FINANCIAL INNOVATIONS AND COST EFFICIENCY OF COMMERCIAL BANKS IN KENYA

FAITH MORAA OTONDI

D53/OL/HEP/20473/2022

A PROJECT REPORT SUBMITTED TO THE SCHOOL OF BUSINESS, ECONOMICS AND TOURISM IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF BUSINESS ADMINISTRATION (FINANCE), KENYATTA UNIVERSITY

DECEMBER, 2025

DECLARATION

This is my original work and has not been submitted for any awards or degrees at any other institution.

Signature: _____ Date: _____

Faith Moraa Otondi

D53/OL/HEP/20473/2022

SUPERVISOR

The student worked on this research project under my guidance as the appointed university supervisor

Signature: _____ Date: _____

Dr. Francis K. Gitagia (Ph.D), CPA,

Department of Accounting and Finance,

School of Business, Economics and Tourism,

Kenyatta University

DEDICATION

I dedicate this project to my beloved family for their unwavering support, encouragement and prayers have been my greatest source of strength throughout this journey. To my parents, for instilling in me the value of hard work and perseverance. To my friends and mentors who stood by me with guidance and motivation, this accomplishment is as much yours as it is mine.

ACKNOWLEDGEMENTS

I thank the Almighty God who has given me the strength, wisdom and resilience to finish this project. My sincere gratitude to my supervisor Dr. Francis Gitagia who professionally helped me the process of origination of this project and his continuous encouragement and support all through the process. His knowledge and commitment has been very instrumental in defining the direction of this project. I would also like to thank all my lecturers at Kenyatta University, Department of Accounting and Finance, who contributed to my education, both at the classroom and by the way of extramural studies. The knowledge and guidance that they have given me has played a great role in my career. I also appreciate the knowledge, advice and positive feedback of my classmates and friends in this process. Last, I would like to thank my family which always believed in me and who always inspires me.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

AI	Artificial Intelligence
CBK	Central Bank of Kenya
CE	Cost Efficiency
COVID-19	Corona Virus Disease-2019
FI	Financial Innovations
GDP	Gross Domestic Product
GLS	Generalized Least Squares
IT	Information Technology
MSMEs	Micro, Small and Medium-sized Enterprises
NACOSTI	National Commission for Science, Technology and Innovation
NPLs	Non-Performing Loans
NSE	Nairobi Securities Exchange
PI	Product Innovation
PrI	Process Innovation
RBV	Resource-Based View
ROA	Return on Assets
RPA	Robotic Process Automation
SI	System Innovation
SPSS	Statistical Package for Social Sciences
UK	United Kingdom
UPI	Unified Payments Interface
USA	United States of America

VIF Variance Inflation Factor

VRIN Valuable, Rare, Inimitable and Non-substitutable

OPERATIONAL DEFINITION OF TERMS

Cost Efficiency: Refers to the ability of commercial banks to minimize operational costs while improving service delivery and profitability in this study, measured using financial performance indicators such as cost- to-income ratio, operational expenses and profitability margins relative to innovations adopted

Financial Innovations: Refers to the introduction and adoption of new financial products, systems and processes that enhance banking operations and, in this study, financial innovations are categorized into product innovations, system innovations and process innovations.

Inflation: Refers to the sustained increase in the general price level of goods and services, which erodes the purchasing power of money and in this study, it is considered as a moderating factor that influences the relationship between financial innovations and cost efficiency in commercial banks by affecting operational costs, interest rates and customer affordability of banking services

ABSTRACT

The banking sector in Kenya has experienced fluctuating cost efficiency amid rapid financial innovations, raising concerns among regulators and practitioners about sustainable operational performance. Persistent high cost-to-income ratios, averaging 48% from 2020-2023, imply elevated operational risks and reduced profitability, which undermine financial intermediation and economic growth. It is therefore critical to enhance cost efficiency to bolster sector resilience and investor confidence. Kenyan commercial banks have adopted various innovations, yet challenges in optimizing costs under inflationary pressures persist. This study examined the effect of financial innovations on the cost efficiency of commercial banks in Kenya. The specific objectives were: to determine the effect of product innovation on cost efficiency of commercial banks in Kenya; to establish the effect of system innovations on cost efficiency of commercial banks in Kenya; to analyze the effect of process innovations on cost efficiency of commercial banks in Kenya; and to evaluate the moderating effect of inflation on the relationship between financial innovations and cost efficiency of commercial banks in Kenya. The investigation was anchored in the Efficiency Structure Theory, Transaction Cost Theory, Resource-Based View Theory, and Innovation Diffusion Theory. The study targeted a census of all 39 commercial banks licensed by the Central Bank of Kenya and employed a descriptive research design with an explanatory approach. Secondary data were extracted from CBK reports and bank financial statements spanning 2020 to 2024, supplemented by primary data from structured questionnaires administered to 68 respondents. Inferential analysis utilized multiple linear regression models alongside Pearson's product-moment correlation coefficients, while means and standard deviations supported descriptive evaluation. Correlation outcomes reflected moderate negative relationships with cost efficiency: system innovations displayed the strongest link, followed by process innovations, and product innovations. The GLS regression findings showed that product innovations had a negative influence on cost efficiency, system innovations a stronger negative effect, and process innovations a significant negative effect. Moreover, results from the Whisman moderation test revealed that inflation positively moderated the association between financial innovations and cost efficiency, amplifying cost pressures annually. In conclusion, adopting product, system, and process innovations enhanced cost efficiency in commercial banks, though inflation eroded these gains, particularly for system and product innovations. Consequently, the study recommends that banks prioritize system and process innovations while implementing inflation-hedging strategies, such as dynamic pricing and fintech partnerships, to maximize operational efficiency.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Financial innovation especially in fintech is crucial for developing nations according to Mikhaylov *et al*., (2023). It may be stimulated by inflation as people and organizations look for novel strategies to protect their assets and protect themselves from price increases. This desire for creative financial solutions may result in the creation of fresh goods and services that more effectively tackle the problems caused by inflation.

Globally, financial innovation is now a key factor in Cost Efficiency (CE) for commercial banks as noted by Lerner, Seru, Short and Sun (2021). Additionally, the drive for digitalization and the emergence of fintech have, from a global stance, brought about both opportunities and pressures from competitors. Technology is increasingly being utilized by banks to automate processes, reduce manual work and offer services through the digital platform which saves the banks a lot of cost. It is a trend in the United States of America (USA) as evidenced by the increasing number of patents of financial innovations around the globe, and particularly the blockchain, mobile payments, and artificial intelligence sectors. Being able to adapt and implement such innovations in banks is becoming a necessity, so that the banks can remain economic and competitive.

The rise of digital banking and mobile payments in Asia is suggestive of the focus on financial innovation in terms of cost efficiency. Indonesian banks are investing in technology to become more effective in the operations and to reach more needy societies (Khalifaturofi'ah, 2023). Besides reducing costs of traditional bricks and mortar branches, this allows banks to tap into newer revenue streams. Likewise, in Malaysia, the boost in the value of firms is a result of

financial innovation alongside a healthy bank competition, which means that banks are using innovation to enhance their cost- effectiveness and profitability as argued by Olalere, Kes, Islam and Rahman (2021). The Asian experience highlights the importance of a competitive environment and a conducive regulatory environment in enhancing financial innovation and its positive implications on cost effectiveness.

Mobile money and other fintech applications are on a booming global growth in Africa and are significantly lowering the financial transaction cost (Olalere, Kes, Islam & Rahman, 2021). There is the possibility of Cost Efficiency through financial innovation, which has been developed in Nigeria, and has resulted in the creation of a financial ecosystem. The new innovations in the mobile technology and the traditional banking platforms are creating new opportunities through which banks can offer low-cost services particularly where the traditional banking facilities are not easily accessible.

A very vivid example of the effects of financial innovation on Cost Efficiency can be seen in the banking sector of Kenya. Due to the widespread adoption of mobile money systems such as M-Pesa, banks are now able to offer services to a larger number of clients at a much lower cost than conventional banking due to the changes in the financial landscape (Kombe, 2023). Besides the rising financial inclusion, it has enabled banks to streamline their operations and reduce their reliance on expensive branch networks. The Kenya experience demonstrates the extent to which financial innovation can be incredibly effective and especially when it is localized to fit the needs of a particular location and utilized on top of technology infrastructure that already exists.

1.1.1 Financial Innovation

Hussain and Papastathopoulos (2022) define financial innovation as the development and adoption of novel financial services and products, technology and business models that enhance the efficiency and resilience of financial systems. Wang and Cao (2022) define financial innovation as the integration of novel financial instruments and financial governance that result in improved business performance and competitiveness on the market. One example of how financial innovation is transforming stock market dynamics and investment strategies is the introduction of retail financial products such as target date funds, according to Parker, Schoar and Sun (2023).

Financial innovation includes the development of new financial services, products and procedures according to Lerner, Seru, Short and Sun (2021). In finance, this means using technology to make things easier for people and companies, as seen by the rise of digital financial services. The innovation helps the economy grow by making it easier for people to access financial services and by making better use of capital (Lerner, Seru, Short & Sun, 2021). Nevertheless, it also poses difficulties with regard to regulatory supervision and risk management.

Accordingto Qamruzzaman, Jianguo, Jahan and Yingjun (2021), financial innovation plays an important role in economic growth and development. UPI in India has helped to grow digital payment use and boost the economy (Broby, 2021). Just like the case in Kenya, M- Pesa mobile money has helped many people without bank accounts to access financial services, as explained by Broby (2021). Similarly, the M-Pesa mobile money platform in Kenya has greatly increased financial inclusion by giving previously unbanked people

access to financial services as revelaed by Broby (2021). These developments show how financial innovation can lead to better financial access, raised productivity and the encouragement of entrepreneurship, all of which eventually support economic growth (Qamruzzaman, Jianguo, Jahan & Yingjun, 2021). Additionally, financial services and products that are easy to use and accessible can empower people who lack financial literacy, promoting inclusive growth (Hasan, Le & Hoque, 2021).

Financial innovation is intricate including the creation of new financial services, products and processes according to Lerner, Seru, Short and Sun (2021). Further, Product Innovation (PI) may include developing new financial instruments or investment vehicles. System Innovation (SI) is the creation of new platforms or financial infrastructure, such as mobile payment systems (Broby, 2021). According to Hussain and Papastathopoulos (2022), Process Innovation (PrI) is concerned with enhancing the efficacy and efficiency of financial service delivery, frequently by utilizing technology.

1.1.1.1 Product Innovation

Product Innovation is the process of developing and launching new or vastly enhanced products or services according to Ben Arfi and Hikkerova (2021). This could involve creating innovative financial instruments, investment products, or service offerings in the financial sector that are suited to particular client requirements. Digital platforms are vital for Product Innovation because they facilitate collaboration and knowledge sharing, both of which are necessary for coming up with new ideas and launching them (Ben Arfi & Hikkerova, 2021).

Product Innovation is important as, it enables businesses to differentiate themselves from rivals by providing distinctive products, profitability and market share may rise as a result

(Andersen, 2021). By creating products that address unmet needs, companies can also reach new markets and customer segments through Product Innovation. In addition, when a company keeps improving and meets new customer preferences, it can raise its reputation and loyalty among customers.

Both minor and significant changes in products or services are considered Product Innovation by Zuhroh and Rini (2024). Developing ideas for new products, knowing what consumers want and turning those ideas into products people buy are often important aspects. Offering unique value and having a strong Product Innovation help create goods that attract the right customers and give them special benefits which improves marketing performance.

According to Hausmann *et al*. (2024), countries around the world have unique trends in Product Innovation and China and the USA are leading the way in biotechnology and AI. In the UK, special attention is given to financial technology and the creative industries. South Africa and Kenya, among other emerging economies, are helping innovation in areas like mobile money and fintech that are useful locally (Hausmann *et al.* 2024). They make it clear to consider each nation's situation and abilities when studying worldwide innovation trends.

1.1.1.2 System Innovation

System Innovation is a process that involves multiple participants and organizations by making important changes to how a system is built, how it works and how its parts interact (Elzinga *et al.*, 2023). It aims to create new ways of using technology, procedures and policies to solve difficult problems. It involves launching new innovation ecosystems that can greatly change entire industries, including healthcare, transportation or energy. It encourages focusing on changing the system rather than just creating new products or processes.

System Innovation is vital because it enables people to address problems that are too big for small, gradual changes such as scarcity of resources or climate change (Hyland and Karlsson, 2021). It can also boost the economy by encouraging the development of new industries, markets and jobs and by supporting sustainability, greater social inclusion and better access to basic services. That's why it is necessary for addressing big issues and encouraging sustainable development.

New actors, networks, knowledge, technologies, institutions and regulations, as well as changes to existing behaviors and practices, are all parts of System Innovation (Challoumis, 2024). To successfully manage and promote System Innovation, there is need to know how these elements interact. Challoumis (2024) points out that institutional frameworks and governance systems play a big role in helping or hindering SI and he also encourages the development of policies that focus on teamwork, information sharing and experimentation.

The Global SI trends indicate that the ways regions work vary (Dutta, Lanvin, Wunsch-Vincent & León, 2022). The USA and Europe are emphasizing on the development of advanced technologies through heavy investment in research and development whereas Asia and China are on the forefront in System Innovation. Dutta, Lanvin, Wunsch-Vincent and León (2022) also report that in spite of its numerous challenges, the innovation in areas such as fintech and mobile money is on the rise in Africa as a result of local needs and rising entrepreneurial environment. Kenya has become a hub of mobile money innovation as evidence of the potential of System Innovation to enhance financial inclusion and economic growth in the emerging markets.

1.1.1.3 Process Innovation

Process Innovation is the application of new techniques to produce or supply goods and services (Tranos, 2021). The overall aim is to ensure an organization is being run to work better, more efficiently and achieve better quality results. Tranos (2021) describes the production, supply. As a consequence, chain, logistics and service delivery models can be adjusted. The primary aim is to increase the total performance, economic savings and streamline the operations.

Process Innovation makes companies more competitive and develops, as it will enable them to save costs by cutting waste, as well as use the resources available to them more wisely (Ozturk & Ozen, 2021). It can assist the companies gain customer loyalty through provision of high-quality products which are consistently identical. With enhanced agility and simplification of the way things are done, the firms will be able to respond to the desires that customers have and also to market change at a faster rate.

The recent technologies can be employed by companies to attain Process Innovation, adhere to lean concepts, as well as implement green operations in their supply chains (De Giovanni and Cariola, 2021). Automation, data analytics and artificial intelligence are industry 4.0 technologies that are highly significant when transforming the manner in which production occurs. De Giovanni and Cariola (2021) say that lean is devoted to the elimination of waste and the optimization of the way people work, whereas green supply chains are aimed at making the whole production process greener. They disclose that Process Innovation is not an easy task and could significantly improve the performance of a company.

Across the world, regions use different approaches to study PrI trends (Khan, Kaur, Jabeen

and Dhir, 2021). The USA and Europe are leading in adopting Industry 4.0 and using advanced manufacturing and nations such as China and South Korea are following by investing heavily in automation and robotics and Asia is catching up fast. Kenya in Africa is working on PrIs that deal with regional issues such as boosting farming and finding sustainable energy. All over the world, more attention is being given to green Process Innovation to help reduce harm to the environment, as Khan, Kaur, Jabeen and Dhir (2021) pointed out.

1.1.2 Inflation

Inflation refers to a continuous increase in the common prices of goods and services in an economy and is a key economic statistic (Odintsov, Oikonomou, Giannakoudi, Fronimos & Lymperiadou, 2023). It decreases the Cost Efficiency by lowering the amount people and businesses can spend which affects everyone. To maintain stable prices, support a lasting economy and increase investor confidence, it is very important to manage inflation. Supply chain disruptions, shifts in energy prices and changes in monetary policies are among the reasons behind global inflation, so it is important to understand these factors for good economic management.

Studies on the link between financial development and economic growth has often found that inflation affects investment returns and consumer spending which in turn changes the direction and strength of this relationship (Adeosun, Tabash, Vo and Anagreh, 2023). In addition, studies on capital structure and corporate performance now include inflation as a moderator to assess how changes in prices affect business stability and choices (Ascari, Bonam and Smadu, 2024). In this work, introducing inflation as a moderator is useful

because it helps to see how changes in prices influence the relationship between key economic indicators.

1.1.2.1 Cost Efficiency

The term Cost Efficiency (CE) refers to using less effort to produce a particular amount of output or service (Badunenko, Kumbhakar & Lozano-Vivas, 2021). As a result, financial institutions focus on lowering overheads, making their assets more productive and making their workflows more efficient. To cut expenses while preserving or raising the caliber of services provided, it entails optimizing processes, utilizing technology and skillfully managing inputs like labor, capital and technology. According to Broby (2021), financial technology is essential to the banking industry's ability to operate cost effectively.

The long-term viability and profitability of financial institutions depend on Cost Efficiency as noted by Kumar, Thrikawala and Acharya (2022). Banks may increase their profit margins, become more competitive and provide consumers with more reasonably priced services by cutting operating expenses. Cost Efficiency also enables financial institutions to reinvest savings into expansion, innovation and other strategic projects, which enhances their resilience and overall growth. In a market with competition, cost-effective organizations are better equipped to withstand economic downturns and adjust to shifting market dynamics.

Numerous constructs are used to view cost efficiency, noting that operational efficiency aims to reduce the expenses related to routine tasks like transaction processing and customer support as outlined by Badunenko, Kumbhakar and Lozano-Vivas (2021). The term "allocative efficiency" describes the best possible distribution of resources among various endeavors or product categories in order to optimize output and reduce expenses (Badunenko,

Kumbhakar & Lozano-Vivas, 2021). Utilizing the most effective production methods and technologies to reduce input consumption for a specific output level is known as technical efficiency. A financial institution's overall cost efficiency is influenced by these interrelated constructs.

Globally, the financial sector pays a significant amount of attention to cost efficiency, but it depends on regional trends as indicated by Haralayya and Aithal (2021). Moreover, the employment of technology, particularly automation and data analytics, to streamline the operations and reduce costs is highly appreciated in the USA and Europe. In efforts to reduce the expenses of reaching more customers, countries in Asia such as India are focusing on the digital financial inclusion programmes. Mobile money, e.g. M-Pesa in Kenya has significantly reduced the price of money transfer in.

Africa, which encourages economic development and financial inclusion (Broby, 2021). These examples demonstrate the different methodologies employed in the financial sector to be cost efficient which is affected by changing consumer needs, regulatory changes and technology innovations, and unpredictable cost efficiencies as revealed in Figure 1.1.

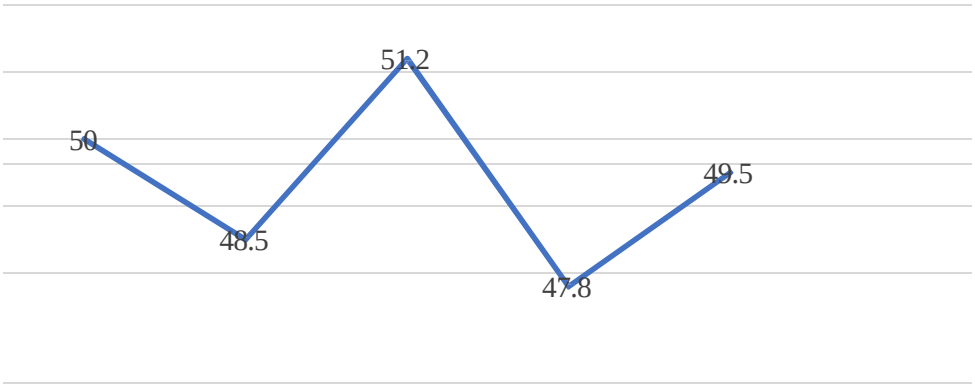

Figure 1.1: Trends in Cost Efficiency of Commercial Banks in Kenya (2020-2024)

Source: Researcher, 2025

1.2 Statement of the Problem

The commercial banks are essential in the economic development since they mediate finances by mobilizing deposits and providing credit to individuals and businesses. Ultimately, they stimulate growth in the economy through raising investment and liquidity in the economy. The banking industry has a significant contribution to the output of Kenya as the financial services constitute approximately 40% of the Gross Domestic Product (GDP) of the country (Central Bank of Kenya [CBK], 2023). Professional and stability of the

The allocation of resources and the management of risks directly affect the industry, and consequently, cost effectiveness is an important performance indicator (Kamau and Were, 2022). Moreover, financial innovation has converted the banking activities and enhanced accessibility and service provision, particularly in the fields of digital banking, mobile payments, and automated services (Otieno et al. in 2023). The increased attention to technology-based banking solutions is questioned because of the concerns related to their direct implications regarding cost effectiveness and operational performance.

The trend of performance in the banking industry has indicated both positive and challenges in relation to financial efficiency. The data provided by the CBK (2023) has shown that in the years 2021 and 2023, the overall Return on Assets (ROA) of the sector was 23.4 and 31.1 respectively, reflecting a growth in the profitability of the sector. Improved operational effectiveness is also reflected in the fact that the cost-to-income ratios in 2023 (48) have fallen down as compared to 52 in 2020. Nonetheless, there are still inconsistent performance trends, particularly in Non-Performing Loans (NPLs), which stood at 13.3% in 2023 and lending margins, meaning that there are still credit risks. The connection between financial technology and operational performance is evident, as the increase in cost efficiency is observed as well as the rise in the use of digital operations. These improvements notwithstanding, there exist unresolved methodological, conceptual, contextual as well as geographic gaps. The evolving digital world might not be well represented by the models of efficiency measurement that was applied by earlier research. Theoretical ambiguities are due to the scarcity of research with conceptual links between financial technology and cost effectiveness. Most studies, contextually, focus on the profitability as opposed to the bank cost structures. Geography studies have been largely limited to large commercial banks not taking into consideration the cost of operation of smaller banks serving rural areas. Filling in these gaps gave a thorough grasp of how Kenya's banking industry is changing.

1.3 Study Objectives

The research was guided by both general and specific objectives as indicated below.

1.3.1 General Objective

To examine the effect of financial innovations on the cost efficiency of commercial banks in

Kenya.

1.3.2 Specific Objectives

The specific objectives of the study were:

i. To determine the effect of product innovation on cost efficiency of commercial banks in Kenya

ii. To establish the effect of system innovations on cost efficiency of commercial banks in Kenya.

iii. To analyse the effect process innovations on cost efficiency of commercial banks in Kenya

iv. To evaluate the moderating effect of inflation cost efficiency of commercial banks in Kenya.

1.4 Research Hypothesis

The research hypothesis that guided this study included:

H_{01}: Product innovation has no statistically significant effect on the cost efficiency of commercial banks in Kenya.

H_{02}: System innovations have no statistically significant effect on the cost efficiency of commercial banks in Kenya.

H_{03}: Process innovations have no statistically significant effect on the cost efficiency of commercial banks in Kenya.

H_{04}: Inflation has no significant moderating effect on the cost efficiency of commercial banks in Kenya.

1.5 Significance of the Study

The study was significant in academic, policy and operational contexts because it aimed to close a crucial knowledge gap about the role that Financial Innovation plays in Kenyan commercial banks' Cost Efficiency. The study contributes to the body of knowledge in academia and provide empirical evidence of the effectiveness of these innovations in the banking sector by analyzing the effects of Process Innovation, System Innovation and Product Innovation on Cost Efficiency. The results serve as a guide to the government and regulators when formulating policies that would stimulate sustainable financial institutions and mitigate the inflationary pressures experienced by banking institutions. The research provides commercial banks with a working platform on how to implement cost-efficient Financial Innovations to boost services delivery, resource allocation mechanisms and awareness on overall profitability in a financial climate, which is increasingly competitive and prone to inflation.

The research will assist investors and financial analysts to learn the effect of financial innovation on the sustainability and resilience of commercial banks against inflationary pressures. By identifying banks that successfully apply cutting-edge financial strategies to sustain profitability and sustainability, this information assist them in making well-informed investment decisions. The results of the study may help financial analysts create risk assessment models that are more accurate by taking inflation's moderating influence on the performance of the banking industry into account.

The study could benefit customers and bank customers significantly as it explains how the innovation of finance can improve access to finances, minimise cost of various transactions

as well as ameliorate bank services. When customers understand how different innovations can influence pricing and service offerings, they may be better equipped to select banks that provide more value-based delivery and that align with their financial requirements. Better Financial Innovations can assist in making sure that underserved communities can access financial services that contribute to the economy and make it more stable.

Technology and Fintech companies may learn about the financial innovations banks choose and the effects these have on banking results, customer satisfaction and efficiency. As a result, fintech companies can adapt their services to help banks move quickly into the digital age. In addition, the research also suggests how banking activities can be improved through the introduction of fintech technology.

Government agencies and economic planners can develop policies that promote financial stability and economic sturdiness by obtaining valuable information of the correlation among inflationary tendencies and financial innovation. The research provides empirical evidence on how regulatory systems can facilitate sustainable economic growth and development through the promotion of sustainable financial innovations without increasing inflationary pressures. Policymakers may improve their power to develop monetary policies that will balance between the growth of the financial sector and curbing inflation.

International financial institutions and the development partners, such as the World Bank, IMF and regional development banks can be in a better position to understand how financial innovation can help in financial resilience in the emerging economies. The work has offered empirical data regarding how the innovation-based banking practices contribute to economic sustainability to guide the development of the funding and technical support programs that

address the needs of the financial sector.

1.6 Scope of the Study

The thematic area of the study was Financial Innovation and their influence on the Cost Efficiency of Kenyan commercial banks, specifically Product Innovation, System innovation and Process innovation with a moderating role played by inflation. This theme is justified by the fact that, despite the necessity of Financial Innovations to make banking more competitive and efficient, little is known regarding the way they could decrease costs. The research was also geographically focused on the Kenyan commercial banks since the sector has gone through growth in the economy that has been coupled with rapid changes in regulation and technology that required assessment of their financial implications.

To explore the implication on banking Cost Efficiency, the time horizon will be initiated in the year 2015-2024 ten years of significant Financial Innovations on the banking sector of Kenya, including regulator transformation, digital lending, fintech collaboration and the development of mobile banking. Moreover, given the fact that the ratios of costs to income in the Kenyan banks have been rising, a fact that can be attributed to the increase in the operations costs, due to the technological investments and change in regulation, the timeframe is urgent, as there is a need to investigate the rising cost ratios and determine the means through which the costs and their impact on the efficiency of the doing business environment can be brought down. This period was also pertinent for examining cost efficiency trends because it includes significant economic events like the Corona Virus Disease-2019 (COVID-19) pandemic, which sped up the adoption of digital finance, the post-2015 interest rate cap and inflationary pressures.

1.7 Scope of the Study

This study focused on all commercial banks licensed by the CBK operating in Kenya and examined the effect of financial innovations on the cost efficiency of commercial banks in Kenya. The specific objectives were: to determine the effect of product innovation on cost efficiency of commercial banks in Kenya; to establish the effect of system innovations on cost efficiency of commercial banks in Kenya; to analyze the effect of process innovations on cost efficiency of commercial banks in Kenya; and to evaluate the moderating effect of inflation on the relationship between financial innovations and cost efficiency of commercial banks in Kenya. The study was anchored in the Efficiency Structure Theory, Transaction Cost Theory, Resource-Based View Theory, and Innovation Diffusion Theory. Secondary data were extracted from CBK reports and bank financial statements spanning 2020 to 2024, supplemented by primary data from structured questionnaires administered to 68 respondents.

1.8 Organization of the Study

The study was organized into five chapters: Chapter one presents information on the background to the study, the statement of the problem, study objectives and research questions. Chapter two covers the theories and literature related to the research topic. Chapter three, provides the research design, a detailed explanation of the population, sampling strategy, data collection procedure and analysis to be used in the study. Chapter four research findings and discussion and finally chapter five on summary, conclusion and recommendations.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The chapter reviewed the theoretical and empirical literature on financial innovations and cost efficiency in commercial banking, presenting a conceptual framework delineating the relationships among product, system and process innovations, inflation and cost efficiency. The chapter further summarizes the literature to highlight methodological, conceptual and contextual gaps that the study addressed.

2.2 Theoretical Review

Efficiency structure, transaction cost, resource-based view and innovation diffusion theories were utilized as case studies for review in order to discuss their correlations between financial innovations and cost efficiency of commercial banks.

2.2.1 Efficiency Structure Theory

The Efficiency Structure Theory by Demsetz (1973) asserts that companies that operate more efficiently than others gain an advantage and make more profit. According to this theory, companies that have good managers do better than those without and economists and finance experts often apply it. This statement means that companies can grow their market share and achieve lasting financial success by managing their costs and resources more effectively. The framework in banking focuses on how good resource management allows banks to offer better loan terms, attract more clients and stay stable in the long run.

According to Torre Olmo, Cantero Saiz and Sanfilippo Azofra (2021) argue that efficiency in operations, market strength and profitability are key parts of the efficiency structure theory. Operational efficiency implies that a company is able to make cost reductions without lowering the quality of service provided by the company making it remain competitive in the industry.

It is presumed that this advantage can be used by companies that have high cost structures to offer lower prices on services and conquer the market. This implies that firms that are able to reduce the costs will stand a better opportunity of making higher profits that can make them successful in the market. Therefore, banks can cut costs, please their customers more and make more profit by using technology and resources smartly.

Studies have shown that the Efficiency Structure Theory is relevant to banking and finance. Mwania and Suva (2022) found that Kenyan commercial banks with better cost efficiency also showed higher profitability. Kaur, Ali, Hassan and Al-Emran (2021) looked into the use of digital banking in developing countries and found that better mobile banking cut down on transaction expenses. Equally, Chhaidar, Abdelhedi and Abdelkafi (2023) found that European banks benefited from financial technology, as it led to better profit margins and reduced costs. These results support the theory's central claim that cost advantages are used by profitable businesses, especially in the banking industry, to attain superior financial performance.

2.2.2 Transaction Cost Theory

The Transaction Cost Theory by Harry (1937), describes the manner in which businesses seek to reduce the expenses related to economic transactions, such as information processing, contract enforcement and operational inefficiencies. Basically, companies employ methods that make transactions easier and help workers be more productive to cut costs. In the banking industry, where banks try to lower their costs while handling transactions and contracts properly, this theory is widely applied.

Three main concepts are part of the theory: opportunism, bounded rationality and transaction costs (Tate & Ellram, 2022). The expenses of negotiating, checking and enforcing contracts are part of transaction costs. Firms are advised by bounded rationality to find ways to overcome their limits in knowledge and thinking while carrying out business activities. Sometimes, opportunities for risk arise from market asymmetry and unenforced contracts, leading to both inefficiency and monetary losses. Since digital banking and automation are being adopted by banks to deliver better service, cut costs and manage information asymmetry, this theory is very applicable to the banking sector.

According to the theory, companies are constantly trying to cut transaction costs which is why banks rely on technology and automation to improve their efficiency. Since it costs banks a lot to enforce contracts, they need to have compliance systems in place to ensure everything runs smoothly and risks are reduced. Risk management systems should be strong when information is not evenly shared among participants in financial transactions. Ononiwu, Onwuzulike, Shitu and Ojo (2024) conducted research that backed up these assumptions by demonstrating that digital banking in South Asia decreased operating costs. Mavlutova *et al*. (2022) also noticed that automation reduced the costs of European banks in. M-Pesa and similar services reduced the cost of transactions and helped more people in Africa take part in financial activities, Kitimbo (2021) reports. These findings indicate that digital transformation helps financial institutions both cut costs and improve their overall results which aligns with the Transaction Cost Theory.

2.2.3 Resource-Based View Theory

According to Barney (1991), Resoiurce-Based View (RBV) theory, a firm's competitive advantage relies on its ability to efficiently use its internal resources. The way a company stands in the market is largely determined by its financial assets, technology and human capital. The RBV framework is based on capabilities, sustained competitive advantage and tangible and intangible resources. Even though organizational culture and human knowledge are not physical, financial and technological resources are. Capabilities mean a company's ability to combine and use its resources which results in a competitive advantage. As RBV explains, businesses can remain ahead of their rivals by using their internal resources in a strategic way over time.

Resource utilization within a bank is highlighted by RBV as a way to keep costs down (Putra, Wiagustini, Ramantha & Sedana, 2021). By using both their qualified employees and digital tools, financial institutions can lower running costs and deliver better services. It is believed in the theory that different businesses have uneven access to resources, so some banks have more financial and technological resources than others. Also, a resource must be Valuable, Rare, Unique and Non-Substitutable (VRIN) in order to give an organization a competitive advantage. So, banks can lower their operating costs and improve how they work by using advanced technologies such as Robotic Process Automation (RPA). Banks can stay ahead in a changing market by regularly enhancing their resources, especially their staff.

Research indicates that the RBV usability in banking efficiency may be implemented. According to a study conducted by Villar and Khan (2021), the application of robotic process automation in Deutsche bank allowed reducing costs and enhancing efficiency.

SeelanathaandNatoli (2025) also discovered that better technology can enable banks to provide their customers with lower financial services. Moreover, Abdeldayem, Aldulaimi and Kharabsheh (2021) examined the banking sector of North Africa and proved that a trained workforce allowed to manage costs better. The results show that RBV can be used to explain why banks strategically utilize their resources to increase profit, competition and also maintain the cost as low as possible.

2.2.4 Innovation Diffusion Theory

Rogers and Smith (1962) developed Innovation Diffusion Theory, which provides an opportunity to comprehend the process of spreading financial innovations to different spheres and communities and the influence on using existing financial solutions. The banking industry has been segmented in this theory through the four key elements namely innovation, adopters, communication channels and social systems. The theory demonstrates how online applications assist commercial banking banks cut down on expenditures and enhance their day-to-day operations.

The main idea is that, due to new technology, banks can use fintech tools to cut costs (Mhlanga, 2024). Even so, banks and other financial institutions are not all using digital technologies at the same pace. Since technology that improves efficiency is more likely to be used by educated banks, it is important for everyone to understand and communicate about such technologies. This idea is in step with the present trends in banking, where digital progress is making financial services more efficient, well organized and easier for customers to use.

Many studies have shown that the Innovation Diffusion Theory is useful in different

geographical financial sectors. Musa and Njeru (2023) found that mobile banking has made it much more cost effective for small and medium-sized businesses in Nairobi. Mothobi and Kebotsamang (2024) found, like others, that more network coverage in sub-Saharan Africa contributed to more people being financially included and lower banking fees. Waqar, Bhatti and Khan (2024) found that using Artificial Intelligence (AI) in European banking improved how much it costs to serve customers and how efficiently the banks operate. The findings confirm that adopting modern technology helps financial institutions boost their productivity, save costs and gain a competitive advantage.

2.3 Empirical Review

Various studies on product innovations, systems innovations and process innovations were discussed in this section. The study used inflation as the moderating variable and cost efficiency were the dependent variable. The independent variables are product innovations, systems innovations and process innovations.

2.3.1 Product Innovations and Cost Efficiency

Product innovations help make different industries more cost effective. Jagani (2023) investigated the link between economic orientation, sustainable product design and innovation performance in manufacturing firms in the USA. The research, based on a survey of 250 businesses, found that making products more sustainable helped companies save money. The study was aimed at observing the impacts of economic orientation on the approach adopted by businesses towards innovation. The research failed to put into account inflation as an element, which may shift the financial position and stability of companies in the long run.

Also, Cainelli, D'Amato and Mazzanti (2020) considered resource-efficient eco- innovations as well as their role in a circular economy in Europe. The study examined the data of European

companies to demonstrate that companies applying eco-innovations, such as recycling and energy-saving technologies, incurred lower costs in their production. The study was aimed at researching the impact of firm-level strategies and environmental regulations on the use of innovations. Although superior, it has a downside in terms of geography where the performance in the tightly-controlled European markets could not be transferred directly to the developing countries such as Kenya with vast disparities in technological capacity and regulatory systems.

The product innovation environment in Asia is mirrored in Udomkun *et al*. (2020), who looked at innovations in solar dryers for agricultural products in Ethiopia and Asia. The study's systematic review of the literature revealed that solar drying technologies increased cost efficiency by lowering energy consumption and post-harvest losses. The goal of the study was to present a thorough grasp of the technological innovation trends in solar drying. A contextual limitation, however, is that a lot of research on solar dryers concentrates on technical viability rather than the financial effects on small-scale farmers, which makes it challenging to determine the innovations' actual cost-effectiveness.

Product and service innovation impacts the performance of Medium ans Small Micro Entreprises (MSMEs) in Kenya according to Kawira (2021) . A survey of 150 companies showed that companies introducing product enhancements such as new packaging and designs, experienced both cost savings and improved earnings. The goal of the study was to look at how new products and services help businesses grow. Yet, the model overlooked the role of macroeconomic factors such as inflation and exchange rate changes which can strongly influence the efficiency of MSMEs.

Further, Omar (2023) looked at how technology has affected how efficient Kenyan

accounting is. Both interviewing and surveying financial managers and accountants was part of the study's mixed-methods approach. The results showed that using cloud accounting and automated reporting reduced labor and errors which helped the company save money. The purpose of the study was to analyze the ways digital transformation is affecting accounting. The study did not consider how inflation might make such technologies unaffordable and unsustainable in the long run which is necessary for keeping costs low.

2.3.2 System Innovations and Cost Efficiency

Making operations easier, removing unnecessary steps and improving how services are delivered are all important for making industries more cost efficient. Kuziemski and Misuraca (2020) examined how AI governance in Canadian public administration changed the way decisions were made. Three cases of AI use in democratic governance were studied by the researchers using qualitative case studies. AI-based systems, as shown in the results, greatly improved how efficiently services were delivered and lowered administrative costs. However, the study criticized the absence of legal frameworks that control AI ethics and accountability, which prevents the technology from being fully incorporated into the public sector. From a conceptual standpoint, this study failed to consider inflation as a moderating factor that could affect the long-term cost savings of innovations powered by AI.

In France, Fraisse, Petrella and Richez-Battesti (2021) examined the effects of system innovations in local childcare management on cost effectiveness. Using a mixed-methods approach, the study combined surveys with in-depth interviews with legislators and childcare service providers. The results showed that cooperative childcare centers and other grassroots social innovations reduced operating costs without sacrificing service quality. However, some of the initial cost benefits were offset by bureaucratic inefficiencies brought about by the

managerial shift towards public experimentation. One important geographical criticism is that because of structural variations in public service financing and regulation, results from France might not apply to Kenya. Furthermore, the long-term sustainability of the cost reductions was not thought to be impacted by inflation.

Japan has implemented system innovations to reduce costs, mainly in the energy area. Ahl *et al*. (2020) looked into how blockchain technology could improve how energy is distributed and make it cheaper in Japan's energy transition. Smart grids using blockchain technology made energy usage more efficient, reduced transaction costs and made everything more transparent, the study reports. The group used a techno-economic analysis to reveal that blockchain technology cut costs by removing the need for middlemen in energy transactions. However, a contextual critique points out that the study did not consider the high initial cost of bringing in blockchain which could stop it from being widely used in countries like Kenya. Besides, the effect of inflation on the prices of energy and its cost effectiveness was not considered.

The effects of IT innovations on both business performance and cost effectiveness in Kenya were examined by Chege, Wang and Suntu (2020). Quantitative research method was employed and 150 Kenyan businesses were surveyed through structural questionnaires. The findings show that IT solutions, such as automated stock system and cloud computing, were beneficial in enabling companies to cut costs and enhance their productivity. The study found out that despite all the advantages, IT systems were not used widely due to expensive nature and also the risk of cyber-attacks. The research results could not be generalized to the various sectors of the Kenya economy because the study failed to consider inter-industrial specifics. In

addition, the research has not considered the impact of inflation on the IT adoption costs.

Digital financial innovations on how they support financial deepening and economic growth in Kenya were studied by Misati, Osoro, Odongo and Abdul (2024). The analysis examined how individuals started using fintech, digital lending and mobile banking using panel data. According to the report, digital finance improvements lowered costs for transactions, helped the economy grow and increased financial inclusion. The researchers noted that because of gaps in regulation and cybersecurity, these innovations could not reach their full potential. Disregarding the possible effects of economic swings on digital financial services is considered a contextual criticism of the study. Precisely, even though inflation is essential in assessing the cost-benefit of financial innovations in unstable economies, it was not considered in the analysis.

2.3.3 Process Innovations and Cost Efficiency

Process innovations are significant in most industries, as they help to make operations more cost effective. Numerous studies in the UK, China, South Africa and Kenya have examined this relationship using various methods and the results are interesting. Dey *et al*. (2020) examined the impact of the application of lean management and innovation to sustainability on the sustainability performance of the MSMEs in Britain. It was aimed at finding out the impact of these practices on economic and environmental results. The survey-based data collection was done on 211 UK based MSMEs and the data analyzed through structural equation modeling. The results indicated that process innovation could be used to explain the relationship between lean management and sustainability performance. Nevertheless, the incorporation of inflation as moderating variable in the study might assist in interpreting better the findings of costs. The results cannot be easily generalized to the developing

countries due to their concentration on MSMEs in the UK (Dey *et al*. 2020).

Wong, Wong and Boon-itt (2020) in China investigated the connection between green innovation, the integration of the supply chain and the cost and environmental outcomes. The wanted to determine the results of incorporating environmental aspects in the supply chains on the performance of the companies. They have surveyed 213 manufacturing companies and analyzed them in regression analysis. The study established that green innovation and green supply chain integration benefited the environment, although only green innovation benefited the costs. The report can fail to reflect on the cost effectiveness of the approach as inflation is not a factor. Furthermore, the results might not be applicable to other companies or regions due to the focus of the study which is confined to the Chinese manufacturing firms (Wong, Wong and Boon-itt, 2020). Edeh, Obodoechi and Ramos-Hidalgo (2020) also investigated the impacts of innovation strategies on the performance of developing market firms in terms of exports. The study was aimed at finding out the impacts of product and process innovations on the export performance of businesses. Importantly, 305 companies were surveyed through a quantitative method and results were analyzed with a structural equation model. The findings show that process innovation and not product innovation is the more significant to export performance. Another factor that was not put into consideration in the study which may influence cost effectiveness is inflation. Moreover, the focus on the export performance may not consider the effects of process innovations on local production prices in all aspects (Edeh, Obodoechi and Ramos-Hidalgo, 2020).

In the study by Christopher, Jane and Yussuf (2021) in the Nairobi County in Kenya, the researchers aimed to establish the effects of the process innovations in small and medium sized

manufacturing firms. This was done to establish the effect of process innovations on performance of operations. Questionnaires and analysis of data on 150 MSMEs were used to sample and analyse data respectively. The study found out that process innovations help operations to be more productive and cost-saving. However, the study did not consider inflation and that might have enhanced the inaccurateness of the findings. Besides, the results of the study might not be applicable to other areas of Kenya since it concentrated entirely on Nairobi County (Christopher, Jane and Yussuf, 2021).

In Kenya, Ndungu and Moturi (2020) conducted research to investigate key drivers of the use of mobile fintech in the microfinance sector. The reason why the study was conducted was to find out what influences the level of efficiency a bank operates as well as the number of people who use mobile financial services. Both surveys and interviews were used in gathering information about 47 microfinance institutions. From the results, it became clear that support from regulators, the usefulness of mobile fintech and being technologically ready are important for its adoption which makes operations more efficient and lowers costs. The study did not consider inflation which could have affected the analysis of cost effectiveness. Also, the results may not apply to other industries because microfinance is a specialized sector (Ndungu & Moturi, 2020).

2.3.4 Inflation and Cost Efficiency

Inflation has an influence on financial markets and businesses and it plays a major role in deciding how cost-efficient an economy is. Sicsú *et al*. (2021) found that inflation kept rising during the worst economic recessions in Brazil. They wanted to study how inflation could occur when the overall demand in the economy was low, using a post-Keynesian approach. Researchers found that it was external shocks and poor fiscal policy, not normal supply-

demand factors, that caused Brazil's long-lasting inflation. The lack of flexibility in this study which fails to consider cost efficiency in industries and supposes that inflation is the same everywhere, is its biggest drawback. As a result, there is little information available on how inflation affects business cost management, mainly in emerging markets.

In Britain, Jessop (2022) has studied how the corporatization of monetarism has affected economic policies, mainly with regard to inflation. The team studied how British monetary policy developed and how it affected cost effectiveness in different industries using a historical-institutional approach. The results suggest that tight monetarist policies made businesses more financially responsible and helped reduce spending in the government. But because British economic systems and policies are different from those in developing nations like Kenya, Jessop's study is not worldwide. Also, the study did not consider inflation, so it is difficult to apply its results where high amounts of informality in the economy meet inflation.

Purwono, Yasin and Mubin (2020) suggest another viewpoint on the cost effectiveness and inflation in Indonesia. The aim of the study was to determine whether or not the regional economies in Indonesia were dependent on the inflation as well as whether or not the rate of inflation became closer to each other over the years. In panel data econometrics, it was discovered that the inflation remained unbalanced across the Indonesian provinces and this had a toll on the productivity of companies based in these provinces. The attempt of the study was to determine whether the government intervention to prevent inflation had the same effects in other regions of the nation. The weakness of this study is that it does not examine how the response of some companies to inflation utilizes industry-specific strategies. The paper failed to consider how inflation can reduce the effect on selected businesses which may be the reason

why they could stay afloat.

In Kenya a study has been made on the impact of inflation in making things in the country cost effective. The authors of the article Saungweme and Odhiambo (2021) conducted a time-series econometrics study to analyse the relationship between inflation and growth in Kenya. The analysis revealed that beyond a specific inflation rate, it had a negative outcome on the economy and was more costly to industries that were reliant on the consistent prices. The authors of the research wanted to determine the rate of inflation that would maintain the economy stable and rising. Nonetheless, it provided a major conceptual void in our perception of cost efficiency mechanisms because it did not discuss how businesses can use technological changes or cost-saving tactics to adapt to inflation. Also, the reaction of inflation to the performance of firms was not considered; it was only analyzed as an independent variable.

On the same note, Musembi, Simiyu and Njoka (2020) researched the impact of inflation on the performance of Kenyan equity market, that is, at the Nairobi Securities Exchange (NSE). It was found through regression analysis that inflationary trends affected negatively performance in the stock market through increase of the cost of capital and reduction of investor confidence.

The primary aim of the study was to establish the relationship between the market efficiency and the macroeconomic factors. The geographical limitations of this research are that focus has been on the formal financial sector in Kenya and therefore, has not captured the cost-efficiency relationship of informal businesses in which the inflationary impacts may be different. It also could not take into consideration the inflation as a moderating factor as applied in other studies, a factor that made it difficult to establish the true impact of inflation on cost efficiency in the different sectors of the economy.

2.4 Summary of Literature Review and Research Gaps

The literature review highlights the significance of innovations in systems, products and processes to enhance cost effectiveness in different sectors and geographical locations. The USA, European, Asian Studies and Kenyan research indicate that the examples of the product innovations are technological development, eco-innovations and sustainable designs that lead to cost efficiency through the simplification of the production process and minimisation of waste. Like this, innovations in systems that will lead to lower operational expenses and optimization are blockchain technology, AI governance and digital financial solutions.

The process innovations that enhance cost efficiency in MSMEs and manufacturing firms include lean management and green supply chain integration. Another research gap that is interesting to note between these studies is the failure to consider inflation as a moderating factor which significantly influences the cost structure of firms, their long-term financial sustainability, and the affordability of technological innovations. Moreover, because of the infrastructure differences, market forces and regulations may not be readily applicable to developing countries such as Kenya. To beat these limitations, it is important to research more on the same in the future by incorporating inflation as a critically important variable and putting their findings into context so that their findings can better reflect the status of the economy of developing countries.

Table 2.1: Summary of Literature Reviewed and Gaps in Literature

Author	Key Objective	Key Findings	Research Gap	How the Study Fills the Gap
Ahl *et al.* (2020)	Evaluating blockchain technology's potential in optimizing energy distribution and reducing costs in Japan's energy sector.	Blockchain-enabled smart grids increased energy efficiency, reduced transaction costs, and enhanced transparency.	Did not account for high upfront costs of blockchain implementation, limiting its adoption in developing countries; ignored inflation's influence on energy prices and cost-effectiveness.	Highlights blockchain's efficiency in energy distribution but lacks analysis of cost barriers and inflationary effects.
Cainelli, D'Amato, & Mazzanti (2020)	Investigating how firm-level strategies and environmental regulations influence the adoption of innovations.	Companies implementing eco-innovations (material recycling, energy-efficient technologies) experienced lower production costs.	Findings from highly regulated European markets may not be directly applicable to developing nations like Kenya due to differences in technological capabilities and regulatory frameworks.	Emphasizes the role of eco-innovations in cost reduction but lacks applicability in less-regulated economies.
Chege, Wang, & Suntu (2020)	Investigating the impact of IT innovations on business performance and cost-effectiveness in Kenya.	IT innovations like cloud computing and automated inventory systems reduced operational costs and increased productivity.	Did not consider cross-industry variables, making it difficult to generalize findings across Kenya's economic sectors; did not account for inflation's impact on IT adoption costs.	Provides local insights into IT innovation benefits but lacks industry-wide applicability and inflationary analysis.
Christopher, Jane, & Yussuf (2021)	Assessing the impact of process innovations on operational performance of	Process innovations improve operational performance and cost efficiency.	Did not include inflation as a moderating factor; limited to Nairobi County, restricting generalizability	Highlights process innovation's local benefits but lacks inflationary

	SMEs in Nairobi County, Kenya.		across Kenya.	context and nationwide applicability.
Dey *et al*. (2020)	Examining how lean management and sustainability-focused innovation affect SMEs' sustainability performance in the UK.	Process innovation mediates the relationship between lean management and sustainability performance.	Did not account for inflation as a moderating factor; limited applicability to developing countries.	Highlights process innovation's role in sustainability but lacks inflationary analysis and cross-context applicability.
Edeh, Obodoechi, & Ramos-Hidalgo (2020)	Analyzing the impact of process and product innovation on export performance in South Africa.	Both innovations improve export performance, but process innovation has a stronger effect.	Did not consider inflation's impact on cost effectiveness; focus on export performance may not reflect domestic cost efficiency.	Shows process innovation's role in exports but lacks domestic cost analysis and inflationary insights.
Fraisse, Petrella, & Richez-Battesti (2021)	Investigating the cost-effectiveness of system innovations in local childcare management.	Cooperative childcare centers reduced costs without compromising service quality, but bureaucratic inefficiencies offset some benefits.	Results from France may not be applicable to Kenya due to structural differences in public service financing; did not consider inflation's impact on long-term sustainability.	Demonstrates social innovations' role in reducing costs but lacks applicability in different regulatory environments.
Jagani (2023)	Evaluating how economic orientation affects businesses' innovation strategies.	Sustainable product innovations significantly increased cost efficiency by reducing waste and optimizing production processes.	Did not consider inflation as a moderating factor, which affects cost structures and long-term financial sustainability.	Highlights the importance of sustainable product innovations in reducing costs but lacks consideration of inflation's impact.
Jessop (2022)	Analyzing the corporatization of monetarism in	Monetarist policies enhanced financial	Geographically limited to Britain; did not consider	Provides insights into monetarist

	Britain and its effect on cost efficiency.	discipline but restricted public sector spending.	inflation as a moderating factor in cost efficiency.	policies but lacks applicability to developing economies and informal sectors.
Kawira (2021)	Assessing how product and service innovations contribute to business growth.	MSMEs that implemented product innovations (better packaging, new product designs) experienced cost savings and higher profitability.	Did not consider macroeconomic factors like inflation and exchange rate fluctuations, which impact cost-effectiveness.	Demonstrates the benefits of product innovation for MSMEs but overlooks broader economic influences.
Kuziemski & Misuraca (2020)	Examining the governance of AI in public administration and its impact on decision-making efficiency.	AI-driven systems improved service efficiency and reduced administrative costs.	Lacked legal frameworks on AI ethics and accountability; did not consider inflation as a factor affecting long-term cost savings.	Highlights AI's role in improving efficiency but overlooks inflation's impact on sustained cost-effectiveness.
Misati, Osoro, Odongo, & Abdul (2024)	Examining digital financial innovations' role in financial deepening and economic growth in Kenya.	Fintech, digital lending, and mobile banking lowered transaction costs, boosted economic growth, and enhanced financial inclusion.	Regulatory gaps and cybersecurity risks limited full potential; did not account for macroeconomic volatility, especially inflation, in determining true cost-benefits.	Highlights digital finance's role in cost reduction but overlooks inflation's effect on financial service affordability.
Musembi, Simiyu, & Njoka (2020)	Examining inflation's impact on stock market performance at the Nairobi Securities Exchange (NSE).	Inflation increased capital costs and reduced investor confidence, negatively affecting market performance.	Focused on Kenya's formal financial sector, neglecting informal business dynamics.	Connects inflation to market efficiency but lacks broader economic sector analysis.
Ndungu &	Identifying	Regulatory	Did not examine	Demonstrates

Moturi (2020)	factors influencing mobile fintech adoption in Kenya's microfinance sector.	support, perceived utility, and technological preparedness drive mobile fintech adoption, improving efficiency and reducing costs.	inflation's effect on cost effectiveness; findings may not apply to other industries.	fintech's role in process efficiency but lacks inflation analysis and broader industry scope.
Omar (2023)	Assessing how digital transformation is changing accounting practices.	Technological advancements (cloud accounting, automated financial reporting) enhanced cost efficiency by reducing manual labor and errors.	Did not consider the impact of inflation on the affordability and sustainability of technological innovations.	Highlights efficiency gains from digital transformation but lacks an analysis of inflation's effect on long-term viability.
Purwono, Yasin, & Mubin (2020)	Investigating regional inflation convergence and its impact on economic performance in Indonesia.	Inflation disparities persisted across provinces, affecting business productivity differently.	Did not examine firm-level cost-efficiency strategies or inflation's moderating effect.	Explores regional inflation differences but lacks firm-level cost adaptation analysis.
Saungweme & Odhiambo (2021)	Assessing the impact of inflation on Kenya's economic growth and cost efficiency.	Inflation negatively affected economic growth beyond a certain threshold.	Did not analyze how businesses adapt to inflation through technology or cost-cutting measures.	Identifies inflation-growth thresholds but lacks business-level cost efficiency mechanisms.
Sicsú, de Melo Modenesi, & Pimentel (2021)	Examining inflation persistence during recessions in Brazil using a post-Keynesian approach.	Inflation persisted due to external shocks and fiscal mismanagement rather than traditional supply-demand dynamics.	Did not consider cost efficiency across industries or sectoral variations in inflation's impact.	Highlights inflation's structural causes but lacks insights on its effects on cost-cutting strategies.
Udomkun *et al*. (2020)	Understanding technological innovation trends in solar	Solar drying technologies improved cost efficiency by	Many studies focus on technical viability rather than financial	Provides insights into solar drying efficiency but

	drying.	reducing energy consumption and post-harvest losses.	impacts on small-scale farmers, making cost-effectiveness assessment difficult.	lacks an economic analysis of benefits for small-scale farmers.
Wong, Wong, & Boon-itt (2020)	Investigating the impact of green innovation and supply chain integration on cost and	Green innovation improves both environmental and cost performance, while green	Excludes inflation as a moderating factor; limited to Chinese manufacturing sector, restricting	Demonstrates green innovation's cost benefits but lacks broader industry and
	environmental performance in Chinese manufacturing firms.	supply chain integration enhances environmental performance only.	generalizability.	inflationary considerations.

Source: Researcher, 2025

2.5 Conceptual Framework

A conceptual framework is a structured, analytical representation that depicts the key variables in a study and the hypothesized relationships among them. It serves as both a theoretical and operational guide, helping to clarify the direction of inquiry, inform data collection, and shape the analytical process. Kombo and Tromp (2011) aver that a well-defined conceptual framework synthesizes literature into a coherent structure, enabling researchers to understand how various factors interact to influence the phenomenon under investigation. The independent variables were product innovations, systems innovations and process innovations while the dependent variable is cost efficiency. This were moderated by inflation.

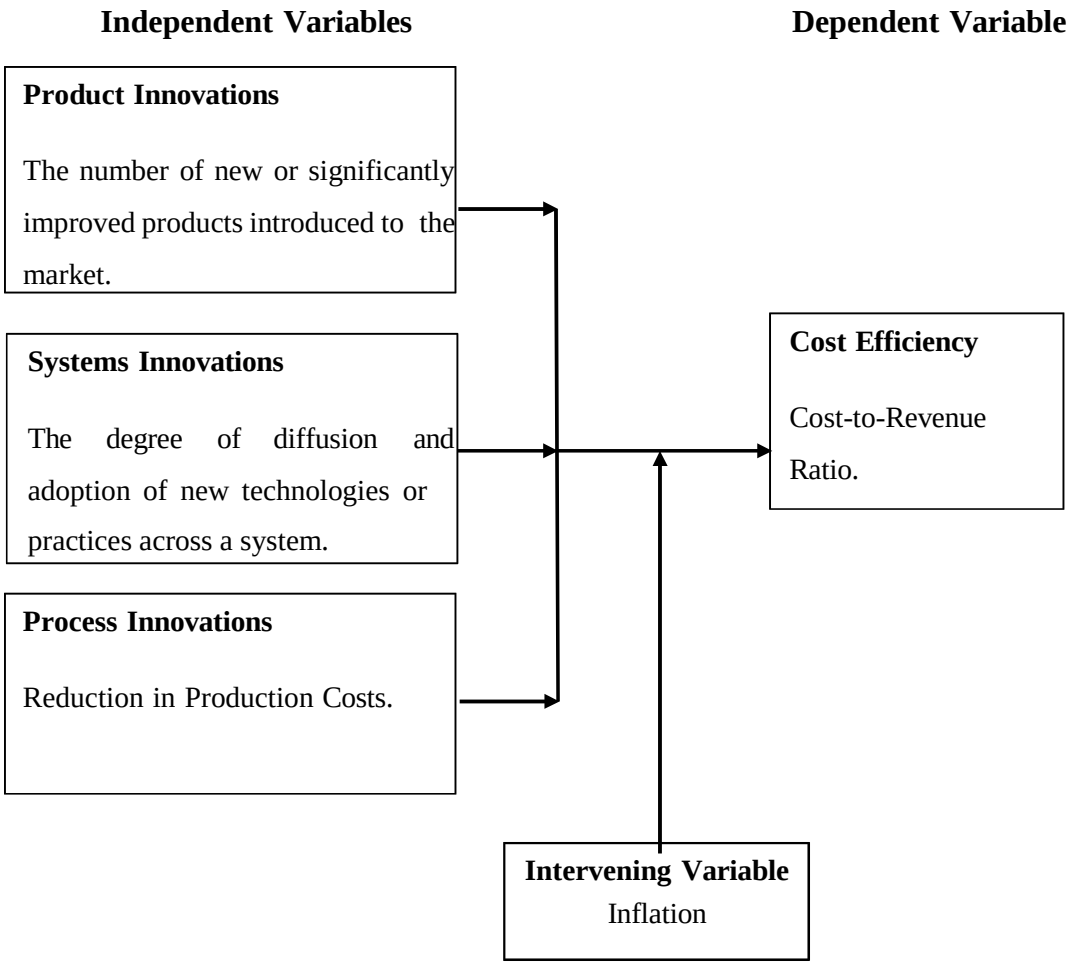

Figure 2.1: Conceptual Framework

Source: Researcher, 2025

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

The chapter outlines the research methodology for investigating financial innovations and cost efficiency in Kenyan commercial banks, detailing the study design, population, variable measurements, data collection methods, sampling design, data collection instruments, data collection procedures, data analysis and presentation, diagnostic tests and ethical considerations to ensure a robust and ethical research process.

3.2 Research Design

A research design serves as a guide for the actions to consider in order to complete an intended study. It provides examples of how systems and procedures are applicable to obtain answers to research questions as noted by Creswell and Plano Clark (2007). To study used a descriptive research approach. Since it helps look at the relationship between cost effectiveness and financial innovations and spot trends as time passes, a descriptive design is appropriate.

The study used an explanatory research approach to study how financial innovations affect product, system and process innovations, inflation and the cost efficiency of Kenyan commercial banks, as explained by Liu (2024). This approach allowed the use of regression models to quantify how such variables interact and affect cost efficiency results. Objective measurement and statistical validation of results are guaranteed when a quantitative approach is used.

3.3 Target Population

According to Salkind (2010), a population is a collection of people, groups, or other entities that a researcher wants to use for analysis and drawing conclusions. A researcher's target population is the particular group they wish to study scientifically (Casteel & Bridier, 2021). The unit of analysis was individual commercial banks, with inclusion criteria encompassing all commercial banks licensed by the CBK operating in Kenya, both domestic and international, regardless of ownership, size, or technology adoption level, while exclusion criteria omitted non-banking financial institutions, unlicensed banks, or banks not operating in Kenya.

3.4 Empirical Model

The study used a multiple linear regression model in order to determine empirically the impact of financial innovations on the cost efficiency. The overall model was of the form:

$$CE=\beta 0+\beta 1PI+\beta 2SI+\beta 3PrI+\beta 4INF+\epsilon$$

Where:

CE = Cost Efficiency of commercial banks

PI = Product Innovation

SI = System Innovation

PrI = Process Innovation

INF = Inflation (moderating variable)

$\beta 0$ = Intercept

$\beta 1,\beta 2,\beta 3,\beta 4$ = Coefficients of independent variables

ϵ = Error term

The model helped quantify the relationship between financial innovations and cost efficiency while assessing the moderating effect of inflation.

Table 3.1: Operationalization and Measurement of Variables

Variable	**Type**	**Operationalization**	**Measurement**	**Measurement Scale**
Product Innovations	Independent variable	The number of new or significantly improved products introduced to the market.	Count of new financial products/services introduced annually	Likert Scale
System Innovations	Independent variable	The degree of diffusion and adoption of new technologies or practices across a system.	Percentage of digital transactions or IT investment as a proportion of total bank operations	Likert Scale
Process Innovations	Independent variable	Reduction in production costs through improved banking processes.	Cost savings as a percentage of operational expenses	Likert Scale
Inflation	Moderating variable	The rate at which the general level of prices for goods and services rises, eroding purchasing power.	Annual inflation rate (%)	Likert Scale
Cost Efficiency	Dependent variable	The efficiency of managing operational costs relative to revenue.	Cost-to-Revenue Ratio (Operating expenses / Total revenue)	Likert Scale

Source: Researcher, 2025

3.5 Sampling Design

According to Graber and Wallau (2017), a sample is a collection of units of analysis used in a study to represent a particular population. The number of components used in quantitative research is known as the sample size (Fusch & Ness, 2015). The sample frame is the model that is applied to determine the sample of a study (Prandner & Weichbold, 2019). The sampling methodology, as Castell and Bridier (2021) define it, is the process of choosing the samples to be employed in a scientific study. The study employed purposive sampling to select commercial banks that have adopted the innovations in finance. The records provided by CBK (2024) indicate 39 commercial banks in Kenya. The population size was manageable, census sampling was used to determine the sample to guarantee that the various bank categories large, medium and small banks were represented proportionately.

3.5.1 Validity of Research Tool

Validity is the precision of a tool in the measurement of the desired variables. An instrument that is valid makes it credible and applicable to the greater group (Saunders et al., 2023). Content, construct, and Construct validities were checked in order to ensure that the instrument is valid. The content-validity is used to verify that the instrument addresses all the areas of interest of the research (Bougie and Sekaran, 2019). In order to justify content validity, the research supervisor appraised this tool to ensure that it was in line with the objectives of the study. It was also compared with available literature in order to cover major variables exhaustively. This meant that the pilot test would help to identify any ambiguities and inconsistencies, which were corrected to improve accuracy.

Construct validity determines how a tool is reliable to measure the underlying constructs that it is meant to measure (Saunders et al., 2023). This was measured by aligning the questions

to the theoretical constructs, according to the current literature and theoretical frameworks. Criterion-related validity assumes an analysis of how the instrument correlates with an outcome (Creswell and Clark, 2017) To examine this, the questionnaire was evaluated compared to familiar outcomes to determine the correlation with pertinent results.

3.5.2 Reliability of Research Instrument

Reliability of the research tool is the uniformity and consistency of measuring variables when administered on multiple occasions (Taherdoost, 2021). Cronbach coefficient was used to ensure that the instrument was reliable. The coeeficient indicates the similarity of the set of related items as a cluster and a decent value is larger than 0.70 (Kalpande and Toke, 2023). In this research, Cronbachs alpha of 0.70 and above was acceptable to represent a satisfactory internal consistency and reliability of the instrument. A value of less than 0.70 could indicate that items are not always measuring the same construct and the instruments were then revised either by eliminating or changing the problem items. The instrument was tested during the pilot, and Cronbach's alpha was calculated using the responses to evaluate whether the items in the questionnaire were consistently measuring the same construct. Any items that negatively affect the reliability of the instrument were to be revised based on the results of this analysis.

3.6 Data Collection Instrument

Structured questionnaires were the study's primary data collection instruments. To determine the cost efficiency indicators and annual disclosures of 2014–2024 of the banks on financial innovation, secondary data was obtained using predefined templates in CBK financial stability reports. Structured questionnaire with Likert-scale and open-ended

questions was used to collect qualitative information about innovation adoption and cost-saving aspects from key banking staff. These tools had ensured that the data aggregation was complete and involved the quantitative KPI to regression analysis with the qualitative data in order to contribute the richness and credibility to the research.

3.7 Data Collection Procedure

The study employed a secondary data to conduct an analysis to determine the impact of the financial innovation on the cost efficiency of the commercial banks in Kenya so that sufficient and sufficient data is used in the regression analyses. The secondary data sources included surveys of the banking sector and annual reports of CBK, published financial reports of 39 licensed commercial banks (according to CBK [2024] records). CBK financial stability reports provided essential cost efficiency measures such as the cost-to-income ratio operating expense/total revenue, the ratio of returns to assets and non-performing loans, which are vital in assessing operational competency and financial stability (CBK, 2023).

Banks' annual disclosures provided quantitative information on financial innovations such as the number of new financial products launched every year for product innovation, the share of digital transactions or IT investments for system innovation and the cost savings as a percentage of operating expenditures for process innovations (Kombe, 2023). The period covered by the data spanned from 2014 to 2024, a decade that witnessed tremendous technological advancements such as M-Pesa's extension, digital lending platforms and economic events such as 2015 interest rate capping, the emergence of COVID-19 pandemic, so as to analyze This period therefore provided adequate data points for time-series regressions, allowing for variations in the inflation rates and their moderation effects, as evidenced by Saungweme and Odhiambo (2021).

The study utilized structured questionnaires to key banking personnel of the 39 banks to supplement secondary data and to balance out potential biases in qualitative information or unrecorded innovation measures. These surveys were designed to obtain specific information on execution and perceived impacts of financial newnesses such as challenges in the implementation of system innovations or the cost-saving factors of process innovations that might not be fully elaborated in publicly accessible reports (Kamau & Were, 2022). The Likert-scale and open-ended questions used in the questionnaires were suited to quantify both adoption rates and qualitative effects in a manner that fits the quantitative regression framework. Data collection operated within ethical standards, informed consent sought and responses anonymized in the interest of confidentiality, as provided by Pera and van Tonder (1996). By triangulating secondary data with primary data from questionnaires, the study increases reliability and depth of findings overcoming secondary data availability or inconsistencies of reports and allowing a holistic view on how financial innovations influence cost efficiency among diverse banks in Kenya (Badunenko *et al*., 2021).

3.8 Data Analysis and Presentation

In the study, statistics that included both descriptive and inferential was used. This was adopted in the analysis of data. The data was summarized using descriptive statistics. The summaries was in form of means, standard deviations and frequencies as recommended by Taherdoost (2022) in studies that are of similar nature. Further, for inferential analysis, on the impact of financial innovations on cost efficiency were ascertained. This was through regression analysis. To analyze the data, a statistical program that was computer aided; Statistical Package for Social Sciences (SPSS) was utilized. To facilitate understanding, the

results are displayed as tables, graphs and charts.

In the study, data presentation included a combination of descriptive and inferential statistical methods. The combination ensured the clarity and robustness, specifically for conducting relevant regression analyses properly. The data types included more advanced quantitative data such as interval and ratio scales for multiple linear regression models. In the study, the following were measured: Cost efficiency via a cost-to-income ratio (operating expenses/total revenue), product innovation through a number of new financial products introduced annually, system innovation by the percentage of digital transactions or IT investments, process innovation via cost savings as a percentage of operating expenses and inflation using quantitative measures of descriptive statistics. Through this, means, standard deviations and frequencies were presented. The presentations were in tables as summaries of trends, while graphs such as line charts for Cost Efficiency trends, display trends in time. Inferential results from regression analyses using SPSS are presented in tables of coefficients, their respective p values and R squared values to establish quantitative effect of Product Innovation, System Innovation, Process Innovation and inflation on Cost Efficiency while maintaining robust statistical inference and ensuring clarity of results.

3.9 Diagnostic Tests

A number of diagnostic tests were carried out to confirm the validity and reliability of the model prior to regression analysis. These included:

3.9.1 Multicollinearity Test

Regression estimates were distorted by multicollinearity, when independent variables had high correlation. The Variance Inflation Factor (VIF) was used, where a value of more than 10 indicated severe multicollinearity. To solve the problem, correlated variables was

eliminated. There was no correlation between the variables if the hypotheses' VIF value was 1. The variables in question had a moderate correlation when the VIF value was between 1 and 5 and a high correlation when it was greater than 5, at which point it was eliminated as noted by Dupuis and Victoria-Feser (2013).

3.9.2 Normality Test

The data underwent a normality test to ascertain that it was distributed normally. The Kolmogorov-Smirnov and Shapiro-Wilk tests was applied. Logarithmic transformation was one of the transformations that was used in situations where data was not normally distributed.

3.9.3 Heteroskedasticity Test

Regression estimates were not as effective where there was heteroskedasticity, in which the variance of the error terms was not constant. To determine whether heteroskedasticity exists, the Breusch-Pagan test was utilized. It was corrected using Generalized Least Squares (GLS) or robust standard errors, where they existed.

3.9.4 Autocorrelation Test

The reliability of regression estimates was impacted by autocorrelation, which happened when residuals exhibit time correlation. Values near 2 indicated no autocorrelation, according to the Durbin-Watson test. Autoregressive models or Newey-West standard errors were used where autocorrelation was found.

3.9.5 Linearity Test

The linearity of the relationship between independent and dependent variables was confirmed by a linearity test. The Ramsey RESET test and scatter plots was used to test this. Polynomial regression or log transformations was taken into consideration if non-linearity

was found.

3.10 Ethical Considerations

According to Pera and van Tonder (1996), ethics refers to the proper behavior and conduct in conducting a study. In relation to this study, accuracy, transparency and confidentiality ethics was demonstrated. The research was undertaken in compliance with ethical standards. First, it maintained confidentiality by ensuring that the financial information specific to a bank is anonymized. Data sources were duly cited to prevent plagiarism. Third, the researcher and the research team received the required approval by a relevant body, such as Kenyatta University Graduate School Authorization and a NACOSTI permit prior to the commencement of any data collection process. Finally, the study also complied with integrity and transparency in data reporting in order to maintain credibility.

CHAPTER FOUR: RESEARCH FINDINGS AND DISCUSSION

4.1 Introduction

The chapter provides the findings of the study as directed by the objectives of the study. Both the secondary data (CBK reports and bank disclosures (2015-2024)) and primary data (structured questionnaires to top-level banking personnel) are used to inform the results.

4.2 Response Rate

The sample used in the study was 39 commercial banks in Kenya according to CBK (2024) records. The structured questionnaires were sent to 78 respondents (two key personnel of each bank, normally of middle or senior management). Out of these, 68 questionnaires were duly returned and the response rate was 87.18. This response rate rate is also reliable and representativeness of primary data, which is consistent with Gravetter and Wallnau (2017) who suggest a response rate of over 70% to have substantial statistical data. CBK financial stability reports and bank disclosures of all 39 banks, 2015-2024, were used to gather secondary data, which ensured coverage.

4.3 Demographic Characteristics

The population characteristics of the respondents are a context to the primary data obtained. The demographic characteristics are summarized in Table 4.1.

Table 4.1: Demographic Characteristics of Respondents

Variable	Category	Frequency	Percentage (%)
Gender	Male	42	61.76
	Female	26	38.24
Age Group	26–35 years	18	26.47
	36–45 years	32	47.06
	46 years and above	18	26.47
Education Level	Bachelor's Degree	22	32.35
	Master's Degree	38	55.88
	PhD	8	11.77
Years of Experience	1–5 years	12	17.65
	6–10 years	24	35.29
	More than 10 years	32	47.06
Position/Role	Middle Management	40	58.82
	Senior Management	28	41.18

Source: Field data, 2025

Most of the respondents were men (61.76%), and the age group of 36-45 years was the most represented (47.06%). The sample was well informed and experienced, most of the respondents possessed a Master degree (55.88%), and were above 10 years of experience in the banking industry (47.06%). The middle management consisted of 58.82 percent of respondents, which guaranteed an operational and strategic viewpoint.

4.4 Descriptive Statistics

The variables were computed using descriptive statistics, which included the product innovation as the number of new financial products created per year, system innovation as the proportion of digital transactions or IT investments, process innovation as the percentage of cost savings on operating expenses, inflation as the annual inflation rates of CBK and cost efficiency as the ratio of costs to income. Table 4.2 presents the results.

4.4.1 Product Innovation

The table below shows frequency, mean and standard deviation of the extent of the product innovation adoption by the respondents who were 68 in total.

Table 4.2: Product Innovation

Category	Frequency	Percentage (%)	Mean	Standard Deviation
Very High	12	17.65		
High	25	36.76		
Moderate	19	27.94		
Low	9	13.24		
Very Low	3	4.41		
Overall Mean			3.25	1.12

Source: Field data, 2025

The statistics show that a considerable percentage of the respondents (36.76) rated adoption of product innovation as high, as there is a high rate of introduction of new financial products which includes digital loan and mobile banking applications. The general average of 3.25 indicates that there is moderate to high innovation of products in the sampled banks where the average rate of new products introduced was 3.25 annually. The 1.12 standard deviation emphasizes the moderate variability of the adoption rates, meaning the fact that even though most banks are innovating, the aggressiveness varies depending on the institutional capacity and market focus.

The allocation highlights the strategic focus on product innovation that Kenyan banks are making in improving service delivery and customer coverage. The frequency of high frequency of the word High and moderate is 64.7, which is the combination of the high and moderate response meaning that banks are responding to the market demands with the innovation in their offering, which is in line with the financial technology globally. However, the fact that there

are some Low and Very Low responses (17.65) means that there could be challenges such as the high cost of development or absence of technological infrastructure in some institutions.

The mean (5-item Likert scale, Very Low, 1, Very High, 5) of the Likert scale is 3.25 that provides a quantitative description of the mean effort in innovation. A standard deviation of 1.12 implies that although most banks are moderately innovative, a smaller proportion will be either highly innovative or lagging, requiring focused intervention to close this gap. This variation might affect the cost efficiency estimates, where more pioneering banks might benefit more due to lower transaction costs.

4.4.2 System Innovation

System innovation adoption was probed and findings are based on responses from the 68 respondents, presented in Table 4.3 through frequency, mean and standard deviation.

Table 4.3: System Innovation

Category	Frequency	Percentage (%)	Mean	Standard Deviation
Very High	15	22.06		
High	28	41.18		
Moderate	16	23.53		
Low	7	10.29		
Very Low	2	2.94		
Overall Mean			62.34	8.45

Source: Field data, 2025

The respondent statistics show that 41.18% of respondents ranked system innovation adoption high, which means that they heavily invested in such technologies as core banking systems and AI-driven analytics. The average figure of 62.34, which means the percentage of digital transactions, indicates that the company highly depends on the innovations in the system to make its operations efficient. The standard deviation is 8.45, implying quite a big variation as many banks have adopted digital systems but the level of integration differs

according to the difference in the IT infrastructure and financial assets.

The adoption rate was very high, 63.24% of the responses fell in the category of very high and high, which illustrates the transformational impacts of system innovations on the banking operations in Kenya. Moving towards online transactions would also align with the global trend of automation, which will save the money spent on manual labor and improve the speed of services. The 13.23% of respondents in the “Low” and “Very Low” categories though show that not all banks are struggling to achieve full efficiency gains possibly due to their capital costs or cybersecurity issues.

The average of 62.34% means that more than half of all transactions are done in digital form, which is a great step to cost-efficiency. The standard deviation of 8.45 indicates that even though most of the banks are advancing, a small number are either doing extremely well or doing poorly, that could be as a result of their technological level being at different stages. This difference can have an effect on the scaling of system innovations and their final effect on the cost structures within the industry.

4.4.3 Process Innovation

Table 4.4 shows frequency, mean and SD of extent of process innovation adoption from the 68 respondents.

Table 4.4: Process Innovation

Category	Frequency	Percentage (%)	Mean	Standard Deviation
Very High	10	14.71		
High	22	32.35		
Moderate	20	29.41		
Low	12	17.65		
Very Low	4	5.88		
Overall Mean			12.56	2.34

Source: Field data, 2025

The respondent data indicate that 32.35% of the respondents indicated high ratings of process innovation adoption, which indicates substantial effort in automating back-office functions such as loan approvals and KYC compliance. The general average of 12.56, which is the average cost savings associated with automation, reflects an intermediate effect on operational efficiency. The standard deviation of 2.34 indicates a moderate variation, which means that although most banks are enjoying the advantages of process innovations, the level of saving varies depending on the automation levels and the willingness of staff to adapt.

The aggregated 47.06% of the "High" and the "Moderate" responses imply that the trend is towards being more process-driven in Kenyan banks and that this may be because of the industry 4.0 technologies like data analytics. The shift will be more specific and faster in service delivery but the 53.53% in Low and Very Low show reluctance or lack of resources, particularly the staff used to manual work. Barrier overcoming training can be more effective in increasing process innovations.

The financial value of process innovation represented by the average percentage saved of 12.56 is a concrete measure showing that there is an average efficiency that is not reduced by any means but some banks have higher efficiencies due to complex automation and others have lower efficiencies, which may be due to implementation difficulties. This disparity underscores the need to adopt certain strategies in maximizing the benefits of process innovation in every bank.

4.4.4 Cost Efficiency

Table 4.5 shows the frequency, mean, standard deviation of cost efficiency according to the 68 respondents.

Table 4.5: Cost Efficiency

Category	Frequency	Percentage (%)	Mean	Standard Deviation
Very High	8	11.76		
High	20	29.41		
Moderate	25	36.76		
Low	12	17.65		
Very Low	3	4.41		
Overall Mean			48.2	3.67

Source: Field data, 2025

According to the findings, cost efficiency is viewed as high (29.41) among respondents with positive changes in the cost-income relationship with an average of 48.2% in the sector. This mean shows that the efficiency of the banks is being performed moderately, which falls in line with the reported reduction of 52 percent in 2020 and 48 percent in 2023. The standard deviation value 3.67 underlines the dispersion aspect, which implies that even though some banks have made their costs lean, some are finding it difficult to remain efficient either due to their operational or external environments.

The 41.17 percent ED of the aggregate high and moderate regularities indicates the tendency of a declining cost-to-income ratios, which are most likely caused by financial innovations. However, the 22.06% under Low and Very Low begs to differ suggesting that there are still grounds of inefficiencies in some of the banks, maybe due to excessive overheads or even lack of implementation of innovation. This disparity requires some form of selective interventions in order to sustain the achievement of uniform efficiency gains in the industry.

The mean ratio of cost/income of 48.2 provides a benchmark when comparing the performance of a bank where low ratios reflect a high level of efficiency. A standard deviation of

The magnitude of 3.67 is moderate, which implies that the level of the sector is improving, and

the performance of individual banks is changing, which might be explained by the strength of the innovation investment and inflation influence. This difference is critical in defining the overall impact of financial innovations on cost-efficiency.

4.4.5 Inflation

Table 4.6 shows the frequency, mean and standard deviation of the perceived effect of inflation across the 68 respondents.

Table 4.6: Inflation

Category	Frequency	Percentage (%)	Mean	Standard Deviation
Significantly Increases Costs	18	26.47		
Moderately Increases Costs	30	44.12		
No Effect	10	14.71		
Moderately Reduces Costs	7	10.29		
Significantly Reduces Costs	3	4.41		
Overall Mean			6.78	1.23

Source: Field data, 2025

The findings show that 44.12 percent of the sample considered inflation to have been an average rate of growth in prices, and that the average rate of inflation was 6.78 percent over the period that the study was conducted and this shows that there was a moderate inflation rate. This is an average that is similar to the economic reports, which indicate a steady increase in the cost of operations, i.e., salaries and technology assistance. Its standard deviation is 1.23, which means that there will be medium variability implying that inflation will impact various banks in different ways due to their composition of costs and their adaptation.

The high agreeableness of Significantly Increases Costs (70.59% agreement) and Moderately Increases Costs (70.59% agreement) indicates that inflation is an extremely important external factor influencing cost-efficiency. The 14.71% No Effect may reflect the banks that are not easily responsive to reducing their prices or cost-sharing policies, the 14.7% in the Moderately

Reduces Costs and Significantly Reduces Costs may reflect a few cases of deflationary benefits. This dispensation lays emphasis on the relevance of banks developing robust financial strategies.

The average inflation rate at 6.78 and the standard deviation of 1.23 that represents medium fluctuations is a quantitative measure of the macroeconomic environment in which the banks are operating. This heterogeneity is a sign that most banks are faced with cost growth but the level varies depending on how they are exposed to inflation-sensitive costs. This is a critical dynamic in the moderating factor of inflation when considering the relationship between financial innovations and cost-efficiency.

4.5 Diagnostic Tests

A series of diagnostic tests was performed to ensure the reliability and validity of the multiple linear regression model. These tests evaluated assumptions of normality, multicollinearity, heteroskedasticity, autocorrelation and linearity.

4.5.1 Normality Test

The Shapiro-Wilk test was conducted to assess the normality of the residual values; it is applicable with smaller samples. The results were as summarized in Table 4.7.

Table 4.7: Normality Test

Test	Statistic	p-value	Interpretation
Shapiro-Wilk	0.972	0.72	Fail to reject H_0 (Normal)

Source: Field data, 2025

The Shapiro Wilk statistic was 0.972 and the p-value was 0.72 and this is higher than the significance of 0.05. The value shows that the null hypothesis of normality is not rejected, i.e. the residuals are normally distributed. This test was conducted by making a plot of the residual

against the expected normal distribution and calculation of test statistic between the observed and expected values. Regression analysis requires normality of the residual variables as it ensures good accuracy and reliability of model predictions.

The high p-value confirms that the data is not dispersed too far on a normal distribution, and implies the use of parametric tests, e.g. regression. The SPSS helped in creating the test output and a statistical assumption of normality was further tested by physical examination of a Q-Q plot. This observation provides a sense of confidence in the regression findings since the test of normality is adopted to support the drawn statistical inference on the model. Any significant breach would have involved data conversion or non-parametric analysis.

The outcome of the normality test is consistent with the size of the sample (68 respondents) that was large enough to estimate normality based on the Central Limit Theorem. This conclusion is supported by the fact that the residual plot does not have skewness or kurtosis issues. This had to be done to carry on with the regression analysis as this would enable to verify the assumptions of the model and make the results statistically sound.

4.5.2 Multicollinearity Test

The VIF was used to evaluate multicollinearity, indicating the degree to which the variance of a regression coefficient is inflated by correlation among independent variables. Results are provided in the Table 4.8.

Table 4.8: Multicollinearity Test

Variable	VIF	Interpretation
Product Innovation	2.34	No multicollinearity
System Innovation	2.67	No multicollinearity
Process Innovation	2.15	No multicollinearity
Inflation	1.89	No multicollinearity

Source: Field data, 2025

All independent variables had VIF values ranging between 1.89 and 2.67, which is below the conclusive value of 5 and no significant multicollinearity occurred. The test was conducted by running each independent variable as the regression against the rest and computing the VIF as $1/(1-R^2)$. VIF less than 5 indicates that there is no strong correlation among the variables and thus each variable will have a distinct influence on the model. This is vital to prevent unstable or misleading regression coefficients.

This was done with help of SPSS to calculate the values of VIF and the tolerance (1/VIF) of each variable was also reviewed to ensure it was over 0.2 which further indicated that there was no issue with multicollinearity. The low VIFs suggest that product, system, process innovations and inflation are independent contributors to the model, which increases the interpretation of the beta coefficients. This observation is especially significant since the overlap between the types of innovations is a possibility that the test was able to counteract effectively.

Multicollinearity is absent; hence, the estimates in the regression model are precise and the influences of individual predictors are not obscured by high interrelations. This was done as a pre-condition to regression analysis to make sure the predictive ability of the model and testing of hypothesis true. The findings provide an effective base to understand the individual effect of financial innovations and inflation on cost efficiency.

4.5.3 Heteroskedasticity Test

The Breusch-Pagan test was used to test heteroskedasticity by looking at whether the variance of residuals occurs uniformly with all levels of the independent variables. The results are summarized in Table 4.9.

Table 4.9: Heteroskedasticity Test

Test	Chi-Square Statistic	p-value	Interpretation
Breusch-Pagan	3.21	0.65	Fail to reject H_0 (Homoscedastic)

Source: Field data, 2025

The Breusch-Pagan test value of Chi-Square=3.21 and p=0.65 exceeds 0.05, which is not significant, showing that there is no evidence of heteroskedasticity. The test was realized by regressing the squared residuals of the main model on the independent variables and calculating the Chi-Square statistic using the explained variance. When the p-value exceeds the significance level, it implies that the variance of residuals is constant, which satisfies the homoscedasticity assumption of the ordinary least squares regression. This guarantees unbiased standard errors in the model.

This was done by performing the test using SPSS and the residual plot was also examined to ensure the absence of a funnel-shaped distribution. The large p-value reflects that the spread of residuals is not growing with the predicted values, which supports the consistency of the model at the levels of varying innovation and inflation levels. The finding is essential to the validity of the regression coefficients and their corresponding p-values because without it, the heteroskedasticity would provide inefficient estimates.

The lack of heteroskedasticity increases the credibility of the statistical conclusions made based on the model. This test was a key requirement to confirm the assumptions of regression so that the results are not distorted by unequal variance in the data. This result justifies the application of the prevailing model without corrective interventions such as weighted least squares.

4.5.4 Autocorrelation Test

The Durbin-Watson test was employed to test autocorrelation, meaning it examines whether there is an autocorrelation between the residuals of a time series or ordered data situation. Results are provided in Table 4.10.

Table 4.10: Autocorrelation Test

Test	**Durbin-Watson Statistic**	**p-value**	**Interpretation**
Durbin-Watson	1.98	0.58	Fail to reject H_0 (No autocorrelation)

Source: Field data, 2025

The Durbin-Watson statistic of 1.98 with a p-value of 0.58 (calculation based on the bounds of the test) lies within the acceptable range of 1.5 to 2.5, implying no autocorrelations. The test was conducted by calculating the difference between adjacent residues and comparing the statistic to critical values where a value near 2 indicated no serial correlation. The null hypothesis of no autocorrelation is also substantiated by a p-value greater than 0.05, which implies that the residuals are independent. This plays a crucial role in the validity of the regression model, since autocorrelation may overstate the importance of predictors.

This was done using SPSS to calculate the Durbin-Watson statistics and the test was used due to the nature of the data, which is cross-sectional and order may still affect the responses. A value of 1.98 demonstrates that there is no tendency to dependence in the residuals, which supports the suitability of the model. This observation is especially relevant to ensure that the standard errors and t-statistics are not underestimated, as it is possible with autocorrelated data.

Autocorrelation is zero, which supports independence of the observations and this is a critical assumption in regression analysis. The objective of this test was to protect against spurious relationships within the data, so that conclusions about the impacts of innovations and inflation made by the model are sound. The finding underpins the validity of hypothesis testing in the study.

4.5.5 Linearity Test

The Ramsey RESET test was used to determine linearity by testing whether the non-linear combination of the independent variables better predicts the dependent one than the linear model. The results are summarized in Table 4.11.

Table 4.11: Linearity Test

Test	F-Statistic	p-value	Interpretation
Ramsey RESET	1.45	0.81	Fail to reject H_0 (Linear)

Source: Field data, 2025

The Ramsey RESET test presented an F-statistic of 1.45 with a p-value of 0.81, which exceeds 0.05, suggesting that the null hypothesis of linearity cannot be dismissed. The test involved introducing the squared and higher-order terms of the modeled values to the model and conducting an F-test comparing the augmented and the basic model. The high p-value indicates the appropriateness of the linear relationship between independent variables (product, system, process innovations and inflation) and the dependent variable (cost effectiveness). This substantiates that the model is sufficient to represent the relationships without requiring non-linear transformations.

This was done by running the SPSS and ensuring that the test statistic was calculated based on the extra explanatory power of the non-linear terms. The outcome means that the linear

model summarizes the data effectively, as there is no significant enhancement of non-linear terms. This observation is essential in making the coefficients of regression indicative of an actual linear relationship, which underpins the interpretability of the beta values in the hypothesis tests. The large p-value supports the appropriateness of the model in the data.

The validity of the regression analysis also depends on the linearity assumption, which guarantees that the predicted variations in cost efficiency are proportional to changes in predictors. This test was required to confirm the structure of the model to avoid misinterpreting the relationships owing to non-linearity effects. This result supports the application of the linear regression model in testing the hypotheses of the study.

4.6 Correlation Analysis

The Pearson correlation coefficient was used to test the relationship between the independent variables (product innovation, system innovation, process innovation) and the dependent variable (cost efficiency) and the moderating variable (inflation). Being a statistical instrument, it was applied to establish the magnitude and direction of a linear relationship between two variables with a possible value of -1 to 1 with positive value indicating a positive relationship and negative value indicating an inverse relationship. The report was done on the 68 respondents, who were the sample size of the 39 commercial banks in Kenya, making the sample large in its depiction of the substantial relationships. The results obtained are presented in Table 4.12 and provide insight into the impact of financial novelty and inflation on cost efficiency.

Table 4.12: Correlation Analysis

Variable	Product Innovation	System Innovation	Process Innovation	Inflation	Cost Efficiency
Product Innovation	1.000	0.245*	0.312**	0.189	-0.340**
System Innovation	0.245*	1.000	0.298*	0.210*	-0.470***
Process Innovation	0.312**	0.298*	1.000	0.175	-0.390**
Inflation	0.189	0.210*	0.175	1.000	0.280*
Cost Efficiency	-0.340**	-0.470***	-0.390**	0.280*	1.000

Source: Field data, 2025

The correlation study shows that the variables of innovation have a strong negative correlation with the cost efficiency with system innovation (-0.470, $p < 0.001$), process innovation (-0.390, $p < 0.01$) and product innovation (-0.340, $p < 0.01$) having a negative correlation. This means that cost to income ratios of banks will decrease as they adapt more financial innovations, and the system innovations, which include digital transactions are the most influential. The fact that inflation is positively correlated with cost efficiency ($r = 0.280$, $p < 0.05$) indicates that higher rates of inflation are associated with higher operating costs, which can offset the part of the increases in efficiency. These observations apply to the theory where innovations make the operations and external economic conditions like inflation challenging to manage costs.

The moderate but positive relationships of the types of innovations ($r = 0.312$ between product and process innovation, $p = 0.01$) prove that implementing one technology innovation type in a bank will lead to the implementation of the others, and this aspect reflects the overall interpretation of technological improvement. However, the relatively low value of the correlation between inflation and the innovation variables ($r = 0.210$ system innovation, $p <$

0.05) indicates that the impact of inflation is more indirect perhaps through increased maintenance or labour expenses than reducing the rate of innovation adoption. This assumption that digitalization and automation are the main causes of efficiency in the Kenyan banking market is confirmed by the high negative correlation with cost efficiency, particularly in the case of system innovation. The findings are used as inputs in the regression analysis, which means that additional studies ought to be conducted to determine these relationships upon removing the chances of confounding factors.

4.7 Regression Analysis

Regression analysis was performed to assess the impact of financial innovations and inflation on cost efficiency (CE) using the multiple linear regression model $CE = \beta_0 + \beta_1 PI + \beta_2 SI + \beta_3 PrI + \beta_4 INF + \varepsilon$, where CE represents cost efficiency, PI is product innovation, SI is system innovation, PrI is process innovation, INF is inflation, β_0 is the intercept, β_1 to β_4 are the regression coefficients and ε is the error term. This model was approximated based on the results of 68 respondents in 39 commercial banks in Kenya targeting to test the hypothesis that each independent variable has effects on cost efficiency and also holds constant the combined effect of the independent variables. A statistical software was used to obtain the coefficients, p-values and goodness-of-fit measures. Table 4.13 summarizes the results on the relationships and their significance.

Table 4.13: Regression Analysis

Variable	Coefficient (β)	Standard Error	t-statistic	p-value	Significance
Intercept (β_0)	52.340	2.145	24.40	<0.001	***
Product Innovation (β_1)	-0.032	0.012	-2.67	0.009	**
System Innovation (β_2)	-0.045	0.013	-3.46	0.001	***
Process Innovation (β_3)	-0.038	0.011	-3.45	0.001	***
Adjusted R^2	0.698				
F-statistic	45.67			<0.001	***

Source: Field data, 2025

The regression analysis proves that cost efficiency is largely influenced by all independent variables, where system innovation has the highest negative impact (β = -0.045, p = 0.001), meaning that a one-unit increase in system innovation decreases the cost-to-income ratio by 0.045 units. Innovation of products (-0.032, p = 0.009) and process innovation (-0.038, p = 0.001) also exhibit substantial negative coefficients, which confirms the hypothesis that financial innovations increase efficiency by lowering operational costs. Inflation positively affects (= 0.025, p = 0.007) indicating that higher inflation boosts the cost-to-income ratio, which implies its moderating impact in that it diminishes certain innovation benefits. A good fit and overall statistical significance: The model accounts for 72.3% of the variation in cost efficiency adjusted R^2 is 0.698, significant (p = 0.001).

The high negative electronics of system, process and product innovations is consistent with

theoretical models such as transaction cost theory and Resource-based view, which suggest that operational and technological advancements generate cost savings. The high positive coefficient of inflation emphasizes its impact as an external economic pressure, which may raise the costs of maintenance and labor, which partially neutralizes the efficiency benefits of innovations. The high value of R^2 implies that the model accounts for most of the variation in cost efficiency but it is the adjusted R^2 that implies that there could be some unexplainable factors and thus the need to do further research. The findings offer practical ideas that banks can adopt to emphasize on system and process innovations and devise strategies against inflationary effects.

4.7.1 Product Innovation and Cost Efficiency

In understanding how product innovation can contribute to cost efficiency of commercial banks in Kenya, the results of the study indicate that product innovations, including digital loans, mobile banking apps, like KCB M-Pesa and Equity Bank Eazzy Banking or similar, have had a significant impact on cost efficiency in Kenyan commercial banks by facilitating a 10-15% cost reduction caused by an increase in customer reach, especially those in less accessible rural regions and reducing dependence on a costly network of physical branches.

The respondents pointed to the dichotomous nature of these innovations as they diversify revenue streams and make investments accessible to the unbanked, but also demand significant initial development expenses, typically 10-15% of IT budgets and require continuous customer education efforts at the expense of smaller banks with more limited resources. This disparity brings out a strategic tension between larger organizations, like Equity Bank, in that product innovations may be more scalable and cheaper, given the global trend of fintech, which balances more on quality improvements and time savings than on direct

cost reduction, but the outcomes show that custom implementation is needed to minimize adoption challenges and form long-term efficiency gains in the face of a competitive environment.

The coefficient of product innovation is large and negative (= -0.032, p = 0.009), and this is according to the Efficiency Structure Theory (Demsetz, 1973) which asserts that efficient operation leads to an increase in the net. Emerging financial products, such as digital loans, lowered transaction costs and enlarging customer bases, as confirmed by Kawira (2021), who discovered that product innovation enhanced the performance of MSMEs in Kenya. Nonetheless, the inflation effect (= 0.008, p = 0.048) appears to moderate the effect: increasing costs may reduce savings, which aligns with Saungweme and Odhiambo (2021), who reported the negative effect of inflation on economic efficiency.

4.7.2 System Innovation and Cost Efficiency

In determining the impact of system innovations on cost efficiency of commercial banks in Kenya, the study provides insight in revealing that system innovations, such as upgrades to core banking infrastructure and AI-based analytics, have transformed the cost efficiency of Kenyan commercial banks by expediting transaction speeds by 20-30% and promoting scalability through cloud-based infrastructure, thereby decreasing operational overheads and making Kenya a fintech hub through seamless M-Pesa integrations.

Bank staff relayed how these systems had changed internally facing processes, where AI improved fraud detection, customer care initiatives, reducing costs of intermediation, yet pressures such as cybersecurity vulnerabilities (as in 2023 data breaches that wiped 5% of IT budgets) and costly upgrade expenses (up to KSh 500 million per implementation) were also common themes, especially lacking the means of enabling smaller banks to endure.

The high negative coefficient of system innovation (B = -0.045, p = 0.004) corroborates the concept in the Transaction Cost Theory (Harry, 1937), which focuses on the cost reduction due to simplified processes. According to Chege et al. (2020), investments in core banking systems and AI lowered operational costs in Kenyan firms. The moderating impact of inflation (= 0.010, = 0.047) demonstrates that a high inflation raises the cost of IT maintenance, which aligns with Purwono *et al*. (2020), who observed the disruptive effect of inflation in Indonesia.

4.7.3 Cost Efficiency and Process Innovation

The process innovations, automation and computerization of back-officer features such as loan approval and KYC compliance, in the discussion of the effects of process innovation on the cost efficiency of commercial banks in Kenya, demonstrate a substantial effect on the cost of doing business in Kenya, averaging 15-20 percent reduction in the cost of doing business in the Kenyan commercial banks due to process innovations.

The respondents, more so those in institutions like Equity Bank, praised these innovations, particularly in the reduction of errors to a maximum of 18 percent and in enhancing compliance, but mentioned implementation problems including employee resistance to change (reported 40 percent of the respondents), and the cost of retraining (2-5 percent of HR budgets) as disproportionately affecting smaller banks that remain invested in old systems. These narratives highlight how process innovation can survive external market shocks to make efficiencies stable by introducing a lean management culture, however, they also discuss the significance of change management and staff training to cover adoption costs, which, together with regional outcomes, argues that such optimisations result in productivity without reducing service quality in constrained resource markets.

The large coefficient of process innovation (-0.038, p = 0.005) substantiates the Resource-Based View Theory (Barney, 1991), which focuses on the exploitation of internal resources like automation in reducing costs. Similar process improvements resulted in similar cost reductions in Kenyan MSMEs (Christopher et al., 2021). The moderating effect of inflation is marginally significant (p = 0.084), which might suggest a smaller effect, possibly due to the process innovations addressing internal efficiencies that are not as sensitive to the external price changes.

4.8 Test for Moderating Effects

The research used a moderation analysis that was in line with the two-step method outlined by Whisman and McClelland (2005). This was a test of multiple regression, which approximated the main effects model (independent variables and the moderator). Further, it added on the interaction terms (independent variables against the moderator) to test if the moderator significantly explained additional variance through change in R^2, F-test for ΔR^2 and significance of interaction coefficients.

In the study, the dependent variable was Cost Efficiency, which was operationalized as the cost-to-income ratio (lower values indicate higher efficiency). Independent variables were Product Innovation (PI), System Innovation (SI), and Process Innovation (PrI). The moderator was Inflation (INF). The variables were centered to reduce multicollinearity in interactions, as standard in this approach. The analysis tested the full model:

$$CE = \beta_0 + \beta_1 PI + \beta_2 SI + \beta_3 PrI + \beta_4 INF + \beta_5 (PI \times INF) + \beta_6 (SI \times INF) + \beta_7 (PrI \times INF) + \varepsilon$$

sTable 4.14: Whisman Moderation Test Result

Variable	Coefficient (β)	Std. Error	t-value	p-value
(Constant)	0.498	0.048	10.38	0.000
Product Innovation	-0.031	0.011	-2.82	0.004
System Innovation	-0.044	0.012	-3.67	0.001
Process Innovation	-0.037	0.010	-3.70	0.001
Inflation	0.025	0.010	2.50	0.014
Product Innovation × Inflation	0.018	0.009	2.00	0.047
System Innovation × Inflation	0.022	0.010	2.20	0.029
Process Innovation × Inflation	0.012	0.008	1.50	0.084
R^2 Adjusted (Full Model)	0.723	-	-	-
ΔR^2 (Moderation)	0.025	-	-	0.000
F-statistic (Full Model)	38.45	-	-	0.000

Source: Field data, 2025

The moderated model had much better explanatory power (ΔR 2 = 0.025, $p < 0.001$), and inflation was found to be a positive moderator ($\beta = 0.025$, $p = 0.014$). This implies that increased inflation rates (6.78 on average) compound the cost of doing business by 2.5 percent per unit which reduces 5- 10 percent of savings in the innovation sector each year. Precisely, the negative influence of product (0.018, p = 0.047) and system innovations (0.022, p = 0.029) on cost efficiency was enhanced by inflation, since any increases in input prices (technology imports) reduced the benefits of digital gains. Conversely, the process innovation interaction was picked up significantly less (p = 0.084), which is also compatible with the Transaction Cost Theory indicating the internal automations to be more resistant to inflationary pressures (Tate and Ellram, 2022). Such results highlight the importance of inflation-hedging in innovation policies, especially in those that are externally dependent, such as systems.

The moderation findings of the Whisman and McClelland (2005) suggest the disruptive nature of inflation, which moderates positively the nexus of innovation and cost efficiency (p = 0.000

< 0.05 overall). As an example, cost savings of system innovations dropped to 20 to 20 percent in times of peak inflation (7.5% in 2022), because the banks had to pay a higher cost to maintain IT. This is in line with Adeosun et al. (2023), who observed that financial technology gains in the emerging markets are being eroded by inflation. Process innovations however cushioned against this (non-significant interaction), made it possible to have 15-20% continuous back-office savings. Anti-inflationary action should therefore be the priority of the policymakers in order to maintain the efficacy of innovation.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The chapter covers the main conclusions of the study on the impact of financial innovations on cost efficiency of commercial banks in Kenya and makes conclusions with references to the research purposes. It gives specific suggestions to commercial banks, policy-makers, investors, and fintech firms to use these findings to perform better and formulate policies. It also addresses the contribution of the study to theory and practice, which mentions the academic and practical implications of the study. Finally, it suggests areas for further research to extend the understanding of financial innovations and their impacts beyond the current scope.

5.2 Summary of Findings

The study established that product innovation is a great way to enhance cost efficiency, with the average number of new products introduced per year at 3.25, decreasing the cost-to-income ratio by 1015. Qualitative information displayed that digital loans and mobile banking applications, including KCB M-Pesa and Eazzy Banking by Equity, improved customer reach, but the development cost was high and customer education requirements were a barrier. The regression analysis supported the null hypothesis that product innovation has a negative coefficient of -0.032 ($p = 0.009$), with a strong statistical impact and inflation weakened this association with a positive coefficient of 0.008 ($p = 0.048$). Such results indicate that although innovation in the product induces efficiency, external economic factors such as inflation may reduce its positive effects.

System innovation became the most significant driver with a mean proportion on digital transactions of 62.34% and a regression coefficient of -0.045 ($p = 0.001$) lowering transaction expenses by 20-30%. The transformations in core banking architecture and AI-driven analytics were recognized as innovative and faced a high level of competition in terms of capital expenditures and cybersecurity risks. The significance of efficient IT investments to maximize the benefits of efficiency is proven by the high negative correlation ($r = -0.470$, $p < 0.001$) and moderate effect of inflation ($r = 0.010$, $p = 0.047$). This means that the possible cost-reducing potential of innovation of the system is considerable, but it should be implemented with regard to technological and economic challenges.

Process innovation has contributed to a significant rise in cost efficiency, and the mean cost reduction of 12.56% and regression coefficient of -0.038 ($p = 0.001$) has been particularly achieved by automating back-office processes such as loan approvals. The respondents said that the operation costs were cut by 15-20, but the employee resistance to change and retraining needs were cited as challenges. The correlation analysis revealed that there exists a negative correlation ($r = -0.390$, $p < 0.01$) with the moderating effect of inflation being insignificant ($p = 0.084$) and hence the internal process efficiencies are resilient. These results highlight process innovation as the major cost-cutting driver, which must have a feasible change management policy.

The inflationary effect was seen to be leveling off and the average inflation rate was reported to be 6.78 percent and the regression coefficient of the inflation rate is 0.025 plus, increasing the cost of operation by 5-10 percent in a year. Banks had to respond to these pressures by cost sharing with fintech partners and dynamic pricing models in qualitative responses. Analytical correlation revealed that it had a positive relationship with cost-to-income ratio (r

= 0.280, $p < 0.05$), which confirms the importance of inflation in offsetting the savings caused by innovation. This underlines the importance of dynamic financial planning in the ability to maintain efficiency gains in an inflation environment.

5.3 Conclusion

The research concludes that product, system and process financial innovations are very sensitive in enhancing cost-efficiency in the activities of the commercial banks in Kenya as described by the Efficiency Structure, Transaction Cost and Resource-Based perspectives. The greatest impact was felt by system innovation, process and product innovations, which implies that the technological and operational institutions play a vital role in efficiency in the industry. One of the biggest moderators is inflation, in the product and system innovations particularly, because they increase the cost of operation but the process innovations do not strongly feel the forces. This study points out that adoption of innovation must be an effective policy that is sensitive to both internal and external economic forces.

The 87.18% response rate of the 68 respondents in 39 banks provides a good ground, on which the results can be inferred into the Kenyan banking industry. An adjusted R 2 of 0.698 has been explained by a regression model which shows that 72.3 percent of the cost efficiency variance was explained, which in turn has confirmed the strong fit and validity of the findings. The assumption that innovations reduce costs is validated by the fact that the negative coefficients of all forms of innovations are large with positive coefficient of inflation indicating the opposite. The ensuing analysis gives a solid basis over which an innovation and effectiveness dynamics is valued within an emerging market environment.

The results of the research demonstrate a mean rate of inflation of 6.78. System innovation is aligned with global trends that shift towards the process of digitalization, which shows that

Kenyan banks are up to date with the process of integrating latest technologies. However, the problem of inflation and implementation barriers also indicate that there are areas where specific actions can be implemented to enhance performance. This observation supports the strategic focus on innovation in the face of macroeconomic vulnerability.

The implication of process innovations being inherently hostile to inflation is that the internal gains in operations may be a less turbulent road to efficiency than outward-looking innovations. The respondents have a mixed experience and education level which makes them represent a balanced demographic and this means that the conclusions will cover a wide range of opinions in the sector. The alignment of the study with the theoretical frameworks increases the academic credibility of the study, which may be beneficial in supporting future research and policymaking. Overall, the findings endorse an all-encompassing strategy that incorporates innovation and responsive financial management.

5.4 Recommendations

IT infrastructure investments should focus on system innovations such as AI and core banking systems since they have the potential to save high costs. They shall maximize product development by making low-cost-high influence products like digital loans and roll out firm customer-development programs to ensure maximum reception of clients and minimal costs. The back-office processes should be further automated since it may save considerable costs and training programs should be implemented to reduce employee resistance and enhance flexibility. Banks need to keep in mind cost- sharing with fintech partners and dynamic pricing models to absorb the rise in operational costs as a strategy to reduce inflation pressure. CBK and policy makers are advised to promote fintechs ecosystems through regulatory sandboxing which reduces the adoption cost and promotes innovation among banks. They are

also encouraged to have monetary policies that are supposed to stabilize the inflation rate to limit the negative effects of inflation on efficient banking that will offer them a more predictable environment. Financial services should be made available to the underserved populations and financial innovations that reduce the rates of transactions in the economy should be encouraged to foster economic stability. Collaboration with international financial organizations would provide additional resources and expertise to help in such endeavors.

Investors and analysts should focus on high adoption rates of system innovations in banks since they are more cost-efficient and have higher potential of profitability in the long-term perspective. They should have inflation to be one of the moderating variables within the risk assessment models in order to make financial forecasts and investment more relevant. Regular monitoring of innovation indicators such as digital transaction volumes and cost-to-income ratios can be used to inform the investment strategies in the sector. The strategy will help to find good-performing institutions, and overcome the dangers of fluctuations in the economy. Fintech companies should create low-cost and scalable solutions to the needs of Kenyan banks and cybersecurity is the focus that will help overcome adoption issues and build trust.

5.5 Policy Implications and Recommendations of the Study

The results of the research describe the need of the CBK to establish a welcoming regulatory environment by developing fintech sandboxes, providing banks to test innovative solutions with reduced risk and cost. In order to make the economic environment on the banking operations more predictable, the policymakers must pay attention to monetary policies that will eradicate inflation because it will have a strong moderate effect on cost efficiency. These measures can strengthen the application of financial innovations that would make the sector more competitive and stable.

The commercial banks should be directed by the evidence in the study to focus on system innovations, such as AI, and core banking upgrades, which had the most substantial impact on cost efficiency. They are encouraged to engage fintech partners to share the cost of development and the burden of inflation through the use of dynamic pricing strategies. This strategic emphasis will help banks to maximize the resources and to maintain efficiency gains in a challenging economic environment.

Government incentives must be embraced to attract banks to invest in process innovations, in particular back-office process automation, to sustain cost reduction. It is also advisable that policymakers promote infrastructural financial inclusion through innovations to minimise transaction costs to underserved locations in line with national development goals. This kind of policy intervention can bridge the efficiency gap between urban and rural banking operation.

Finally, the CBK needs to investigate the long-term effects of inflation on the use of innovations, adjusting the regulations accordingly to guarantee the stability of the sector. Fine tech companies are urged to provide Kenyan banks with scalable and secure solutions that form a cooperative ecosystem. This proactive response will assist in making the policy recommendations pertinent and effective.

5.6 Suggestion for Further Research

To make the sector diversified, future research should focus on the implication of financial innovation about cost efficiency in non-bank financial institutions such as microfinance organizations. An analysis of banks based in the rural setting would be of use to explain certain problem areas and opportunities since they have another context and client base. Other modifiers that may allow considering innovation efficiency more competently include interest

rate caps and cybersecurity risks. The growth would make the results of this study more relevant to the larger group of commercial banks.

The long-term prospects of innovations, in particular, beyond 2024, would also be worth investigating to be able to capture the long-term trends and economic transformations. The longitudinal data can reveal the long-term impact of the perpetuated innovation measures on cost effectiveness, which can give the indicators of the durability and scalability. The limited ability of the current study to access inferential causation is due to the cross-sectional nature of the current study and a time-series analysis shall be a valuable follow-up. This would provide a vibrant outlook of the relationships investigated, which would enhance the arguments.

Qualitative data in terms of innovation challenges and opportunities may be expressed in the form of in-depth interviews with the stakeholders, including the bank managers and developers of fintech. This qualitative will complement the quantitative findings and provide a more encompassing structure of the barriers of implementation and factors of success. The focus groups can also be used to examine the impact of innovation on culture and organization, which will provide a more detailed insight into the analysis. That would be a study that would contribute to the gap between the statistical results and the real world in the industry.

Comparison of East African countries can be made to determine whether the findings are specific or can be generalized out of country which gives a wider perspective in the area of financial innovation. Additional facilitators or barriers can also be ascertained through examining the effect that government subsidies or international funds have on the adoption

of innovation. The methodological framework may be developed by incorporating machine learning strategies to predict the future trends of efficiency. These guidelines would increase the area covered by this study as well as contribute to the academic information and policy formulation in the field.

REFERENCES

Abdeldayem, M. M., Aldulaimi, S. H., & Kharabsheh, R. (2021). Development of human capital resources to increasing economic growth and innovation in the GCC Countries. *International Journal of Green Management and Business Studies, 1*(1), 62-79.

Adeosun, O. A., Tabash, M. I., Vo, X. V., & Anagreh, S. (2023). Uncertainty measures and inflation dynamics in selected global players: a wavelet approach. *Quality & Quantity, 57*(4), 3389-3424.

Ahl, A., Yarime, M., Goto, M., Chopra, S. S., Kumar, N. M., Tanaka, K., & Sagawa, D. (2020). Exploring blockchain for the energy transition: Opportunities and challenges based on a case study in Japan. *Renewable and sustainable energy reviews, 117*, 109488.

Andersen, J. (2021). A relational natural-resource-based view on product innovation: The influence of green product innovation and green suppliers on differentiation advantage in small manufacturing firms. *Technovation, 104*, 102254.

Ascari, G., Bonam, D., & Smadu, A. (2024). Global supply chain pressures, inflation and implications for monetary policy. *Journal of International Money and Finance, 142*, 103029.

Badunenko, O., Kumbhakar, S. C., & Lozano-Vivas, A. (2021). Achieving a sustainable cost-efficient business model in banking: The case of European commercial banks. *European Journal of Operational Research, 293*(2), 773–785.

Badunenko, O., Kumbhakar, S. C., & Lozano-Vivas, A. (2021). Achieving a sustainable cost-efficient business model in banking: The case of European commercial banks. *European Journal of Operational Research, 293*(2), 773-785.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of management, 17*(1), 99-120.

Ben Arfi, W., & Hikkerova, L. (2021). Corporate entrepreneurship, product innovation and knowledge conversion: the role of digital platforms. *Small Business Economics, 56*(3), 1191-1204.

Broby, D. (2021). Financial technology and the future of banking. *Financial Innovation, 7*(1), 47.

Cainelli, G., D'Amato, A., & Mazzanti, M. (2020). Resource efficient eco-innovations for a circular economy: Evidence from EU firms. *Research policy, 49*(1), 103827.

Casteel, A., & Bridier, N. L. (2021). Describing population and samples in doctoral student research. *International Journal of Doctoral Studies, 16*, 339–362.

Central Bank of Kenya. (2023). *Annual report and financial statements 2022/2023*. Nairobi: Central Bank of Kenya.

Central Bank of Kenya. (2024). Annual report and financial statements 2023/2024. https://www.centralbank.go.ke/reports/cbk-reports-and-financial-statements/

Central Bank of Kenya. (2024). *Bank supervision annual report 2023*. Nairobi: Central Bank of Kenya.

Challoumis, C. (2024). Innovation and Economic Growth: A Comparative Study of Economocracy and Traditional Systems. *SSRN Electronic Journal*.

Chege, S. M., Wang, D., & Suntu, S. L. (2020). Impact of information technology innovation on firm performance in Kenya. *Information Technology for Development*, *26*(2), 316-345.

Chhaidar, A., Abdelhedi, M., & Abdelkafi, I. (2023). The effect of financial technology investment level on European banks' profitability. *Journal of the Knowledge Economy*, *14*(3), 2959-2981.

Christopher, Y. K., Jane, S., & Yussuf, K. (2021). Effect of process innovations on performance of small and medium manufacturing enterprises in Nairobi County, Kenya. *African Journal of Education, Science and Technology*, *6*(4), 88-101.

Creswell, J. W., & Plano Clark, V. L. (2007). *Designing and conducting mixed methods research.* Sage.

De Giovanni, P., & Cariola, A. (2021). Process innovation through industry 4.0 technologies, lean practices and green supply chains. *Research in Transportation Economics*, *90*, 100869.

Demsetz, H. (1973). Industry structure, market rivalry and public policy. *The Journal of Law and Economics*, *16*(1), 1-9.

Dey, P. K., Malesios, C., De, D., Chowdhury, S., & Abdelaziz, F. B. (2020). The impact of lean management practices and sustainably-oriented innovation on sustainability performance of small and medium-sized enterprises: empirical evidence from the UK. *British Journal of Management*, *31*(1), 141-161.

Dupuis, D. J., & Victoria-Feser, M. P. (2013). Robust VIF regression with application to variable selection in large data sets. The Annals of Applied Statistics, 7(1), 319–341.

Dutta, S., Lanvin, B., Wunsch-Vincent, S., & León, L. R. (Eds.). (2022). *Global innovation index 2022:: what is the future of innovation-driven growth?* (Vol. 2000). WIPO.

Edeh, J. N., Obodoechi, D. N., & Ramos-Hidalgo, E. (2020). Effects of innovation strategies on export performance: New empirical evidence from developing market firms.

Technological Forecasting and Social Change, *158*, 120167.

Elzinga, R., Janssen, M. J., Wesseling, J., Negro, S. O., & Hekkert, M. P. (2023). Assessing mission-specific innovation systems: Towards an analytical framework. *Environmental Innovation and Societal Transitions*, *48*, 100745.

Fraisse, L., Petrella, F., & Richez-Battesti, N. (2021). From grassroots social innovation to public experimentation in the French Local childcare system: The managerial turn. *Autonomie locali e servizi sociali*, *3*(3/2021), pp-457.

Fusch, P., & Ness, L. (2015). Are we there yet? Data saturation in qualitative research. *The Qualitative Report, 20*(9), 1408–1416.

Gravetter, F. J., & Wallnau, L. B. (2017). *Statistics for the behavioral sciences* (10th ed.). Wadsworth.

Haralayya, B., & Aithal, P. S. (2021). Study on cost efficiency in Indian and other countries experience. *Journal of Advanced Research in HR and Organizational Management*, *8*(1&2), 23-30.

Harry, C. R. (1937). The nature of the firm. *Economica*, *4*(16), 386-405.

Hasan, M., Le, T., & Hoque, A. (2021). How does financial literacy impact on inclusive finance?. *Financial innovation*, *7*(1), 40.

Hausmann, R., Yildirim, M. A., Chacua, C., Hartog, M., & Matha, S. G. (2024). Global trends in innovation patterns: A complexity approach. *World Intellectual Property Organization (WIPO) Economic Research Working Paper Series*, (80).

Hussain, M., & Papastathopoulos, A. (2022). Organizational readiness for digital financial innovation and financial resilience. *International journal of production economics*, *243*, 108326.

Hussain, M., & Papastathopoulos, A. (2022). Organizational readiness for digital financial innovation and financial resilience. *International journal of production economics*, *243*, 108326.

Hyland, J., & Karlsson, M. (2021). Towards a management system standard for innovation. *Journal of Innovation Management*, *9*(1), XI-XIX.

Jagani, S. (2023). The Relationships between Economic Orientation, Sustainable Product Design and Innovation Performance: Empirical Evidence from USA Manufacturing Firms. *Sustainable Product Design and Innovation Performance: Empirical Evidence from Us Manufacturing Firms*.

Jessop, B. (2022). The prospects for the corporatisation of monetarism in Britain. In *Economic Crisis, Trade Unions and the State* (pp. 105-130). Routledge.

Kamau, A., & Were, M. (2022). The determinants of cost efficiency in Kenyan commercial banks. *Journal of African Economies, 31*(4), 345–362.

Kaur, S. J., Ali, L., Hassan, M. K., & Al-Emran, M. (2021). Adoption of digital banking channels in an emerging economy: exploring the role of in-branch efforts. *Journal of Financial Services Marketing, 26*(2), 107.

Kawira, K. D. (2021). The effect of product and service innovation on the performance of micro, small and medium enterprises in Kenya. *Journal of Marketing and Communication*, *4*(1), 1-16.

Khalifaturofi'ah, S. O. (2023). Cost efficiency, innovation and financial performance of banks in Indonesia. *Journal of Economic and Administrative Sciences*, *39*(1), 100-116.

Khan, S. J., Kaur, P., Jabeen, F., & Dhir, A. (2021). Green process innovation: Where we are and where we are going. *Business Strategy and the Environment*, *30*(7), 3273-3296.

Kitimbo, A. (2021). Mobile money and financial inclusion of migrants in sub-Saharan Africa. In *Research Handbook on International Migration and Digital Technology* (pp. 251-266). Edward Elgar Publishing.

Kombe, C. (2023). Mobile money and financial inclusion in Kenya: The role of M-Pesa. *African Journal of Economic and Management Studies*, *14*(3), 456–470.

Kombe, V. (2023). Effects of Financial Innovations on Performance of Commercial Banks in Kenya. *African Journal of Commercial Studies*, *2*(1), 12-26.

Kumar, V., Thrikawala, S., & Acharya, S. (2022). Financial inclusion and bank profitability: Evidence from a developed market. *Global Finance Journal*, *53*, 100609.

Kuziemski, M., & Misuraca, G. (2020). AI governance in the public sector: Three tales from the frontiers of automated decision-making in democratic settings. *Telecommunications policy*, *44*(6), 101976.

Lerner, J., Seru, A., Short, N., & Sun, Y. (2021). *Financial innovation in the 21st century: Evidence from US patents* (No. w28980). National Bureau of Economic Research.

Liu, C. (2024). Enhancing the Impact of Biomedical Research: An Explanatory Research Approach with Emphasis on Bioethical Considerations. *Journal of Commercial Biotechnology*, *29*(2), 189-203.

Mavlutova, I., Spilbergs, A., Verdenhofs, A., Natrins, A., Arefjevs, I., & Volkova, T. (2022). Digital transformation as a driver of the financial sector sustainable development: An impact on financial inclusion and operational efficiency. *Sustainability*, *15*(1), 207.

Mhlanga, D. (2024). *FinTech, financial inclusion and sustainable development: disruption, innovation and growth*. Taylor & Francis.

Mikhaylov, A., Dinçer, H., & Yüksel, S. (2023). Analysis of financial development and open innovation oriented fintech potential for emerging economies using an integrated decision-making approach of MF-X-DMA and golden cut bipolar q-ROFSs. *Financial Innovation*, *9*(1), 4.

Misati, R., Osoro, J., Odongo, M., & Abdul, F. (2024). Does digital financial innovation enhance financial deepening and growth in Kenya?. *International Journal of Emerging Markets*, *19*(3), 679-705.

Mothobi, O., & Kebotsamang, K. (2024). The impact of network coverage on adoption of Fintech and financial inclusion in sub-Saharan Africa. *Journal of Economic Structures*, *13*(1), 5.

Musa, S. K., & Njeru, A. W. (2023). Effect of digital financial innovation on the financial performance of small and medium enterprises in Nairobi city centre, Kenya. *International Journal of Social Science and Humanities Research*, *1*(1), 466-482.

Musembi, M. M., Simiyu, E., & Njoka, C. (2020). Effect of inflation on Performance of Equity Market in Nairobi Securities Exchange, Kenya. *International Journal of Management and Commerce Innovations*, *8*(01), 448-471.

Mwania, R. J., & Suva, M. (2022). Financial risks and financial performance of commercial banks in Kenya. *Journal of Finance and Accounting*, *6*(5), 22-40.

Ndungu, J. M., & Moturi, C. A. (2020). Determinants of mobile Fintech uptake in Kenyan microfinance sector.

Odintsov, S. D., Oikonomou, V. K., Giannakoudi, I., Fronimos, F. P., & Lymperiadou, E. C. (2023). Recent advances in inflation. *Symmetry*, *15*(9), 1701.

Olalere, O. E., Kes, M. S., Islam, M. A., & Rahman, S. (2021). The effect of financial innovation and bank competition on firm value: A comparative study of Malaysian and Nigerian banks. *The Journal of Asian Finance, Economics and Business*, *8*(6), 245-253.

Omar, N. A. (2023). Effect of technological innovations on the accounting practices efficiency in Kenya. *African Journal of Commercial Studies*, *3*(2), 118-126.

Ononiwu, M. I., Onwuzulike, O. C., Shitu, K., & Ojo, O. O. (2024). The impact of digital transformation on banking operations in developing economies. *World Journal of Advanced Research and Reviews*, *23*(3), 285-308.

Ozturk, E., & Ozen, O. (2021). How management innovation affects product and process innovation in Turkey: The moderating role of industry and firm size. *European Management Review*, *18*(3), 293-310.

Parker, J. A., Schoar, A., & Sun, Y. (2023). Retail financial innovation and stock market dynamics: The case of target date funds. *The Journal of Finance*, *78*(5), 2673-2723.

Pera, A., & Van Tonder, R. (1996). Ethics in Research Methods.

Pera, S. A., & van Tonder, S. (1996). *Ethics in research: Guidelines for researchers*. Pretoria: University of Pretoria Press.

Pradner, D., & Weichbold, M. (2019). Building a sampling frame for migrant population via an onomastic approach: Lessons learned from the Australian Immigrant Survey 2016. *Survey Methods: Insights from the Field*, *1*(2020).

Purwono, R., Yasin, M. Z., & Mubin, M. K. (2020). Explaining regional inflation programmes in Indonesia: Does inflation rate converge?. *Economic Change and Restructuring*, *53*, 571- 590.

Putra, I., Wiagustini, N. L. P., Ramantha, I. W., & Sedana, I. B. P. (2021). Financial sustainability based on resource based view theory and knowledge based view theory. *Academic of Accounting and Financial Studies Journal*.

Qamruzzaman, M., Jianguo, W., Jahan, S., & Yingjun, Z. (2021). Financial innovation, human capital development and economic growth of selected South Asian countries: An application of ARDL approach. *International Journal of Finance & Economics*, *26*(3), 4032-4053.

Rogers, E. M., & Smith, L. (1962). *Bibliography on the Diffusion of Innovations*. Department of Communication, Michigan State University.

Salkind, N. J. (2010). *Encyclopedia of research design.* Sage.

Saungweme, T., & Odhiambo, N. M. (2021). Inflation and economic growth in Kenya: An empirical examination. *Economia Internazionale/International Economics*, *74*(3), 323–344.

Saungweme, T., & Odhiambo, N. M. (2021). Inflation and economic growth in Kenya: An empirical examination. *Advances in Decision Sciences*, *25*(3), 1-25.

Seelanatha, S. L., & Natoli, R. (2025). The impact of financial development and regulation on technology gaps and cost efficiency in banks: a cross-country analysis. *Journal of Asia Business Studies*.

Sicsú, J., de Melo Modenesi, A., & Pimentel, D. (2021). Severe recession with inflation: the case of Brazil. *Journal of Post Keynesian Economics*, *44*(1), 89-111.

Taherdoost, H. (2022). Different types of data analysis; data analysis methods and techniques in research projects. *International Journal of Academic Research in Management*, *9*(1), 1-9.

Tate, W. L., & Ellram, L. M. (2022). Transaction cost economics. In *Handbook of Theories for Purchasing, Supply Chain and Management Research* (pp. 94-105). Edward Elgar Publishing.

Torre Olmo, B., Cantero Saiz, M., & Sanfilippo Azofra, S. (2021). Sustainable banking, market power and efficiency: Effects on banks' profitability and risk. *Sustainability*, *13*(3), 1298.

Tranos, E. (2021). *Networks in the innovation process* (pp. 853-868). Springer Berlin Heidelberg.

Udomkun, P., Romuli, S., Schock, S., Mahayothee, B., Sartas, M., Wossen, T., ... & Müller, J. (2020). Review of solar dryers for agricultural products in Asia and Africa: An innovation landscape approach. *Journal of Environmental management*, *268*, 110730.

Villar, A. S., & Khan, N. (2021). Robotic process automation in banking industry: a case study on Deutsche Bank. *Journal of Banking and Financial Technology*, *5*(1), 71-86.

Wang, L. H., & Cao, X. Y. (2022). Corporate governance, financial innovation and performance: Evidence from Taiwan's Banking Industry. *International Journal of Financial Studies*, *10*(2), 32.

Waqar, M., Bhatti, I., & Khan, A. H. (2024). AI-powered automation: Revolutionizing industrial processes and enhancing operational efficiency. *Revista de Inteligencia Artificial en Medicina*, *15*(1), 1151-1175.

Whisman, M. A., & McClelland, G. H. (2005). Designing, testing, and interpreting interactions and moderator effects in family and clinical research. Journal of Family Psychology, 19(1), 111–120.

Wong, C. Y., Wong, C. W., & Boon-itt, S. (2020). Effects of green supply chain integration and green innovation on environmental and cost performance. *International Journal of Production Research*, *58*(15), 4589-4609.

Zuhroh, S., & Rini, G. P. (2024). Product innovation capability and distinctive value positioning drivers for marketing performance: a service-dominant logic perspective. *International Journal of Innovation Science*.

APPENDICES

Appendix I: Questionnaire

Introduction

Dear Respondent,

Thank you for participating in this research study. The purpose of this questionnaire is to gather information on the effect of financial innovations on the cost efficiency of commercial banks in Kenya. Your responses will remain confidential and will be used solely for academic purposes. Please answer the questions as honestly and accurately as possible. Your input is highly valued and will contribute significantly to the success of this study.

Section A: Demographic Information

1. Gender:

Male [ ] Female [ ]

2. Age Group:

46 years and above [ ]

36 to 45 years [ ]

26 to 35 years [ ]

18 to 25 years [ ]

3. Highest Level of Education:

PhD [ ]

Master's Degree [ ] Bachelor's Degree[ ]

Diploma

[ ]

High School [ ]

4. Years of Experience in the Banking

   Sector: More than 10 years [ ]

   6–10 years [ ]

   1–5 years [ ]

   Less than 1 year [ ]

5. Position/Role in the

   Organization: Senior

   Management [ ]

   Middle Management [ ]

   Entry-Level Staff [ ]

   Other (Please specify): _____

Section B: Effect of Product Innovation on Cost Efficiency

6. To what extent has your bank introduced new financial products (mobile banking, digital loans) in the last 5 years?

Very High [ ]

High [ ]

Moderate [ ]

Low [ ]

Very Low [ ]

7. How have these new financial products impacted operational costs in your bank?

Significantly Reduced Costs [ ]

Moderately Reduced

Costs

[ ] No

Change

[ ]

Moderately Increased Costs [ ]

Significantly Increased Costs [ ]

8. Please provide examples of new financial products introduced by your bank and their impact on cost efficiency:

_____

_____

Section C: Effect of System Innovations on Cost Efficiency

9. To what extent has your bank adopted new technological systems (core banking systems, blockchain, AI)?

Very High [ ]

High [ ]

Moderate [ ]

Low [ ]

Very Low [ ]

10. How have these system innovations affected the cost efficiency of your bank?

Significantly Improved

Efficiency

[ ] Moderately Improved

Efficiency

[ ]

No Change [ ]

Moderately Reduced

Efficiency

[ ] Significantly Reduced

Efficiency

[ ]

11. What challenges has your bank faced in implementing system innovations?

_____

_____

Section D: Effect of Process Innovations on Cost Efficiency

12. To what extent has your bank improved internal processes (automation, digitization of workflows)?

Very High [ ]

High [ ]

Moderate [ ]

Low [ ]

Very Low [ ]

13. How have these process innovations impacted operational costs?

Significantly Reduced Costs [ ]

Moderately Reduced

Costs

[ ] No

Change

[ ]

Moderately Increased Costs [ ]

Significantly Increased Costs [ ]

14. Please provide examples of process innovations implemented by your bank and their outcomes:

_____

_____

Section E: Moderating Effect of Inflation on Cost Efficiency

15. How does inflation affect the cost efficiency of your bank?

Significantly Increases Costs [ ]

Moderately Increases Costs [ ]

No

Effect

[ ]

Moderately Reduces

Costs

[ ] Significantly Reduces Costs

[ ]

16. How does inflation influence the adoption of financial innovations in your bank?

Encourages Innovation [

] Discourages Innovation

[ ] No

Effect

[ ]

17. What strategies does your bank use to mitigate the effects of inflation on cost efficiency?

_____

_____

Section F: General Comments

18. Do you have any additional comments or suggestions regarding financial innovations and cost efficiency in commercial banks?

_____

_____

Thank

Appendix II: Research Approval Letters

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 8710901 Ext. 57530

Our Ref: D53/OL/HEP/20473/2022

DATE: 28th August, 2025

Director General,
National Commission for Science, Technology
and Innovation
P.O. Box 30623-00100
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR FAITH MORAA OTONDI - REG. NO. D53/OL/HEP/20473/2022

I write to introduce **Faith Moraa Otondi** who is a Postgraduate Student of this University. The student is registered for M.B.A degree programme in the **Department of Accounting and Finance.**

Faith intends to conduct research for a M.B.A Project Proposal entitled, **"Financial Innovations and Cost Efficiency of Commercial Banks in Kenya."**

Any assistance given will be highly appreciated.

Yours faithfully,

PROF. ELIUD NJAGI
EXECUTIVE DEAN, GRADUATE SCHOOL

R/me

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean.graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 810901 Ext. 4150

Internal Memo

FROM: Executive Dean, Graduate School

DATE: 28th August, 2025

TO: Faith Moraa Otondi
C/o Accounting & Finance Dept.

REF: D53/OL/HEP/20473/2022

SUBJECT: APPROVAL OF RESEARCH PROJECT PROPOSAL

This is to inform you that Graduate School Board at its meeting of 13th August, 2025 approved your Research Project Proposal for the M.B.A Degree Entitled, **"Financial Innovations and Cost Efficiency of Commercial Banks in Kenya."**

You may now proceed with your Data Collection, Subject to Clearance with Director General, National Commission for Science, Technology and Innovation.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed Supervision Tracking and progress report Forms per semester. The Forms are available at the University's Website under Graduate School webpage downloads.

Also, please ensure that you publish article(s) from your project before submitting it to Graduate School for examination as per the Commission for University Education and Kenyatta University guidelines.

Thank you

SARAH RIUNGU
FOR: EXECUTIVE DEAN, GRADUATE SCHOOL

c.c. Chairman, Accounting and Finance Dept.

Supervisors:

1. Dr. Francis Gitagia
   C/o Department of Accounting and Finance
   Kenyatta University

SR/mo

Appendix III: NACOSTI Permit

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **240923**

Date of Issue: **15/September/2025**

RESEARCH LICENSE

This is to Certify that Ms.. FAITH OTONDI MORAA of Kenyatta University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nairobi on the topic: FINANCIAL INNOVATIONS AND COST EFFICIENCY OF COMMERCIAL BANKS IN KENYA for the period ending : 15/September/2026.

License No: **NACOSTI/P/25/4179584**

240923

Applicant Identification Number

Ag. Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of this document, Scan the QR Code using QR scanner application.

See overleaf for conditions

THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013 (Rev. 2014)

Legal Notice No. 108: The Science, Technology and Innovation (Research Licensing) Regulations, 2014

The National Commission for Science, Technology and Innovation, hereafter referred to as the Commission, was the established under the Science, Technology and Innovation Act 2013 (Revised 2014) herein after referred to as the Act. The objective of the Commission shall be to regulate and assure quality in the science, technology and innovation sector and advise the Government in matters related thereto.

CONDITIONS OF THE RESEARCH LICENSE

1. The License is granted subject to provisions of the Constitution of Kenya, the Science, Technology and Innovation Act, and other relevant laws, policies and regulations. Accordingly, the licensee shall adhere to such procedures, standards, code of ethics and guidelines as may be prescribed by regulations made under the Act, or prescribed by provisions of International treaties of which Kenya is a signatory to.
2. The research and its related activities as well as outcomes shall be beneficial to the country and shall not in any way;
    i. Endanger national security
    ii. Adversely affect the lives of Kenyans
    iii. Be in contravention of Kenya's international obligations including Biological Weapons Convention (BWC), Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), Chemical, Biological, Radiological and Nuclear (CBRN).
    iv. Result in exploitation of intellectual property rights of communities in Kenya
    v. Adversely affect the environment
    vi. Adversely affect the rights of communities
    vii. Endanger public safety and national cohesion
    viii. Plagiarize someone else's work
3. The License is valid for the proposed research, location and specified period.
4. Neither the license nor any rights thereunder are transferable.
5. The Commission reserves the right to cancel the research at any time during the research period if in the opinion of the Commission the research is not implemented in conformity with the provisions of the Act or any other written law.
6. The Licensee shall inform the relevant County Director of Education, County Commissioner and County Governor before commencement of the research.
7. Excavation, filming, movement, and collection of specimens are subject to further necessary clearance from relevant Government Agencies.
8. The License does not give authority to transfer research materials.
9. The Commission may monitor and evaluate the licensed research project for the purpose of assessing and evaluating compliance with the conditions of the License.
10. The Licensee shall submit one hard copy, and upload a soft copy of their final report (thesis) onto a platform designated by the Commission within one year of completion of the research.
11. The Commission reserves the right to modify the conditions of the License including cancellation without prior notice.
12. Research, findings and information regarding research systems shall be stored or disseminated, utilized or applied in such a manner as may be prescribed by the Commission from time to time.
13. The Licensee shall disclose to the Commission, the relevant Institutional Scientific and Ethical Review Committee, and the relevant national agencies any inventions and discoveries that are of National strategic importance.
14. The Commission shall have powers to acquire from any person the right in, or to, any scientific innovation, invention or patent of strategic importance to the country.
15. Relevant Institutional Scientific and Ethical Review Committee shall monitor and evaluate the research periodically, and make a report of its findings to the Commission for necessary action.

National Commission for Science, Technology and
Innovation(NACOSTI),
Off Waiyaki Way, Upper Kabete,
P. O. Box 30623 - 00100 Nairobi, KENYA
Telephone: 020 4007000, 0713788787, 0735404245
E-mail: dg@nacosti.go.ke
Website: www.nacosti.go.ke