positive and statistically significant effect of mobile banking on technical efficacy of commercial banks in Kenya (=0.0255, p=0.000).

Discussion of Results

The study sought to determine mobile banking's effect on the commercial banks' technological efficiency in Kenya. The average amount of money transferred via mobile banking was estimated to be 201,399,867 by the descriptive data to be used in this study. There is a lot of scatter in the information, with some transactions significantly higher or lower than the mean (as indicated by the standard deviation figure of 102,751,642). The efficiency of banking via mobile device has been observed to correlate positively with technical efficacy (r= 0.720*, p=0.000.05). There was a link of 72% between having a technologically advanced bank and using a mobile banking app. A positive correlation of this magnitude demonstrates unequivocally the technological efficacy of mobile banking systems.

Through regression analysis, we find that mobile banking is positively associated with technical efficacy (= 0.0255, p=0.000). The null hypothesis that mobile banking would have no influence on the technical efficiency of Kenya's commercial banks was rejected with a significance level of 0.000. These results are comparable with those found by Bagudu, Khan, and Roslan (2017), who demonstrated that mobile banking had a positive and significant impact on the technical efficiency of Nigeria's commercial banks. Malaquias and Silva (2020), researchers into the factors that influence Brazilian farmers' acceptance of mobile banking, found that perceived ease of use, perceived value, and trust were the most important elements in farmers' use of mobile banking. Peer pressure did not correlate positively with the use of a mobile banking app.

These findings are consistent with those of Bochaberi and Job (2021), who investigated how mobile banking affected the technical performance of four Kenyan banks and found a significant influence. More transactions are processed by commercial banks because of mobile banking, customers find it trustworthy, the bank can provide secure and economical services to the largest number of unbanked people, and mobile banking is effective, according to the study's authors. Among the officially recognized commercial banks in Kenya, mobile banking agility accounted for 35.4% of the variance in bank performance, according to research by Lydiah and Kyalo (2021). Online balance enquiries are much more popular than online bill payments among Kenyan bank clients, according to study by Okiro and Ndungu (2019) on the implications of mobile and internet banking on Kenyan banks' bottom lines.

Interpretation of Results

The study's secondary goal was to determine mobile banking's impact and the commercial banks' technological efficiency in Kenya. The average amount of money transferred via mobile banking was estimated to be 201,399,867 by the descriptive data to be used in this study. There is a lot of scatter in the information, with some transactions significantly higher or lower than the average (as indicated by the standard deviation figure of 102,751,642). There is a statistically significant positive relationship between the use of mobile banking and technological efficacy (r= 0.720*, p=0.000.05). There was a link of 72% between having a technologically advanced bank and using a mobile banking app. With such a strong positive correlation, it's clear that mobile banking systems are highly efficient technically. The positive and significant correlation between mobile banking and technological efficiency found by the regression analysis is (= 0.0255, p=0.000). Since the 0.000 p-value is less than the accepted 0.05 level, we cannot accept the null hypothesis that mobile banking has no practical impact on the technical efficiency of Kenya's commercial banks. The results suggest that using a mobile banking app improves this type of technical efficiency. It implies that by providing mobile banking services, banks may improve efficiency, increase productivity, and make better use of available resources. Customers can take advantage of mobile banking's convenience and accessibility by making transactions remotely, without having to visit a branch. This allows financial institutions to cut down on overhead expenses, improve service

quality, and streamline the management of customer transactions by minimizing the need for physical branch locations. Mobile banking also has the potential to increase the bank's productivity by speeding up transactions, automating routine tasks, and giving customers instantaneous access to their accounts and other financial data. Banks can increase client satisfaction, response time, and transaction accuracy by using mobile banking technologies. The "positive and substantial impact" of mobile banking on bank technical effectiveness has been cited as evidence of the technology's value. This shows that the increase in mobile banking adoption and the improvement of technical efficacy are inextricably linked.

Conclusion

The research shows that commercial banks in Kenya benefit greatly from mobile banking from a technical standpoint. Rejecting the null hypothesis indicates a correlation between mobile banking usage and improved technological effectiveness in the banking industry. This result is consistent with the widely-held belief that mobile banking has had a dramatic, positive effect on commercial banks' productivity and efficiency. Customers may access their accounts and make payments from their smartphones or tablets, making mobile banking a simple way to manage their finances on the go. Because of the size of the effect seen, it seems likely that Kenyan commercial banks will gain from adopting mobile banking technologies. Banks may improve service delivery, lower costs, and delight customers by switching to mobile banking. In turn, this can lead to enhanced technical efficiency by maximizing the use of available resources, boosting output, and facilitating safer, more expedited financial dealings. The results stress the significance of banking institutions keeping up with technology developments and consumers' changing demands. To improve their technical effectiveness and keep up with the competition in the quickly evolving digital market, commercial banks in Kenya may want to implement mobile banking as a strategic option.

Recommendations

Based on the findings of the study, commercial banks in Kenya are urged to upgrade their mobile banking systems. The growing number of people using mobile banking necessitates the creation of user-friendly mobile applications, the guarantee of a safe and smooth transaction process, and consistent connectivity. Banks can increase their technological effectiveness and meet the growing demand for accessible banking services by expanding the technology capabilities of mobile banking. Customers, especially those in more remote places, must be made aware of the advantages and capabilities of mobile banking. Workshops and other forms of public education about the benefits of digital literacy and mobile banking should be hosted by commercial banks. Banks can improve their technological efficiency by encouraging more consumers to use mobile banking platforms and equipping those customers with the knowledge and abilities to do so.

References

Abbasi, T., & Weigand, H. (2017). The impact of digital financial services on firm's performance: a literature review. *arXiv preprint arXiv:1705.10294*.

Achugamonu, B. U., Adegbite, E. O., Omankhanlen, A. E., Okoye, L. U., & Isibor, J. A. (2020). Dynamics of Fintech and financial inclusion nexus in sub-Saharan Africa.

Adusei, M. (2019). Determinants of bank technical efficiency: Evidence from rural and community banks in Ghana. *Cogent Business & Management*, *3*(1).

Alakwe, K. O. (2017). Positivism and knowledge inquiry: From scientific method to media and communication research. *Specialty Journal of Humanities and Cultural Science*, 2(3), 38–46.

Albliwi, S. A., Antony, J., & halim Lim, S. A. (2015). A systematic review of Lean Six Sigma for the manufacturing industry. *Business Process Management Journal*. *13*(5), 1-45.

Alemu, F. Z. (2016). Evaluating the technical efficiency of commercial banks in Ethiopia: A data envelopment analysis. *European Journal of Business and Management*, *8*, 37-45.

Ali, A. A. (2018). *Impact of Online Banking on Technical efficiency of Commercial Banks: A Case Study of Barclays Bank of Kenya*. United States International University-Africa.

Banker, R. D., Charnes, A., & Cooper, W. W. (1984). Some models for estimating technical and scale inefficiencies in data envelopment analysis. *Management science*, *30*(9), 1078-1092.

Bell, A., & Jones, K. (2015). Explaining fixed effects: Random effects modeling of time-series cross-sectional and panel data. *Political Science Research and Methods*, *3*(1), 133-153.

Beloke, N. B., & AP, M. E. S. (2021). The Influence of Fintech Services on the Technical efficiency of Commercial Banks in Cameroon.

Bochaberi, O. E. S., & Job, O. (2021). Mobile banking and technical efficiency of selected commercial banks in Kenya. *International Research Journal of Business and Strategic Management*, *2*(1).

Bryman, A. (2013). Introduction:'Inside'accounts and social research in organizations. In *Doing Research in Organizations (RLE: Organizations)* (pp. 11-30). Routledge.

Central Bank of Kenya [CBK] (2021). Retrieved on June 2022 from https://www.centralbank.go.ke/reports/cbk-reports-and-financial-statements/

Chanias, S., Myers, M. D., & Hess, T. (2019). Digital transformation strategy making in pre-digital organizations: The case of a financial services provider. *The Journal of Strategic Information Systems*, *28*(1), 17-33.

Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the efficiency of decision making units. *European journal of operational research*, *2*(6), 429-444.

Chauhan, S., Akhtar, A., & Gupta, A. (2022). Customer experience in digital banking: A review and future research directions. *International Journal of Quality and Service Sciences*. *11*(7), 1979-1984.

DeYoung, R., Lang, W. W., & Nolle, D. L. (2007). How the Internet affects output and performance at community banks. *Journal of Banking & Finance*, *31*(4), 1033-1060.

Gerlach, J. M., & Lutz, J. K. (2021). Fintech advice solutions–Evidence on factors affecting the future usage intention and the moderating effect of experience. *Journal of Economics and Business*, *117*, 106009.

Hurni, T., Palmié, M., & Miehé, L. (2020). Striving for Trust in Ecosystems: How Cooperation Emerges Between Competitors. In *Research Policy Special Issue Conference*. Elsevier.

Islam, S., Kabir, M. R., Dovash, R. H., Nafee, S. E., & Saha, S. (2019). Impact of online banking adoption on bank's profitability: Evidence from Bangladesh. *European Journal of Business and Management Research*, *13*(5), 1-45.

Kenya Bankers Association [KBA] (2021). Retrieved on June 2022 from https://www.kba.co.ke/downloads.php

Khanboubi, F., Boulmakoul, A., & Tabaa, M. (2019). Impact of digital trends using IoT on banking processes. *Procedia Computer Science*, *151*, 77-84.

Kothari, D. P. (2012). Power system optimization. In *2012 2nd National conference on computational intelligence and signal processing (CISP)* (pp. 18-21). IEEE.

Lydiah W. K & Josphat K. K. (2021). Agility of Mobile Banking and Performance of Commercial Banks in Kenya. *East African Scholars Publisher*. Volume-4 | Issue-2. 6-13.

Malaquias, R. F., & Silva, A. F. (2020). Understanding the use of mobile banking in rural areas of Brazil. *Technology in Society*, *62*, 101260.

Malterud, K., Siersma, V. D., & Guassora, A. D. (2016). Sample size in qualitative interview studies: Guided by information power. *Journal of Qualitative Health Research*, *26*(13), 1753-1760.

McLachlan, C. J., & Garcia, R. J. (2015). Philosophy in practice? Doctoral struggles with ontology and subjectivity in qualitative interviewing. *Journal of Management Learning*, 46(2), 195–210.

Ngalyuka, C. (2021). *The relationship between ICT utilization and fraud losses in commercial banks in Kenya*. University of Nairobi.

Ntwiga, D. B. (2020). Technical efficiency in the Kenyan banking sector: Influence of fintech and banks collaboration. *Journal of Finance and Economics*, *8*(1), 13-20.

Okiro, K., & Ndungu, J. (2019). The impact of mobile and internet banking on performance of financial institutions in Kenya. *European Scientific Journal*, *9*(13).

Padilla-Díaz, M. (2015). Phenomenology in educational qualitative research: Philosophy as science or philosophical science? *Journal of Educational Excellence*, 1(2), 101–110.

Peake, W. O., Cooper, D., Fitzgerald, M. A., & Muske, G. (2017). Family business participation in community social responsibility: The moderating effect of gender. *Journal of Business Ethics*, *142*(2), 325-343.

Pirson, M. A., & Lawrence, P. R. (2010). Humanism in business–towards a paradigm shift?. *Journal of business ethics*, *93*(4), 553-565.

Potrac, P., Smith, A., & Nelson, L. (2017). Emotions in sport coaching: An introductory essay. *Sports Coaching Review*, 6(2), 129–141.

Risman, A., Mulyana, B., Silvatika, B., & Sulaeman, A. (2021). The effect of Fintech on financial stability. *Management Science Letters*, *11*(7), 1979-1984.

Silber, W. L. (1983). The process of financial innovation. *The American Economic Review*, *73*(2), 89-95.

Singh, K. D. (2015). Creating your own qualitative research approach: Selecting, integrating, and operationalizing philosophy, methodology and methods. *Journal of Business Perspective*, 19(2), 132–146.

Suryawati, R. F., & Nurdana, D. P. P. (2021). The Impact of Peer-to-Peer (P2P) Lending on Business Development of Small and Medium-Sized Enterprises. *TIJAB (The International Journal of Applied Business)*, *5*(2).

Thaker, M. A. B. M. T., Thaker, H. B. M. T., Rahman, M. P. B., Amin, M. F. B., Pitchay, A. B. A., & Olaniyi, N. O. (2019). Factors Affecting Investors' Intention to Invest in Peer-to-Peer Lending Platform in Malaysia: An Extended Technology Acceptance Model.

Tufano, P. (2009). Consumer finance. *Annu. Rev. Financ. Econ.*, *1*(1), 227-247.

Vu, H. T., & Turnell, S. (2010). Cost efficiency of the banking sector in Vietnam: A Bayesian stochastic frontier approach with regularity constraints. *Asian economic journal*, *24*(2), 115-139.