

**MODERATING EFFECT OF MACRO ECONOMIC VARIABLES ON THE
RELATIONSHIP BETWEEN FINANCIAL INNOVATIONS ADOPTION AND
FINANCIAL SUSTAINABILITY OF COMMERCIAL BANKS IN KENYA**

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OF COMMERCE**

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DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the thesis contains no material previously published or written by another person except where due reference is made in the thesis itself:

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ABSTRACT

The financial sector has reported a rise in the rate at which new technology applications are upending the established style of operations in favor of one that is more digital, virtual and customer centric. The financial sector is ready for financial technology transformation because of historical institutions, outdated technology, and consumer-unfriendly practices. Most of commercial banks and especially tier II and tier III banks, haven't been performing well financially due to the problem of growing non-performing loans (NPL) with most of them having cases of overreliance on foreign liabilities and debt which signals lack of financial sustainability. Banking technology models are invaluable and powerful tools for stimulating development, promoting growth, driving innovation and increasing competitiveness. Traditional banking services have changed as a result of these financial innovations, and this value addition to financial services cannot be disregarded. Thus, the purpose of the current study is to ascertain the impact financial innovation adoptions have on the financial sustainability of Kenyan commercial banks. The study was primarily examining the impact of integrated payment systems, cloud computing, blockchain technology, and artificial intelligence on commercial banks' sustainability. To anchor the study objectives, the study adopted financial intermediation theory, technology acceptance model and Schumpeter's theory of innovation. Additionally, the moderating impact of macroeconomic conditions on the adoption of financial innovations and the Financial Sustainability of commercial banks was investigated. A total of 205 respondents from 41 commercial banking companies that were active by the end of year 2022 served as the study's targeted population for primary data using questionnaires. The study used a design which was descriptive correlational in nature. The collected data was regressed using SPSS versions 21.0, and the correlation and regression analysis, t-test, and ANOVA was used to explain the data. The study findings established that cloud computing, blockchain technology, artificial intelligence, integrated payments system, and macroeconomic variables are statistically and positively significant in explaining financial sustainability of commercial banks in Kenya. Macroeconomic variables had a negative and significant influence on financial sustainability of commercial banks in Kenya. Macroeconomic variables moderated the relationship between financial innovations and financial sustainability of commercial banks in Kenya. The study concluded that commercial banks have ventured into increasing their utilization of financial innovations. Consequently, the survival and success of commercial banks depend critically on the financial innovation adoption. The study suggested that financial innovations may be used to lessen traditional technology difficulties including capacity, redundancy, and resilience. Furthermore, the scalability of financial innovations gives institutions greater control over concerns like security and credit risk mitigations.

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DEDICATION

I dedicate this research to my entire family who in many ways encourage me to aim highest, as in education there is no limit.

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ACRONYMS AND ABBREVIATIONS

AI	Artificial Intelligence
CBK	Central Bank of Kenya
CEO-	Chief Executive Officer
GDP-	Gross Domestic Product
DOI	Diffusion of Innovation
NPL	Non-Performing Loans
ICT	Information Communication Technology
IT	Information Technology
ML	Machine Learning
PAR	Portfolio at Risk
PU	Perceived Usefulness
PEOU	Perceived Ease of Use
ROA	Return on Assets
ROE	Return on Equity
SAAS	Software as a Service
SPSS	Statistical Package for Social Sciences
TAM	Technological Adoption Model
TOE	Technology Organization Environment
TPP	Third-Party Payment (TPP)
USA	United States of America

OPERATIONAL DEFINITION OF TERMS

Commercial Banks: This refers to financial organizations that provide a range of services, including accepting deposits, lending for business and auto loans, mortgages, and basic investment products like savings accounts and certificates of deposit. The banks in Kenya are the focus of this investigation (Manyaga, 2021). They could also be defined as commercial financial institutions that primarily aim to provide services including receiving bank deposits and lending for retail, business, car, and mortgage purposes. They also offer common investment products like transactional and savings accounts, fixed deposits, and foreign exchange trading. Intermediation is the sole responsibility of commercial banks (Cetorelli, Mandel & Mollineaux, 2012).

Cloud Computing: It is a model created to give companies convenience and technological capacitation with ease and agility (Mashandudze, 2015). It is the practice of employing a network of remote servers hosted on the internet to store, manage, and process data, rather than a local server or a personal computer and the advent of application program interfaces, APIs. (Mugenyi, 2018).

Artificial Intelligence: Refers to the simulation of human intellect in machines that have been designed to think like humans and mimic their actions. The expression can also be used to describe any gadget that exhibits cognitive abilities like learning and problem-solving (Alzaidi, 2018). In the opinion of Mannino et al., (2015) artificial intelligence in computer system presently is human intelligence applied in narrow but well-tested application to enable and expedite automation of every banking operation.

Integrated Payment Systems: Can be defined as the direct delivery of banking services and products over electronic and communication networks directly to customers. It involves making use of the digital era's infrastructure to create opportunities both local and international transactions (Angko, 2018). Sakanko and David, (2019) defined integrated

payment systems as online payment channels that permit clients to remotely access and transact with their financial accounts and exchanges over an electronic system.

Financial Innovation Adoption: Advances over time in the financial instruments and payment channels utilized for lending and borrowing of funds. These changes which include technological advancements have provided banks new and less expensive ways to maximize on their financial performance. Some of these innovations include, mobile banking, online banking, real time gross settlements, and automated teller machines (Mwai, 2020)

Financial Sustainability: Refers to the metric used to determine if an institution is making enough revenue to cover all its expenses, including financial costs, operational costs, and loan loss reserves. It is therefore defined as the ratio of operating revenue to operating expenses (Remer and Kattilakoski, 2021).

Block Chain Technology: Described as a list of records integrated using cryptography. Blockchains function as central repositories and are the ideal back up (Antonopoulos 2014). According to Cesay, Crane, and Johnson (2018), blockchain is a distributed digital ledger that has an encrypted database and is an irreversible and incorruptible digital information repository.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Innovativeness in technology can be attributed to the pertinent revolutions that have taken place in the world of business over several years. Every major change reveals a phenomenal emphasis on efficiency and security (Chilukuri & Madhav, 2015). Both individuals and corporates are keen on optimizing their utility by saving time and accruing maximum rewards on their investments. Nonetheless, businesspeople drive to continuously succeed in the financial sector exceeds all other competing interests.

There has been an eminent change in the approach of business operations and expansion that is spiraled by technological advancement. Due to technology disruption, which interferes with institutions' regular operations, new ideas are developing in all areas of economic development (Beck, 2018). Many entities are at a loss as a result of the dissemination and invitation of such uncommon changes, and most of them are unsure of when or why to participate. According to Hassani, Huang, and Silva (2018), the financial industry has noticed a rise in the rate at which new technology applications are upending the established style of operation in favor of one that is more virtual and focused on the needs of the client. According to current trends, majority of users, particularly the youthful generation, which makes up much of the population in Kenya and around the world, significantly rely on virtual platforms to conduct business or generate income. The financial markets have had to make investments in order to remain relevant to a range of user groups as a result of the disruptions caused by weak systems produced by artificial intelligence and the internet of things (Tapscott & Tapscott, 2017). The advent of digitalized services that aren't governed by a third party in the free market, such blockchain, artificial intelligence, integrated payment systems, and cloud computing, has created a paradoxical puzzle for the financial markets around the world.

Blockchain technology and cryptocurrencies have developed through time to represent security and transparency. The system's goal is to create a digital currency that anybody can influence. Because it is decentralized and anyone can develop it, neither the government nor a private organization can control it. Technological innovation defines the significant revolutions in the world of business over the years. The vast majority of the modifications demonstrate a remarkable focus on efficiency and security (Chilukuri & Madhav 2015). Both individuals and businesses are focused on increasing their utility by saving time and reaping the most possible returns on their investments. But for businesses, the drive to constantly succeed in a financial industry outweighs all other conflicting interests (Dulea 2015).

According to Aketch, Mwambia, and Baimwera (2021), the rate at which new technology applications are upending the conventional way of operations in favor of one that is more virtual and customer-centric has increased, according to reports from the banking sector. The majority of users, particularly the younger generation, which makes up the majority in Kenya and the rest of the world, are significantly dependent on virtual platforms in order to transact business or make money, according to current trends. The transition of the internet of things and artificial intelligence has led to the development of superficial systems that have ended causing havoc to the normal functioning of the financial market forcing them to buy in to remain relevant to mixed quarters of users (Tapscott & Tapscott, 2017).

International banks, who are recent arrivals to the market, have created fierce competition that has compelled local banks to engage in process automation to help them transition from conventional banking to contemporary banking and address growing complex needs of their customers and the problems posed by globalization. According to a CBK poll from 2020, Kenya's banking industry is recognized for its adoption of technology to satisfy customers' demands for "anytime anywhere" financial services and to promote efficiency improvements. As a result of alignment, the sector has seen a diversification of products

created specifically to satisfy the constantly changing client demands while enhancing the competitiveness and financial success of the institutions. While organizations have been effective in using technology to accomplish their goals, mostly as a cost-cutting measure, there is a shift in emphasis toward an alternative strategic currency, where technology is no longer seen as a cost saver but as a revenue source and a catalyst for profitability.

According to Fatoki and Wanjagi's research from 2019, can help Kenyan banks better control the private sector in a number of ways. For instance, digital money facilitates compliance. Dabrowski (2017) study suggested that financial innovations adoption poses a serious challenge to the financial industry's business model in both its banking and non-banking components and thus it is likely to contribute negatively on Financial Sustainability of commercial banks.

1.1.1 Financial Innovation Adoption

Li, Loutskina, and Strahan's (2019) study in the USA found that most institutions have improved their ability to survive after adopting novel product development. The paper concentrated on funding stability while current study focused on Financial Sustainability. Despite research showing that innovation increases profitability and competitive advantage, its impact on economic development through Financial Sustainability necessitates further study to support it. According to Nyangosi and Arora (2016), empirical research on the impact of financial innovation adoption has gained attention, increasing its empirical value among strategic and marketing scholars. The study focused on e-banking only which calls a tailored investigation on its impact when combined with other factors on financial independence.

According to a study by Dabrowski (2017) that was done in the context of Russia, the adoption of financial innovations presents a significant challenge to the business model of the financial industry in both its banking and non-banking components, and is therefore

likely to have a negative impact on the financial independence of commercial banks. Additionally, economic value addition of financial institutions will depend on the caliber and quantity of services provided to clients since the duo will increase customer retention and loyalty. There is need for investigation whether financial innovations such as cloud computing, blockchain technology, artificial intelligence and integrated payment systems contributes positively or negatively on Financial Sustainability in the context of Kenya. If these financial innovations are not responded to appropriately and promptly by regulators, it may introduce new risks to financial stability, as it was the case prior to the global financial crisis of 2007-2009.

Financial innovation characteristics and Financial Sustainability were found to be positively and significantly related in studies on banking that were conducted on more developed economies (Mugenyi, 2018; Alzaidi, 2018). Despite implementing financial innovations, there have been reports of banks reporting decreased profitability and other banks being placed under receivership. When evaluating the performance of commercial banks, relying on standard financial ratios like return on assets and return on equity is pointless unless costs and revenue are properly adjusted to reflect financial sustainability (Balkenhol, 2017).

1.1.1.1 Cloud Computing

Mell and Grance (2009) define cloud computing as a concept that allows universal, practical, on-demand network access to a shared pool of customizable computing resources that can be quickly deployed and released with little administration work or service provider involvement. The computing resources may consist of servers, storage, networks, applications, etc. When computing resources like processing power, storage, and virtual machines can be purchased and used at any time without requiring a human to contact with the cloud service provider, this is referred to as on-demand self-service. An additional feature known as "broad network access" is the ability to use computational resources

across a network with heterogeneous devices, such as laptops and mobile phones. Resource pooling, according to Fatuma and Namisango et al. (2014), refers to a situation in which Cloud Service providers pool their resources, which are subsequently shared by several users. For instance, a physical server can be used to host multiple virtual machines belonging to various users. Other banking innovations that were absent from previous analyses, like artificial intelligence and integrated payment systems, were included in the current analysis.

According to Odhiambo, Mose, and Mwalili (2022), Kenya's financial and educational sectors have implemented cloud computing to some extent. The study highlighted how the Kenyan banking sector is recognized for its adoption of technology to suit consumer needs by quoting from the CBK survey (2021). The banking industry and other sectors hastened their digitization as a result of the start of COVID-19 in 2020. The Innovation Survey 2021 indicates that customer-centricity has been given top priority in innovation within the Kenyan banking sector. In the banking industry for microfinance, in particular, there is a growing interest in innovation for sustainability and climate awareness. Collaboration and partnership were also mentioned as important factors that spur innovation. Due to the financial sector's interconnection, cyber risk and data privacy and protection were subsequently identified as innovation's primary issues. The two surveys conducted in Kenya failed to investigate the impact of block chain technology, thus calls for further enquiry.

1.1.1.2 Blockchain Technology

The use of blockchain technology and the financial inclusion of rural Indians were both explored by Schuetz and Venkatesh in 2019. The implementation of blockchain was cited as the solution to the majority of problems and the key to preventing financial exclusion. Block chain technology, according to Pilkington (2016), compares differently from the most common kinds of money, but its infrastructure is complicated. The most notable

discrepancy relates to the absence of regulation, which is a key characteristic of digital money. Rarely do central banks issue reports on cryptocurrencies. Since the technology is totally virtual, there is no centralized repository for it. In the context of cryptocurrencies, a situation where money can be lost by being robbed from the bank resembles a computer crash. On the other hand, the management of digital currency necessitates technological management expertise along with backup copies of holdings as the central banks develop various security procedures.

Mavilia and Pisani (2019) undertook a study on the assimilation of blockchain occurring in developing countries with a case of financial inclusion in Africa. The study noted that Africa still lacks access to financial inclusion and portrays several weaknesses in the current financial sector as reported by the World Bank Survey of 2018. The study outcome showed that the new wave of blockchain technology is key to solving financial exclusion and enhancing sustainable development to African nations.

Blockchains are the best backup and central repository technology (Antonopoulos 2014). A list of records that have been combined using king sector cryptography is another way to define a blockchain. Big data, data exchange, and data security go hand in hand with this. According to research by Fatoki and Wanjagi published in 2019, blockchain technologies can help Kenyan banks better control the private sector in several ways, such as by enabling compliance with regulations. For banks to be self-sustainable, blockchain technologies can be used to correct any market imbalances. The outlined studies highlighted a few descriptions of blockchain technologies and cannot be generalized and hence calling for more investigations in the current study.

1.1.1.3 Integrated Payment Systems

Empirical research indicates that conventional banks and financial institutions' financial performance is significantly improved when integrated payment systems are implemented in the provision of financial services. (Manning, 2018; Yasin, 2018; Odhiambo, Mose, & Mwalili, 2022; Alzaidi, 2018; Vekya, 2017; Ugwueze & Nwezeaku, 2016; Njoroge & Mugambi, 2018; Kombe & Wafula, 2015) due to its obvious cheapness, in comparison to physical branches delivery, which most often results in the reduction of operational cost, in form of reduced and better utilized workforce, equipment, space and operational savings.

According to Kaabi and Jallouli (2019), who investigated the restructuring taking place in the banking industry to make room for new technologies, changes in consumer behavior may make it possible for small and medium-sized businesses to utilize these technologies as competitive advantages. Singh (2020) outlines several areas in banking where AI has the potential to revolutionize current procedures, including trading and securities, customer service, customer engagement, fraud and risk management, credit evaluation, and regulatory compliance. The current study aims to integrate blockchain technology, cloud computing, integrated payment systems, and other financial innovation factors.

Akhisar et al. (2015) in their study found a positive relationship of electronic payment systems and profitability of banks. In India, Vikram and Gayathri (2018) assessed the impact of information technology on the financial performance of Indian banks and the results indicated that that point of sale systems and Mobile systems had a positive and significant correlation to ROE, while ATM transactions had negative, significant, relationship with profitability. This outcome was in contrast with that of Zu et al. (2019) who discovered in their studies on Impacts of payments system technology on the performance evidence of electronic banking in Africa by adopting a descriptive research design and multiple regression model that ATM impacted banks profitability positively,

while POS and internet payments affected profitability of banks negatively. These findings call for more comprehensive research under the current study.

1.1.1.4 Artificial Intelligence

Artificial intelligence can be used in the banking industry to improve procedures and remove obstacles (Manning, 2018). The financial services industry is no exception to how artificial intelligence (AI) and machine learning (ML) technologies have penetrated many areas of global economies. Financial services firms are able to further automate their business processes and use big data sources to overcome difficulties as a result of the introduction of these technologies in emerging markets. The Kenya Banking Sector Innovation Survey 2021 Report states that the banking industry views AI/ML as one of the solutions that would fundamentally revolutionize the industry.

Awiti (2018) argues that numerous financial institutions, including African banks, are implementing digitized systems to enhance customer service delivery, reduce costs, innovate, and guarantee smooth operations. According to a recent study by Haridas (2018), over 40% of African banking clients prefer to employ computer-assisted platforms or artificial intelligence over manual branch banking activities. It therefore calls for an investigation on to whether the findings were applicable in the Kenyan banking sector.

Ahmad Bhatti, (2019) alluded that in Kenya, artificial intelligence technology appears as the future for the banking industry. However, the level of penetration in the use of artificial intelligence to undertake banking services in the country is still significantly low. A survey conducted by the Kenya Bankers Association (KBA) indicates that Kenyan banks are still unwilling to completely embrace the world of robots to provide banking services to customers. According to a 2022 KBA survey, Kenyan banks have adopted a wait-and-see strategy. The report also revealed that more than 80% of banks continued to employ conventional banking models. In the survey, the banks attributed their reluctance to adopt

robots in the banking sector to Kenyan clients' preference for manual banking procedures over performing their banking needs online. The study was not, however, conclusive, with the report noting that it did not assess whether customer awareness and perceived utility of the artificial intelligence systems was the cause of low uptake of artificial intelligence by Kenyan banking customers or players in the industry (Gomber, 2018). Therefore, the current study is necessary.

1.1.2 Macroeconomic Factors

The banking industry has also experienced significant transformations all over the world under the impact of innovation in technology, regulatory reform and globalization. Both internal and external factors have in one way, or another affected the structure and performance of banking industry (Ally 2014). Despite this rising trend, the banking sector is better able to absorb adverse shocks and continue to support a nation's financial sector.

Financial institutions largely influence the economy since they act as financial intermediaries between people with financial surplus (lenders) and those with financial deficit (borrowers). It was concluded that the macroeconomic indicators among them inflation and interest rates influence the bank's financial performance measures (Alfadli and Rjoub, 2020). The key functions of financial intermediaries range from matching demand and supply, dealing with financial instruments, offering payment mechanism, facilitating financial markets, providing transparency in the market and risk management (Alper & Anbar, 2016). Commercial banks participate in the economic growth of a country by availing funds for investors and at the same time enhance financial growth in the country (Otuori 2017). Commercial banks perform more than just the standard intermediation job; they also ensure strong financial performance, which benefits the shareholders and ultimately fosters the nation's overall economic growth (Ongore & Kusa, 2017). The current study thus adopted inflation and interest rates to moderate the relationship between financial innovation adoption and financial sustainability of commercial banks in Kenya.

1.1.3 Financial Sustainability

According to Remer and Kattilakoski (2021), financial sustainability, when expressed as a percentage, indicates whether commercial banks are generating enough income from interest, fees, and commissions to pay for all their expenses, including running costs, loan loss provisions, and financial costs. Commercial banks can achieve Financial Sustainability of 100% or to a ratio of 1:1, either by increasing their operating income or by decreasing their total costs.

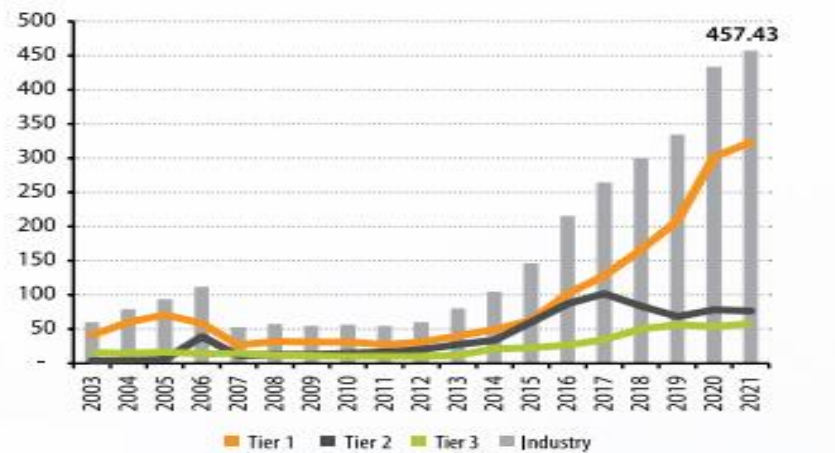
When banks are able to cover their own expenses of operation, financing, and other forms of subsidies valued at market rates, they are considered financially self-sustainable. That is, to pay for its expenses if it raises funds at market rates and if its operations were not subsidized (Balkenhol, 2017). To be deemed self-sustainable, commercial banks must be able to cover opportunity costs for all factors of production and assets from their own revenue. (Chaves and Gonzalez-Vega, 2016).

Profitability is the nonprofit equivalent of Financial Sustainability for commercial banks. According to this idea, a commercial bank that is operating at a loss and has poor financial performance is not considered to be financially self-sustainable. Once more, a commercial bank that pays for some of its operational expenses with subsidies will not be regarded as being financially self-sustainable (Woller and Schreiner, 2014).

The stock of non-performing loans (NPL) in the banking sector increased during the time, reaching about Kshs. 460 billion from Kshs. 436 billion in 2020, according to the Kenya Bankers Report of 2022 (Figure 12.1). Nonetheless, there was still non-homogeneity in the NPL distribution by volume throughout the banking sector. The gross non-performing loans (NPLs) of tier 1 banks increased at a pace of 7.1 percent in 2021, reaching Kshs. 323.20 billion, while the NPLs of tier 3 banks increased at a rate of 5.5 percent, reaching Kshs. 57.78 billion. Nonetheless, tier 2 banks' holdings of NPLs decreased by 2.3 percent.

As the economy continued to experience the catastrophic effects of the pandemic on businesses and households' incomes, as well as the steps taken by individual banks to prevent further deterioration of their credit portfolios, the evolution of non-performing loans (NPLs) in the industry and across bank tiers indicated an elevated credit risk. The trend in NPL means that despite the high profits in tier one banks they are also at risk of lacking financial sustainability if the NPL growth trends persists.

Figure 2.1 Gross Non-performing Loans (Billions).



Source: KBA (2022)

Alzaidi, (2018) found a significant relation of artificial intelligence with profitability of organizations. Mannino et al., (2015) noted that human intelligence applied in narrow but well-tested application enabled and accelerated automation of all the processes in banking. The results of the Angko (2018) study show that advancements in bank payment systems through electronic delivery channels have significantly impacted the delivery of banking services and the development of the banking sector in Ghana. The results of the Aketch, Mwambia, and Baimwera (2021) study revealed that the adoption of blockchain technology had a favorable and significant correlation to the financial system, necessitating testing of its viability in commercial banks financial sustainability

1.1.4 Commercial Banks in Kenya

Central Bank banking sector annual report of 2021 indicated that as at December 31, 2021, the Kenyan banking sector comprised of the Central Bank of Kenya (CBK), as the regulatory body, 41 Commercial Banks, 1 Mortgage Finance Company, 1 Mortgage Refinance Company, 9 Representative Offices of foreign banks, 14 Microfinance Banks (MFBs), 3 Credit Reference Bureaus (CRBs), 17 Money Remittance Providers (MRPs), 8 non-operating bank holding companies and 68 foreign exchange (forex) bureaus. Of the 39 banking institutions, the Kenyan government owned a majority stake in two, while the remaining 37 were privately owned. Of the 37 privately held banks, 16 were controlled by foreigners and 21 were locally owned (the principal owners are based in Kenya).

Njoroge (2022) acknowledged that the banking sector entered 2021 on a strong footing poised to rebound after the coronavirus (COVID-19) pandemic. Due to the different steps implemented at the start of the pandemic, Kenya's economy showed resilience to the COVID-19 shock. The economy partially recovered in 2021 when the majority of pandemic control measures were eased in favor of post-COVID-19 recovery. Banks positioned themselves for recovery by looking at mergers and acquisitions, digital acceleration, evaluating their delivery methods, reviewing their business models, finding long-term funding sources, and investigating equity infusions.

According to the 2021 Central Bank of Kenya report, the ICT Developments section specifically addresses the impact of new technology and pertinent regulations in the banking industry across the following categories: Central Bank Digital Currencies (CBDCs). Digital Lending. Decentralized Finance. Open Banking. Artificial Intelligence and Machine Learning in Kenya's Banking Sector. Digital-Only Banks. Emergence of Super Applications. Adoption of Sustainable Financial Technology. Kenya's Financial Sector's Cyber Threat Landscape. Regulation and Fintech. Additionally, the section outlines CBK's Fintech-related initiatives, including Fintech Festival Afro-Asia. The EAC

Central Banks are developing the Minimum Standards for Guidance on Cloud Computing. The Gender, Technology, and Financial Inclusion Project at Toronto Centre.

1.2 Problem Statement

Most of commercial banks and especially tier II and tier III banks, haven't been performing well financially with most of them having cases of overreliance on foreign liabilities and debt which poses exposure to foreign currency risk and signals lack of Financial Sustainability (CBK, 2021). Mugenyi, (2018) believes that banking technology models are invaluable and powerful tools for stimulating development, promoting growth, driving innovation and increasing competitiveness, but according to KBA study done in 2022 and CBK supervisory report of 2021, Kenyan banks have adopted a wait and see attitude due to cyber risk, data privacy and protection being major concerns of innovation, arising from interconnectedness of the financial sector. However, despite the model being used, commercial banks in Kenya have been going through a difficult time. Some of these banks have collapsed, including Union Bank, Trust Bank, Euro Bank, and Dubai Bank, while others have been placed under receivership, including Imperial Bank and Chase Bank (CBK, 2016). Additionally, there is cause for concern as Kenya's NPL (credit risk) rate is rising and is currently above the target level of 5% and threatening the financial sustainability of commercial banks in Kenya (KBA, 2022). Changes in deposit patterns (liquidity risks) across Kenyan commercial banks should raise concerns (Cytonn, 2018). Furthermore, the increasing trend of foreign liabilities (foreign exchange risk) in commercial banks is a point of concern (Bank Supervisory Report, 2017). This indicates that Kenya's commercial banks lack financial independence. The necessity to research the impact of financial innovation adoption on the financial sustainability of commercial banks in Kenya developed as a result.

Although it has been demonstrated that financial innovations significantly improve the financial performance of commercial banks (Manning, 2018; Yasin, 2018; Mohammed, Ibrahim, & Muritala 2022; Odhiambo, Mose, & Mwalili, 2022; Alzaidi, 2018; Vekya, 2017; Ugwueze & Nwezeaku, 2016; Njoroge & Mugambi, 2018; Kombe & Wafula, 2015; Fatoki and Wanjagi, 2019) because of their obvious affordability in comparison to physical branch delivery, which most frequently results in the reduction of operational cost in the form of reduced and better utilized workforce, equipment, space, and operational savings, it is necessary to conduct additional research on their impact on Financial Sustainability. Dabrowski (2017) suggested that financial innovations adoption poses a serious challenge to the financial industry's business model in both its banking and non-banking components and thus contributing negatively on financial sustainability of commercial banks. Financial innovation and Financial Sustainability have a favorable, significant association, according to studies on banking that have been conducted on more developed countries (Mugenyi, 2018; Alzaidi, 2018). When evaluating the performance of banks, relying on standard financial parameters like ROA and ROE is futile unless expenses and income are correctly adjusted to reflect financial sustainability (Balkenhol, 2017).

By concentrating on the joint effects of cloud computing, block chain technology, artificial intelligence, and integrated payment systems, the study conceptually diverged from earlier research. Commercial banks operational in Kenya was the context of the study. A survey for all commercial banks was adopted using descriptive research design. Although they have been largely disregarded in research, macroeconomic issues have a considerable impact on how financial institutions operate. Therefore, it was also researched at how much macroeconomic factors affect Financial Sustainability. Due to the inconclusiveness of previous research findings, the need to fill conceptual, contextual and methodological gaps necessitated the need to study and seek to establish the link between financial innovation adoption and Financial Sustainability of commercial banks in Kenya.

1.3 Objectives of the Study

The main objective of the study was to assess the effects of financial innovations adoptions and Financial Sustainability of commercial banks in Kenya.

Specific objectives are:

- i. To examine the effect of cloud computing on Financial Sustainability in commercial banks in Kenya
- ii. To examine the effect of blockchain technology on Financial Sustainability in commercial banks in Kenya
- iii. To examine the effect of artificial intelligence on Financial Sustainability in commercial banks in Kenya
- iv. To examine the effect of integrated payment systems on Financial Sustainability in commercial banks in Kenya
- v. To investigate the moderating effect of macroeconomic variables on the relationship between financial innovation adoption and Financial Sustainability of commercial banks in Kenya.

1.4 Research Questions

The study sought to answer the following questions:

- i. To what extent does cloud computing affect Financial Sustainability in commercial banks in Kenya?
- ii. How does blockchain technology affect Financial Sustainability in commercial banks in Kenya?

- iii. How does artificial intelligence affect Financial Sustainability in commercial banks in Kenya?
- iv. How does integrated payment systems affect Financial Sustainability in commercial banks in Kenya?
- v. To what extent does macroeconomic factors moderate the relationship between financial innovation and Financial Sustainability in commercial banks in Kenya?

1.5 Scope of the Study

The study made use of primary data. Primary data was gathered in the form of questionnaires and individual bank personnel who have worked for more than five years gave focal information, and the limited contextual scope particular to the current research was all commercial banks in Kenya. Primary data was collected for a period of four months ranging from September 2023 to December 2023. Thus, all Kenyan commercial banks that are registered and active by the end of 2022 constituted the study population.

The study sought to investigate a total of 5 respondents from 41 commercial banking companies that were active during the time period under consideration that added up to a total of 205 questionnaires. The questionnaires given to respective departments of the company provided the data used in this study.

1.6 Significance of the Study

The purpose of this study was to close a gap in the literature and contribute to it by elucidating the relationship between financial innovations and banks' financial sustainability. This gives credibility to the study because it can replicate the findings elsewhere. As a result, the current study's conclusions were relevant to a range of interest groups, including investors, academia and research scholars, the banking industry, financial institutions' regulators, bank clients, decision-makers, and the government.

1.5.1 The government and policy

The nation's financially well-served regions were identified by the government and policy makers, who then developed measures to strengthen their financial sustainability. These measures included improving technological infrastructure and enrichment by subsidizing tools that improve financial inclusion in financially excluded areas and enhancing the economic empowerment of residents living in unbanked areas.

1.5.2 Investors in Commercial banks

Players in the financial sector can have a better understanding of the unserved and underserved market segments, which will aid them in creating financial innovations to increase their market penetration in underserved areas and address any gaps in the market that may exist. It thus promotes their customer niche and improves on their streams and therefore promote the nation's economic growth.

1.5.3 Researchers and Upcoming Scholars

Senior as well as prospective researchers can benefit from the study. The study significantly advanced academic study since it will expand the body of already published and available literature that can be consulted when conducting additional research. This study will make suggestions for additional research areas. The shareholders of the banks will also gain from it since it has provided them with a clear understanding of efficiency drivers and give them the impetus, they need to hold the managers of the banks responsible for improving the efficiency of the areas that have been identified.

1.5.4 Practitioners

Finally, the study was helpful to practitioners like financial advisors and managers since they will have a better knowledge of how new financial products and services could affect their clients and businesses. This can help them make informed decisions about the

adoption and use of financial innovations and help them identify opportunities to leverage these innovations to improve Financial Sustainability.

1.7 Chapter Summary

This chapter has presented the background of the study, stated the problem, and laid out the objectives and considered the importance of the study to the various stakeholders. Subsequently it has provided the scope and operational terms adopted. Chapter two subsequently reviews previous literature conducted on this area of interest while chapter three described the methodology that was employed in the study.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter outlines the review of empirical literature. It accounts for the prior studies and what have been the findings in the scope of study. This study contributes to our understanding of the Financial Sustainability of Kenyan banks by relying on a collection of theories that have been established over time. The theories include Schumpeter's theory of innovation, the technology adoption model, and the financial intermediation theory. The three theories all concur that the adoption of financial innovations affects the Financial Sustainability of commercial banks in Kenya, but they differ on the best practices for achieving that self-sustainability. The literature review captures the influence of the following four types of financial innovations: cloud computing, blockchain technology, integrated payment systems and artificial intelligence and their effects on Financial Sustainability of commercial banks in Kenya. The next elements contained in this chapter include theoretical and conceptual framework.

2.2 Theoretical Orientation

A theory can be termed as a set of statements or principles that are planned to give an explanation on a combination of facts or phenomena especially the ones that have been in many occasions tested or is extensively acknowledged and made use of to do forecasting of natural phenomena. The diffusion of innovation theory, Schumpeter's theory of innovation, financial intermediation theory, and technology adoption model (TAM) was used as pillars of this study's multi-theory approach. A multiple theory orientation provided a more comprehensive understanding of financial innovation adoption, improved generalization and greater flexibility which will inform the development of more effective strategies for encouraging adoption and fostering innovations in the financial sector.

2.2.1 Financial Intermediation Theory

The financial intermediation theory is based on Raymond Goldsmith's 1969 study. In his work, Goldsmith provided a wide range of information about the financial system and economic growth. It was found that a country's financial system grows more quickly than its national wealth during its economic development. The distribution of the role of saving and investment among the various economic units determines the size of a nation's financial system (Goldsmith, 1969). This idea from the 1960s still applies to the modern process of financial intermediation. The importance of financial intermediation in the growth of the economy is still recognized by modern society (Scholtens & Van Wensveen, 2003). Empirical and theoretical studies have demonstrated the critical role that financial intermediation plays in the expansion of the economy.

The study finds that low income and asset levels among some members of society are among the causes of financial exclusion. Financial intermediation allows for the effective distribution of capital within the economy with the goal of promoting economic growth. Limited knowledge of specific financial factors is another issue highlighted as contributing to financial exclusion. Information is provided through financial intermediation to both capital owners and borrowers. The practice of financial intermediation brings together the surplus and deficit units in a setting they are unfamiliar with (Mandell, 2008).

Scholtens and Van Wensveen (2000) criticized this approach, arguing that the idea of participation costs should be at the center and that risk management is a relatively new notion in the financial industry. According to the study, additional development of the theory of financial intermediation may be necessary to comprehend current occurrences in the financial services industry. The banks make sure that there is financial inclusion through financial intermediation. The banks take a risk on behalf of the many economic participants in order to ensure that there is information access, financial literacy, and efficient resource allocation in the nation (Scholtens & Wensveen, 2003). The financial

institution must be compensated for the risk incurred throughout the financial intermediation process by charging interest. This aspect of financial intermediation is crucial to the research in this paper because it emphasizes how financial institutions might profit from playing this role and so enhance their financial performance. Financial intermediation's components have been shown to be essential for ensuring financial inclusion, hence this kind of study would seek to ascertain whether financial inclusion generates profits for the financial institutions that provide intermediation services. This idea is thus pertinent to the extent which adoption of financial innovation enhances the financial independence of Kenyan commercial banks.

2.2.2 Technology Acceptance Model (TAM)

Global technology investment has increased quickly over the years, and as a result, organizations now need to embrace technology and make use of the advantages that come with it. The Technology Acceptance Model (TAM), created by Davis in 1989 and expanded upon by Luarn & Lin in 2004, is a frequently utilized tool for examining how different businesses absorb technology. TAM is a theory that models how different individuals consent to use a technology that is made available. It continues by explaining that users examine a number of variables before agreeing to utilize a certain technology after being provided with it (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975).

TAM states that the user considers two elements before adopting any given technology: perceived usefulness (PU) and perceived ease of use (PEOU) (Davis, 1989). The user's belief that using a certain system will improve their ability to accomplish their work is referred to as their PU, whereas their belief that using that system will be effort-free is referred to as their PEOU. The two main pillars around which the Technology Acceptance Model is founded are the constructs of Perceived Utility and Perceived Facility, and Why Users Accept Technology (Wright, 2017).

In relation to TAM, banks would assess the cost of technology, and if it is acceptable, they would adopt it without a shadow of a doubt. As a result, their data analytics, credit scoring, and innovation will improve, which will boost efficiency and effectiveness and finally improve financial performance.

The Technology Acceptance Model (TAM) was used in this research study to tie the blockchain study's utility and the simplicity pinned on to the two primary variables in explaining users' acceptance or rejection of blockchain-related services. The degree to which a person believes that implementing a particular system will improve his or her performance in the financial environment or other services related to company is referred to as the individual's technology usage.

According to the TAM model, a user's incentive to use technology, and particularly artificial intelligence, influences their decision to accept it, as does their attitude toward it. Opinions regarding technology, which are made up of the perceived usefulness and simplicity of use, which make it relevant in blockchain technology, have an impact on consumers' attitudes. According to Fitriyani and Sfenrianto (2016), the TAM model is included in the set of very significant and examined theories that describe how technology's ultimate consumers behave.

According to Lule, Omwansa, and Waema (2012), one of TAM's drawbacks is that it was created for usage in an organizational setting rather than in the context of daily life, making it unsuitable for research on financial technology in banking. TAM has limitations when it comes to describing numerous technological developments, which are a prevalent feature of commercial banks' innovations. Therefore, it is advised that TAM be extended, as it was by Luarn & Lin, to analyze the adoption of financial innovations (2004).

2.2.3 Schumpeter's Theory of Innovation

Schumpeter (1954) asserts that, organizations create an opportunity for new profits with their innovations. Due to innovation, new items enter the market, which reduces demand for existing ones, drives down their price, and ultimately eradicates them. The theory holds that competitors in the market swiftly imitate and adapt the features to benefit from the super normal earnings, diminishing the profit margin, anytime entrepreneurs innovate and become successful. A new innovation, however, appears before the supply and demand are equal, starting the business cycle all over again. He contends that entrepreneurs seek out the activities that provide the values that increase and transform the cyclical flow of revenue as well, with invention on one hand and innovation and entrepreneurship on the other.

Schumpeterian competition produces imitators who copy their rivals' strategies and steers innovation, which in turn promotes investment and causes a boom. This view is upheld by Porter (1992), who contends that improvement is crucial for a country's long-term competitive advantage as well as economic expansion. However, critics like Solow (2007) critiqued the Schumpeterian theory of innovation as the most successful attempt to reduce the entirety of a socioeconomic system into a handful of extreme simplifications.

Innovative payment solutions will be extremely beneficial to society when it comes to retail payment services. These systems are advantageous because they can reduce costs and streamline transactions, as noted by Berger (2003). The market will grow significantly and the purchasing power will rise due to the potential ease of money transfers. The idea aims to increase payment means availability, facilitate transactions, and improve processing efficiency in the context of integrated payment services. According to Columba (2009), empirical studies show a reduction in the cost of transaction owing to massive distribution of integrated payment systems thus anchors this variable.

The theory has been criticized by Lambert (2019), who argued that while it would suggest that innovation in the banking sector is a significant driver of economic growth, the role of commercial banks in fostering innovation is limited and that other factors, such as the regulatory environment and market structures, are more important in influencing the development of the banking sector. Additionally, the banking industry's pursuit of innovation may have unfavorable effects including rising inequality and a concentration of economic strength in the hands of a select few major commercial banks.

2.3 Empirical Literature Review

This section entails the empirical literature as outlined by various authors on how financial innovation adoption affects Financial Sustainability of commercial banks in Kenya. This study context was on all commercial banks that were operational in Kenya by the end of 2021.

2.3.1 Cloud Computing and Financial Sustainability

The study by Odhiambo, Mose, and Mwalili (2022) examined the factors that led to the adoption of cloud computing in a few Kenyan banks. The study specifically aimed to determine the impact of data security on cloud computing adoption in selected Kenyan banks, the influence of organizational culture on cloud computing adoption in selected Kenyan banks, the impact of supplier lock-in on cloud computing adoption in selected Kenyan banks, and the influence of regulatory policy on cloud computing adoption in selected Kenyan banks. The study employed explanatory research design and inferential statistics. The 366 ICT employees from 42 chosen banks made up the target population. To get the information, a systematic questionnaire was employed. A computer statistical package for social sciences version 28 (SPSS) application was used to tabulate, code, and process the questionnaire responses in order to analyze the data. The study discovered that even while cloud computing is thought to have advantages, there are issues that need to be

resolved before commercial banks can completely adopt cloud computing. The current study adopted Financial Sustainability as the dependent variable therefore deviating conceptually.

A study on the usage of cloud computing services for the long-term growth of commercial banks in Uganda was undertaken by Mugenyi (2018). This paper looked at the advantages of cloud computing for businesses and how Ugandan institutions might use it to successfully meet the ever-growing issues that are constantly mentioned. Regrettably, the majority of developing nations, like Uganda, have yet to recognize the advantages offered by cloud computing systems and have not yet adopted to it. While Uganda has made an effort to encourage the use of cloud computing in small and medium-sized businesses, the majority of institutions do not have any intentions to embrace or use cloud computing, making the present usage rate of the technology extremely low. The absence of regulations governing cloud computing system operations in the nation is a major factor contributing to this utilization range. The current study was conducted in the Kenyan context to replicate the effect of cloud computing on Financial Sustainability.

The study done by Scholten (2016) identifies the factors that promote and obstruct cloud computing adoption. After Edward Snowden's revelations about digital spying, this becomes even more intriguing. An extensive assessment of the literature was conducted before the study to determine what has already been tried. The results of expert interviews done in the field are added to this data as a supplement. A TOE system, which is validated by a survey of Dutch IT managers, incorporates the structures and associated metrics. Although the technology is identical to that used on-site, it is more flexible. The current study differed methodologically as the researcher adopted explanatory research design and multiple linear regression model.

The most widely used form of cloud services, SaaS (Software as a Service), is being adopted by banks, according to Apostu et al. (2012). SaaS is primarily used in non-core,

peripheral solution areas like collaboration, customer relationship management, and human resources, but there are some exceptions. Apostu et al. (2012) said that a cloud computing architecture must be established for the businesses' operations to be more safe, adaptable, and structured in a modern manner.

2.3.2 Block Chain Technology and Financial Sustainability

Fatoki and Wanjagi (2019) conducted an empirical study on the future of Kenyan banks. Using cryptocurrency and blockchain technology to reduce financial risk Instead of supporting a dominating market player or authority, digital money promotes individual investors. The key to cryptocurrencies' use in Kenya is that no single authority has control over them. For the global markets, which are characterized by rising inequality and financial fraud, digital money is a unifying force. Smart contracts may be used by the Kenyan financial system to solve the numerous risks resulting from the economic actions taken by both private and public parties. Banks can do away with the middlemen that frequently limit the ability of individual traders to enter into contracts by using digital money. Because they are user-to-user transactions, cryptocurrencies give individual traders more flexibility and control. The use of the technology can help the state to reduce the risk of loss owed to inaccurate authentication and valuation of assets. This paper is an empirical study on the future of Kenyan banks while the current study adopted blockchain technology and its role on Financial Sustainability.

Wu Duan (2019) study was on the advantages of blockchain technology in commercial bank operation and management. The benefits of blockchain technology for commercial banks are covered in this paper. The benefits of blockchain technology are examined in commercial banks' asset securitization, cross-border payment, and bill operations. Finally, the findings demonstrate that blockchain technology can lower transaction costs for all parties involved and improve the management and operation efficiency of commercial

banks. The current study aimed at replicating the impact of blockchain technology in the Kenyan context.

The study conducted by Aketch, Mwambia, and Baimwera (2021) examined the effects of blockchain technology on the financial markets in Kenya. The research design used in the study was explanatory. The study's target demographic was chosen from Kenya's Nairobi County's commercial banks. The study's focus was on 84 bank managers who were employed by Kenya's 42 commercial banks' IT and finance departments. According to the study's findings, government policy, internet infrastructure, transaction costs, and risk assessments were all positively and significantly correlated with the use of blockchain technology. The report advised that policy reviews be conducted on matters pertaining to risk analysis in order to stop unauthorized money transfers and improve Kenya's financial markets performance. A study on the stability of blockchain technology use and its effects on economic growth is necessary. This study focused on 84 bank managers which was a smaller sample while the current study adopted 205 respondents as the unit of analysis.

Mavilia and Pisani (2019) established the assimilation of blockchain in developing nations with a case of financial inclusion in Africa. Africa still lacks access to financial inclusion and weakness in the present financial system as reported by the World Bank Survey. This can be attributed to the existence of Bitcoins, which have disrupted markets and produced new entities. According to the study's conclusions, African states can only experience sustainable development with the help of the new wave of blockchain technology, which holds the key to ending financial marginalization. In 2019, Kibet, Thiga, and Karume evaluated blockchain-based contracts for the Kenyan housing market. With many middlemen, including brokers, bank providers, the government, and agents, the housing sector requires a lot of resources to expand, which results in high costs and a lack of transparency. The application of blockchain technology in the smart contract was found to address the weaknesses in the system and can drastically reduce the housing cost.

2.3.3 Artificial intelligence and Financial Sustainability

In their study, Khailtash and Lindqvist (2022) examined how corporations might reduce the risks associated with its adoption and how it will impact their risk-management procedures. The study conducted semi-structured interviews with twelve respondents who had experience with AI, security, or the banking industry to investigate the use of AI in this industry. The study used two theoretical frameworks to understand the information. The first framework, the Dynamic Risk Management Framework, was used to evaluate modifications to the risk management process based on its distinct place in society. The study was able to gain a comprehensive knowledge of the influence of AI as a catalyst for a socio-technical transformation thanks to the second framework, the Multi-Level Perspective. The findings indicate that using AI entails a number of additional risks. The current study adopted a multi theoretical approach and three theories anchored the study variables.

The Middle Eastern banking industry's adoption of artificial intelligence is examined in a 2018 report by Alzaidi. The local banking sector in this area is renowned for accepting new technology tools at varying rates. Using a survey as a research method, the key data needed to analyze the problem at hand was gathered from 200 bank employees at a few carefully chosen institutions in the area. The primary goal of this study is to collect data on how artificial intelligence is being used in the banking industry and to assess its effects. Using the SPSS21.0 software, quantitative analysis of the gathered data was also performed. Some industries have adopted artificial intelligence more widely than others; the banking industry being one of the few that has demonstrated a modest level of acceptance and adoption of this technology.

Smith and Nobanee report of 2020 examined the use of artificial intelligence in the banking industry. There are many contrasting opinions about artificial intelligence (AI) and its potential to increase efficiency in a range of industries. The banking sector is not any

different. Artificial intelligence might also hurt the finance industry as it can be agreed upon that metrics, outcomes, data capture, and quality metrics forms the foundation in any sector. Deployment of these building blocks can be more efficient through technology and automated systems. Thus, the Artificial intelligence adoption inevitable and hence the need to investigate its efficacy on Financial Sustainability.

In their discussion of the effects of using ICT in a business, Barbosa and Murici (2019) concluded that companies can cut expenses and enhance customer interactions. The report does, however, address issues with the human component, suggesting that strong strategic alignment and cultural adaption are necessary for a successful digital transition. This means that while implementing AI in banking, ethical issues must also be considered. In a survey on how the general public views artificial intelligence in the sector, the respondents reacted favorably to how AI sped up financial operations. The study also concluded that the respondents were concerned about the lack of human oversight in decision-making, and how it could affect the sector from a societal perspective.

2.3.4 Integrated Payment Systems and Financial Sustainability

The study by Mohammed, Ibrahim, and Muritala (2022) investigates how Nigerian commercial banks' performance is impacted by payments system improvements. Ex post factor research methodology was used for the investigation. The study's dataset comprised each and every bank doing business in Nigeria. The findings showed that RTGS has a negative impact on the return on assets while POS transactions, internet payments, and mobile payments had favorable and significant impacts on the return on assets of commercial banks in Nigeria. The report recommends that commercial banks in Nigeria should launch extensive public education campaigns on all developments and activities related to the payments system. There is a need to investigate effects of integrated payments systems in Kenyan commercial banks.

Krishna (2015) employed a descriptive study design to examine how information technology (IT) has affected the Indian banking sector. She looked at the different technological advancements in the Indian banking industry that were attributed to ICT in 2015, including telephone banking, ATMs, mobile banking, and online banking. The studies show that using ICT lowers costs, but the impact on profitability is never certain because there may be side effects from the high demand for skilled labor, the reliability of the financial services market competitiveness, and changes in the information system. The current study adopted descriptive research design to investigate the effect of financial innovation adoption on Financial Sustainability.

Gutu (2014) using descriptive research design examined the effect of the Internet technology on the performance of the banks in Romania. The research sample included 11 banks that were examined between 2003 and 2013. Early adopting banks, the proportion of internet users, and online advertising made up the independent variables. The findings demonstrated the significance of the Internet revolution for both banks and customers. By automating the majority of their processes, banks are able to cut labor and branch costs, while customers spend less time and money on activities related to banking. It was evident from the study that the three variables had a favorable impact on the performance. However, such effect was too low to conclude that Internet technology has a vital effect on performance. The conclusion was that internet technology had no impact on Romanian banks and hence the need to test in the Kenyan perspective using explanatory approach.

Yao et al. (2018) examine the effects of payment technology on the financial performance of China's banking industry based on the country's rising economy. They do this by analyzing Third-Party Payment (TPP) data from 2007 to 2014 using the Vector Auto-Regression impulse model. The results showed that TPP raises money turnover and has a favorable impact on the growth of earnings in the financial industry. Therefore, the results empirically show that advancements in payment technology support industry synergies in the development of China's financial sector.

While in Kenya, Vekya (2017) established a substantial positive relationship between ATM transactions and bank profitability using data from 43 commercial banks and a descriptive research design to examine the effect of electronic banking on the financial performance of Kenyan banks. This result supported the conclusions of a study by Muisyo et al. (2014) on the effect of mobile payments on the financial performance of banks in Kakamega Town, Kenya, which showed that mobile payments have benefited banking institutions' performance. Similar to this, Cherotich et al. (2015) used secondary data from a population of 43 commercial banks operating in Kenya as of End-December 2013 to conduct a study on the influence of payments system innovations on the financial performance of Kenyan banks. The results showed that the return on equity of Kenyan commercial banks was positively impacted by financial performance proxies such as electronic fund transfers (EFTs), checks, and real-time gross settlement (RTGS). The current study took into consideration that when evaluating the performance of banks, relying on ROA and ROE is futile unless expenses and income are correctly adjusted to reflect financial sustainability.

2.3.5 Macroeconomic Factors and Financial Sustainability

The inflation rate, GDP, and interest rates were found to be the three main external factors affecting the profitability of commercial banks in Pakistan by Kanwal and Nadeem (2017), who conducted a study to determine the impact of macroeconomic variables on listed commercial banks' profitability in Pakistan. Commercial banks must concentrate more on other external factors that affect them and create strategies to improve internal elements if they want to maximize risk-adjusted returns. Similar to this, Singh and Sharma (2016) examined the factors impacting Indian commercial banks' profitability. The study showed that bank specific factors (bank size, profitability, capital adequacy and deposits) had a significant effect on the bank liquidity. The study discussed how inflation and interest rates affect commercial banks profitability and this forms the basis of this study. The researcher

indicated interest rates and inflation rates have negative and significant impact on the profitability of commercial banks.

Emase (2017) investigated the impact of macroeconomic factors on profitability of Commercial Banks listed at the Nairobi Securities Exchange (NSE) for years 2009 to 2016. Panel data for the 11 listed banks in the NSE was utilized. The impacts of these four macroeconomic variables—Gross Domestic Product (GDP), Real interest rate, Inflation rate, and Exchange rate—on Return on Asset (ROA), a proxy for profitability, were investigated using panel data regression analysis with fixed effects on the data. According to the study's findings, real GDP growth rate, real interest rates, and inflation rates all had a positive, significant impact on the profitability of commercial banks as assessed by return on assets (ROA). While the exchange rate had a negative significant effect on the profitability of listed commercial banks on Nairobi Securities Exchange. It is therefore recommended that macroeconomic variables should be continuously monitored as they have a significant effect on profitability of commercial banks. Interest rates and inflation forms the basis of the current study.

2.4 Summary of the Literature and Research Gap

Although it has been empirically demonstrated that adopting financial innovations like artificial intelligence, cloud computing, blockchain technologies, and integrated payment systems has a significant positive impact on the financial performance of traditional banks and financial institutions (Manning, 2018; Yasin, 2018; Mohammed, Ibrahim, & Muritala 2022; Odhiambo, Mose, and Mwalili 2022; Alzaidi, 2018; Vekya, 2017; Ugwueze & Nwezeaku, 2016; Njoroge & Mugambi, 2018; Kombe & Wafula, 2015; Fatoki and Wanjagi, 2019) because of its obvious affordability, in comparison to physical branches delivery, which most often results in the reduction of operational cost, in form of reduced and better utilized workforce, equipment, space and operational savings, it calls for further investigation on its effect on Financial Sustainability.

Blockchains act as central repository and the ultimate backup (Antonopoulos 2014). A list of records that have been combined using king sector cryptography is another way to define a blockchain. Big Data, data sharing, and data security go hand in hand with this. Blockchain technology, according to Fatoki and Wanjagi's research from 2019, can help Kenyan banks better control the private sector in a number of ways. For instance, digital money facilitates compliance.

Dabrowski (2017) study suggested that financial innovations adoption poses a serious challenge to the financial industry's business model in both its banking and non-banking components and thus it is likely to contribute negatively on Financial Sustainability of commercial banks. Financial innovation characteristics and Financial Sustainability were found to be positively and significantly related in studies on banking that were conducted on more developed economies (Mugenyi, 2018; Alzaidi, 2018). Despite implementing financial innovations, there have been reports of banks reporting decreased profitability and other banks being placed under receivership. When evaluating the performance of commercial banks, relying on standard financial ratios like return on assets and return on equity is pointless unless costs and revenue are properly adjusted to reflect financial sustainability (Balkenhol, 2017). When costs and income are not adjusted to reflect financial sustainability, relying on traditional financial ratios, could often lead to meaningless or even misleading performance assessment.

Table 2.1: Summary of Literature Review and Research Gaps

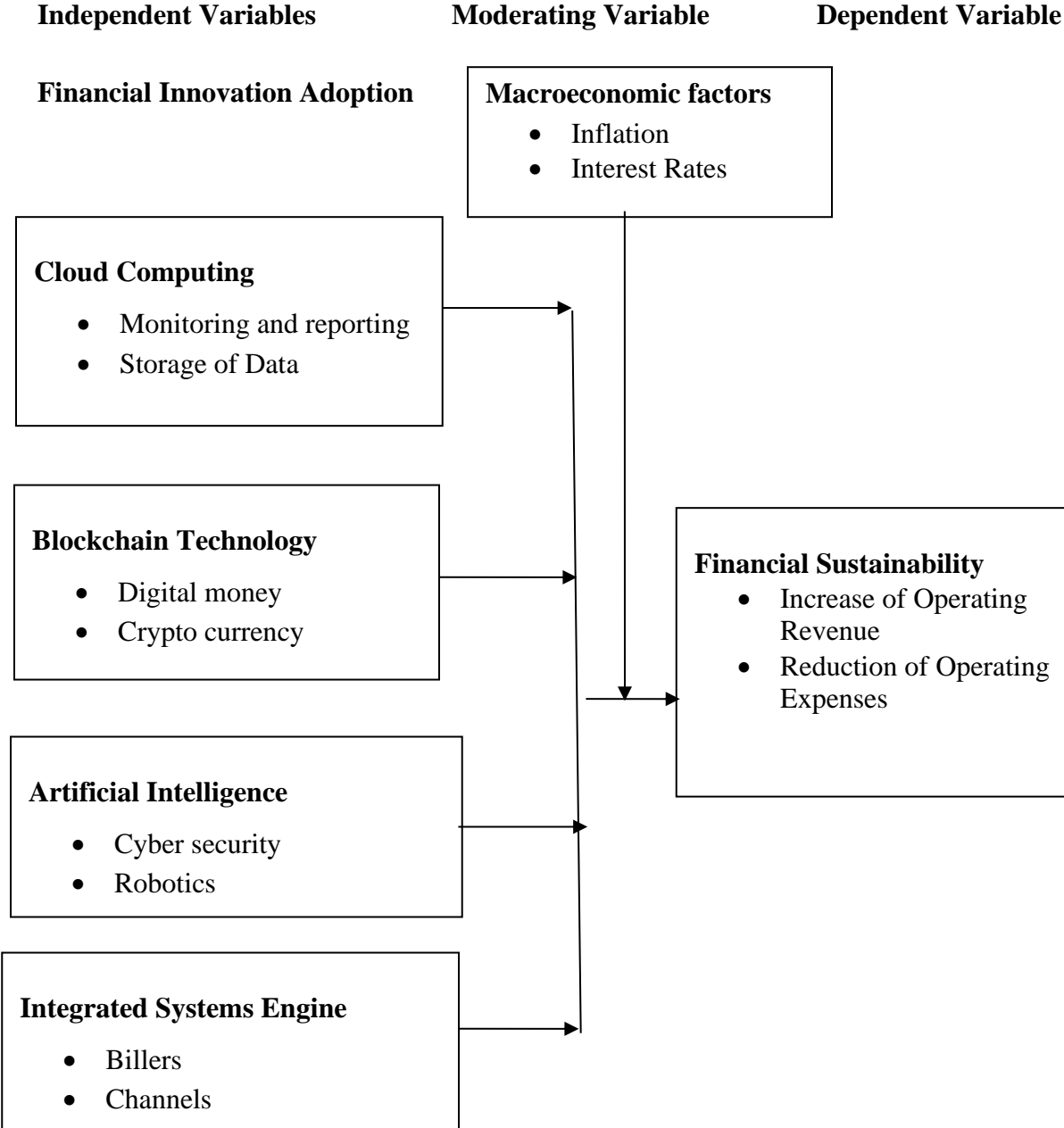
Author/ Year	Focus of Study	Methodolog y	Knowledge Gaps
Odhiambo, Mose and Mwalili (2022)	The precursors of adoption of cloud computing in selected banks in Kenya	The study adopted explanatory research design	The study's focus was on data security and cloud computing adoption in a few Kenyan institutions. The current study concentrated on Kenya's commercial banks. Macroeconomic variables will be adopted as a moderator
Mugenyi (2018)	Adoption of cloud computing services for sustainable development of commercial banks in Uganda	Empirical Review	This paper aimed at studying the benefits of cloud computing to commercial institutions and how the services can be adopted by the institutions of Uganda The current study was a census study on all Kenyan commercial banks
Fatoki and Wanjagi (2019)	Mitigating financial risk using cryptocurrencies and blockchain technology digital money	The study was an empirical review	This paper is an empirical study on the future of Kenyan banks The current study adopted blockchain technology and its role on financial sustainability
Aketch, Mwambia and Baimwera (2021)	Effects of blockchain technology on performance of financial markets in Kenya	This study adopted explanatory research design	This study presented a conceptual gap by focusing only on blockchain technology. The current study introduced macroeconomic variables as a moderator.
Khailtash and Lindqvist, (2022)	Analysis of how organizations can mitigate the risks involved with this implementation and how it affects the risk management process	This study adopted semi-structured interviews with twelve respondents	This study presented a methodological gap as the sample was too small. The current study sample comprised 205 respondents
Alzaidi, (2018)	the adaption of artificial intelligence in banking sector of Middle East	The study adopted multiple regression.	The study presented a contextual gap as it was done in Middle East Current study was conducted in Kenya.

Author/ Year	Focus of Study	Methodolog y	Knowledge Gaps
Mohammed, Ibrahim and Muritala (2022)	Effect of payments system innovations on the performance of commercial banks in Nigeria	This study adopted Ex post factor research design	This study presented contextual and methodological gaps. The current study will adopt descriptive research design and was conducted in Kenyan commercial banks
Kanwal and Nadeem (2017)	Effect of macroeconomic variables on the profitability of listed commercial banks in Pakistan	This study adopted simple multiple regression technique	This study presented a conceptual gap as it focused on profitability in Pakistan while the current study focused on Financial Sustainability
Emase (2017)	Effect of macroeconomic variables on profitability of Commercial Banks listed at the Nairobi Securities Exchange (NSE) for years 2009 to 2016	This study adopted Panel data regression analysis	This study presented a contextual gap as it concentrated on listed banks on the Nairobi Securities Exchange. The current study adopted a descriptive approach and concentrated on all commercial banks in Kenya

2.5 Conceptual Framework

As Mugenda and Mugenda (2003) stated, conceptual framework is a presentation in a diagram format of the associations observed between independent variables and dependent variables. The conceptual framework in Figure 2.1 illustrates that the variable classified as dependent is the Financial Sustainability of commercial banks. Cloud computing, blockchain technology, AI, and integrated payment systems are all categorized as independent variables. Additionally, a macroeconomic variable moderating factor was used in the study.

Figure 2.1 Conceptual Framework.



2.6 Measures of Variables (Operationalization)

The study used Financial Sustainability as the dependent variable. Explanatory variable for this study was financial innovation adoption, which operationalized as cloud computing, blockchain technology, artificial intelligence and integrated payment systems. Macroeconomic variables adopted as the moderating variable. Details of how each of the study variables was measured and operationalized as discussed below in this section.

Table 2.2 Measures of Variables

Variables	Type of Variables	Indicators	Measurement Scale	Supporting Literature	Supporting Theories
Financial Sustainability	Dependent	Ratio of Operating Revenue to Operating Expenses	Likert	Remer and Kattilakoski, (2021); (Chaves and Gonzalez-Vega, 2016).	Financial Intermediation Theory
Cloud computing	Independent	Monitoring and reporting Storage of Data	Likert	Odhiambo, Mose, and Mwalili (2022)	TAM
Blockchain technology	Independent	Digital money Crypto currency	Likert	Aketch, Mwambia, and Baimwera (2021)	TAM
Artificial intelligence	Independent	Cyber security Robotics	Likert	Khailtash and Lindqvist (2022)	TAM
Integrated Payment Systems	Independent	Billers Channels	Likert	Mohammed, Ibrahim, and Muritala (2022)	Schumpeter's Theory of Innovation
Macroeconomic Variables	Independent	Inflation Interest Rates	Likert	Emase (2017)	Schumpeter's Theory of Innovation

Source: Author (2024)

2.7 Chapter Summary

This chapter evaluated the literature study pertaining to research conducted based on the specific objectives associated with the adoption of financial innovation and the financial independence of commercial banks in Kenya. The moderating effect of macroeconomic variables as well as the effects of artificial intelligence, cloud computing, blockchain technology, and integrated payment systems on the Financial Sustainability of commercial banks in Kenya have been examined. The research methodology that was applied during this study is outlined in chapter three.

CHAPTER THREE: RESEARCH METHODOLOGY

3.0 Introduction

This section examined the study's methodology. It describes the inquiry's design, the population it is intended to reach, sampling strategies, research instruments, pilot testing, validity and reliability of the instruments, data collection procedures, data analysis techniques, statistical models to be applied in drawing conclusions, and ethical considerations.

3.1 Research Philosophy

The positivism research philosophy was used in the study. The tenets of positivism encompass that the researcher must be impartial toward the object of observation and that measurement must be made according to objective standards rather than subjective interpretations (Mugenda & Mugenda, 2013). Its foundations include measurement, impartiality, the validity of the results, and the absence of bias. The goal of the current study was to determine how Kenyan commercial banks' financial viability was impacted by their adoption of financial innovations. As a result, positivism was used in the study because it required gathering a large amount of data from commercial banks to support generalizations that resembled laws.

3.2 Research Design

The study employed research design which was correlational in nature. The first section consists of a well-structured questionnaire for the management and other representative of employees. The study, therefore, employed a descriptive correlational research design to agree on the effects of financial innovation adoptions with financial sustainability of commercial banks in Kenya. Descriptive research study according to Mugenda and Mugenda (2013) also offers the researcher described events profile of a phenomena and

interests from persons, organizations and perspectives from the industry. As a result, the correlational design allowed the researcher to collect data from a larger group of participants in the study region and assess the current situation of affairs by characterizing, evaluating, and reporting situations that currently exist or that previously occurred. Variables manipulation was not attempted, and the researcher was not controlled by the setting in the research. The study was quantitative in nature.

3.3 Target Population and Sample

A population is defined as a complete set of individuals, instances or objects with some common observable traits, (Mugenda & Mugenda, 2013). The study was a census study, and the population of the study was all commercial banks in Kenya and primary data was collected from five management employees and representatives of staffs from all the 41 registered commercial banks in Kenya in the year 2021, as laid on appendix III (CBK, 2022). The respondents added up to a total of 205. The questionnaires given to respective departments of the company provided the data used in this study. The fact that Kenya has a bank-based economy rather than a market-based economy influenced the choice of commercial banks because the banking sector acts as an intermediary for most of the funds in the economy.

3.4 Data Collection Method

The study used primary data, and the data was gathered using questionnaires for primary data from respondents. Primary data was collected for a period of four months ranging from September 2023 to December 2023. All respondents to the questionnaire were required to answer a common set of questions, and the drop and pick method was mostly used for data collection. The respondents were all made aware of the main goal of the study during the research process to instill confidence and guarantee the confidentiality of their personal information. A questionnaire, according to Andreadis and Kartsounidou (2020), was perfect for gathering information from time-constrained educated respondents. To help

the respondents easily yet appropriately respond to the questions, the tool was tailor-made to have both open and closed ended questions as well as a 5-point Likert scale, with 1 denoting strongly disagree and 5 denoting strongly agree, as was applied previous by studies such as Odhiambo, Mose, and Mwalili (2022) in the study to assess the factors that led to the adoption of cloud computing in Kenyan commercial banks.

The respondents were informed of voluntary participation and confidentiality was assured. To enhance confidentiality with the data that the participants availed, coding of the data in the questionnaires will be done. The interview schedule was conducted prior and was scheduled only when the respondents were available. Further, the findings of this study were strictly to be used for academic purposes and/or the formulation of policies.

3.5 Data Analysis and Presentation

3.5.1 Data Analysis

According to Mugenda and Mugenda (2013), the raw data collected from the field is difficult to interpret until it is organized, coded, and analyzed. To answer study questions, quantitative analysis included examining, classifying, tabulating, and recombining material. To help with setting a summary and organizing the data, quantitative data was divided into observable themes and patterns. With the help of statistical methods, including frequency percentile counts, arithmetic means, modes, and tabulation to emphasize frequency disparities, the analysis will be carried out. Ordinal regression analysis was conducted where ordinal data and nominal data was displayed using tables. Statistical Package for Social Sciences (SPSS) versions 21.0 was deployed to assist in coding, entering and analysis of the data.

Multiple linear regression model was applied during this study to investigate the relationship that exists between various financial innovation adoption variables and Financial Sustainability of commercial banks in Kenya. Multiple regressions try to

establish whether a group of variables jointly can be used to predict a given variable classified as dependent. As suggested by Alvi, (2016) an empirical model involving multiple linear regression model was deemed appropriate for this study and will be given by the two equations below:

$$FSS = \beta_0 + \beta_1 CC1 + \beta_2 BCT2 + \beta_3 AI3 + \beta_4 IPS4 + \epsilon \dots\dots\dots(1)$$

$$FSS = \beta_0 + \beta_1 CC1 + \beta_2 BCT2 + \beta_3 AI3 + \beta_4 IPS4 + \beta_5 M + \beta_6 CC1 * M + \beta_7 BCT2 * M + \beta_8 AI3 * M + \beta_9 IPS4 * M + \epsilon \dots\dots\dots(2)$$

Where, FSS = Financial sustainability

CC1 = Cloud computing

BCT2 = Block chain technology

AI3 = Artificial intelligence

IPS4 = Integrated Payment Systems

M = Macroeconomic variables

β_0 = regression coefficients

$\beta_1 - \beta_4$ = Beta Co-efficient of Determination

ϵ = Error term

3.6 Research Quality

3.6.1 Pilot Testing of the Instrument

A pilot test was undertaken to put into trial instrument of collecting data on their reliability as well as validity. A pilot study is intended to reduce, up front, the potential difficulties

that arise during the final survey (Blumberg, Cooper, & Schindler, 2014). Before distributing the instruments, this study conducted an upfront pilot evaluation of the questionnaires. Validity, precision, reliability, and clarity of the instruments was determined by their preliminary testing. Pretesting in this study involved 21 respondents, or 10% of the overall sample. Hertzog (2008) recommended that 10% of the sample chosen for the entire study be used for pretesting. The pilot testing sample did not form part of the study respondents.

3.6.2 Reliability

According to Raykov and Gabler (2017), reliability aims to determine the extent to which the data gathering instrument consistently produces the same score. To determine the reliability, the researcher employed the Cronbach Alpha test. For Cronbach's alpha (α) to be deemed acceptable, it should be more than 0.7 while the one to be considered unsatisfactory was below 0.7. High coefficients of alpha imply that the measurement components from the concept of concern are consistent. The researcher made sure the questions are appropriate for the study's goals, are not ambiguous, and are posed in simple English.

3.6.3 Validity

Validity refers to whether a researcher is estimating the variables sought to be estimated. It is the length to which a construct estimated what it is intended to estimate (Easterby-Smith, Thorpe, & Jackson, 2012). In the current study, the researcher extensively relied on banking industry experts, such as supervisors, to assist face validity and construct validity. By adjusting the research tools to satisfy the study objectives, face validity as well as construct validity was improved. A determination of a construct's validity is based on the accumulation of derived evidence from numerous investigations employing specific measurement instruments. Assessment of validity of construct needs establishment of the

relationship of the estimate being assessed with variables well versed to be related in theoretical manner to the construct that the instrument seeks to measure. The item's factor loading was used to represent the degree of correlation between the two; in general, a factor loading of more than 0.30 indicates a moderate correlation between the item and the factor (Alkhawaja, Sobihah & Awang, 2020).

3.7 Diagnostic Tests

The collected data was put through diagnostic tests to see if it would be suitable for analysis with selected multiple linear regression models. The assumptions of classic linear regression model which will be tested, and any misspecifications thereof will be remedied by the researcher by performing a model with robust standard errors. Diagnostic test for normality, multicollinearity, heteroscedasticity, and autocorrelation was carried out to establish the nature of data. If the assumptions were violated, the researcher adopted standard robust errors during analysis.

3.8 Ethical Considerations

To ensure that the approach is ethical to the process, the researcher carried out the study using a clearly stated technique. Prior to beginning the data collection, the respondent's consent was requested. The respondents were informed that their participation was voluntary, that information would be kept confidential, and that it would only be used for this research. Data from respondents was compiled, and all questionnaire responses were coded to ensure confidentiality. Further, the findings from this current study was used only for purposes of academic and/or formulation of policy pertaining to current financial innovations being undertaken in the banking industry.

Consent and approval for the study was sought from Strathmore ethical and review board. The researcher further endeavored to get a NACOSTI license to do the research within the banking industry in Kenya.

3.8 Chapter Summary

This chapter has addressed research methodology that will be used in the study. It has also discussed research design, target population and sampling design and technique, research procedure, design and data analysis methods that was used. This chapter was followed by chapter four, results and findings.

CHAPTER FOUR: PRESENTATION OF RESEARCH FINDINGS

4.1 Introduction

This chapter presents the study inferences, their interpretation, analysis, and their discussion as guided by the specified objectives effect of financial innovation adoption and financial sustainability of commercial banks in Kenya. It also highlighted empirical regression model derived from the analysis.

4.2. Rate of Response

Two hundred and five questionnaires were distributed to five employees per bank as envisaged in the study methodology. 184 of the selected respondents completed the survey and returned it, yielding an 89.7% response rate. Twenty-one respondents refused to reply to the researcher at all, returned incomplete questionnaires, or did not send back any questionnaires at all.

Table 4.1: Rate of Response

ANSWER CHOICES	RESPONSES	
Complete	89.7%	184
Incomplete	10.3%	21
TOTAL		205

(Source: Survey Data, 2024)

The rate of response was as a result of the procedure of data collection, as the researcher administered the instruments through google questionnaires and in person, gave time for respondents to answer the questions and collected the questionnaires once they were filled in full. The response rate clearly indicated the acceptance of the sampled respondents to get engaged in the study. A rate of response that is 70% and above is deemed enough and

acceptable for analysis of data as was indicated by to Bell, Bryman, and Harley, (2022) Hence, 89.7% rate of response warranted the researcher to progress to analyze data.

4.3 Age of the Respondent

The respondents were required to state their range in age in accordance to the ranges given. This was to detect the degree of work experience and expertise acquired in the banking industry. The study outcome revealed that approximately 19% of the responses ranged between 20 and 29 years of age, 45% of the responses aged between 30 and 39 years of age, while 25% of responses depicted an age range of between 40 and 50 years. 11% of the respondents were over 50 years. These findings highlighted that the majority of the actors in the banking industry are of middle age and that majority of the employees who gave data pertaining to the study area are deemed more experienced. This observation was used to infer that most of the employees are skilled in a manner that they adjust to financial innovations and competitiveness within the banking sector, and they are highly experienced to fill appropriate replies concerning the study questions.

Table 4.2: Age of the Respondents

ANSWER CHOICES	RESPONSES	PERCENTAGE
20-29 Years	35	19%
30-39 Years	82	45%
40-50 Years	46	25%
Above 50 Years	21	11%
TOTAL	184	

(Source: Survey Data 2024)

4.4 Level of Education

The study intended to seek out the level of education of the respondents. As depicted by table 4.3 below

Table 4.3: Level of Education

ANSWER CHOICES	RESPONSES	PERCENTAGE
University	146	79%
College	36	20%
Secondary	2	1%
Primary	0	0%
TOTAL	184	

(Source: Survey Data 2024)

Respondents were asked to indicate their educational background using the provided categories. This was to detect the degree of formal work expertise acquired. The study outcome revealed that approximately 79% of the respondents had degrees, 20% of the respondents had college diplomas and certificates, while 1% of respondents had secondary education only. These findings highlighted that the majority of the employees in the banking sector had formal training and this meant that majority of the employees who gave data pertaining to the study area are deemed more knowledgeable in the area of banking sector.

4.5 Years of experience

The respondents were tasked with answering the duration in years they had worked for the organization. 6% indicated that they had worked for the organization for one year or less, 39% indicated that had been employed by the commercial banks between 1-5 years, 38% indicated that they had experience ranging between 6-10 years, 17% of the respondents had worked for the organization for over 10 years.

Table 4.4: Years of Work Experience

ANSWER CHOICES	RESPONSES	Number
Less than 1 year	6%	11
1-5 Years	39%	72
6-10 years	38%	70
over 10 years	17%	31
TOTAL		184

(Source: Survey Data 2024)

4.6 Adaptation of Financial Innovations

The study intended to seek out whether the organization the respondents belonged to had adopted financial innovations. As depicted by table below, 97% (179) of total respondents indicated adoption of various financial innovations, 3% (5) indicated they could not tell whether the firm had adopted various financial innovation.

Table 4.5: Adaptation of Financial Innovations

ANSWER CHOICES	RESPONSES	Number
Cloud Computing	62%	110
Artificial Intelligence	56%	99
Block Chain Technologies	52%	93
Integrated Payments Systems	100%	179

According to the above table, 62% of those surveyed were knowledgeable of the numerous advancements and stated that different commercial banks have embraced cloud computing technology. 56%, which accounted for 99 respondents indicated that the banks had adopted artificial intelligence in their daily operations. 52% of the respondents who said banks had adopted financial innovations indicated that the banks had adopted blockchain technologies. 100% which accounted for 179 respondents indicated that banks had adopted

Integrated payment systems. This indicated that nearly all commercial banks in Kenya had adopted Integrated payment systems to generate more revenue and improve efficiency in service delivery.

4.7 Reliability test

According to table below on reliability of the research instrument, the data collection instrument was reliable by demonstrating its consistency and ability to yield the same results and the possibility of reliably replicating the obtained result using the same procedures and initial conditions. In this regard, all the research variables produced a Cronbach’s Alpha of above 0.70 which were within and above the “acceptability” criteria.

Table 0:6 Reliability Statistics

Variable	Cronbach's Alpha	No of Items
Cloud computing	0.769	21
Blockchain technology	0.804	21
Artificial Intelligence	0.787	21
Integrated payment Systems	0.907	21
Macroeconomic Variables	0.779	21

(Source: Survey Data, 2024)

4.8 Validity Test

After data collection from the 21 participants, the researcher computed communality value or item's factor loading to quantify the direction and strength of a linear relationship between the questions under research variables and obtained the following average factor loadings as shown on table 4.7 below. The average communalities values were derived from tables in appendix V.

Table 4.7: Principal Component Analysis 1

Communalities		
	Initial	Extraction/ Factor loading
Cloud computing	1	0.6422
Blockchain Technology	1	0.8005
Artificial Intelligence	1	0.7468
Integrated Payments System	1	0.9048
Macroeconomics Variables	1	0.7045

From the above table 4.7, for all the questions pertaining Cloud computing, blockchain technology, artificial intelligence, integrated payment systems, and macroeconomic variables had an average Extraction/ Factor loading 0.6422, 0.8005, 0.7468, 0.9048, and 0.7045 respectively. According to the factor analysis criteria, that; when the variable's loading is close to -1 or 1, it has a noteworthy effect on the factor and the communality value and must be more than 0.5 to be considered for further analysis, this meant that, all these items (questions) had moderate to strong correlation with the factor (research variable). This meant that their weights were significant on the factor, hence, valid. This meant that the questions in the questionnaire under the research variables would accurately assess what it was supposed to.

4.6 Descriptive Findings

Descriptive analysis was applied on various questions raised on the research instrument and on each of the study variables were presented as outlined in the following sub-sections.

4.6.1 Financial Sustainability of Commercial Banks in Kenya

The dependent variable of this study was financial sustainability as measured using the ratio of operating income to operating expenses.

Respondents were first asked to state whether banks were financially stable. The results were as the below table 4.8. The five respondents indicated that banks were not financially sustainable.

Table 4.8: Financial Sustainability of Banks

Answer Choices	Responses	Number of Respondents
Yes	97%	179
No	3%	5
TOTAL		184

(Source: Survey Data 2024)

Respondents also indicated how much they agreed or disagreed with various assertions about financial sustainability. The findings are presented in Table 4.9.

Table 4.9: Financial Sustainability of Banks

Statements	Weighted Average	Standard Deviation
The bank has a lower nonperforming portfolio indicating it is financially sustainable	3.919	0.685
Financial innovations have improved sustainability in commercial banks	3.742	0.629
The benefit of adopting financial innovations outweighs its cost on the structure of the bank	3.784	0.818
Increasing interest rates is clearly associated with improved level of financial sustainability	2.924	0.600
Loan intensity through alternate channels affects positively ratio of operating income to operating expenses	3.332	0.662
Overall Mean Score = 3.5402; SD=0.6788; N=184		

From the findings, the respondents were in agreement that the bank has a lower non performing portfolio indicating it is financially sustainable (WA=3.919, SD=0.685); most of the respondents agreed that financial innovations have improved sustainability in

commercial banks (WA=3.742, SD=0.629); The benefit of adopting financial innovations outweighs its cost on the structure of the bank (WA=3.784, SD=0.818). Respondents were neutral about increasing interest rates clearly being associated with improved level of financial sustainability (M=2.924, SD=0.600). Respondents were neutral that loan intensity through alternate channels positively affects ratio of operating income to operating expenses. (M=3.332, SD=0.662).

From the findings of financial sustainability, the overall weighted average was 3.5402 with a weighted variation of 0.6788. This reflected that the respondents agreed that most banks were financially sustainable with a smaller variation from the mean.

4.6.2 Cloud Computing

Respondents were first asked to state whether cloud computing had been adopted by banks. The results were as the below table 4.10. The five respondents who indicated that cloud computing has not been adopted hence did not proceed to the next part of this section about cloud computing.

Table 4.10: Cloud Computing Adoption

Answer Choices	Responses	Number of Respondents
Yes	97%	179
No	3%	5
TOTAL		184

(Source: Survey Data 2024)

Respondents also indicated how much they agreed or disagreed with various assertions about cloud computing. The findings are presented in Table 4.11.

Table 4.11: Cloud Computing

Statements	Weighted Average	Standard Deviation
Cloud computing has been adopted in banking operations thus enhancing sustainability	4.020	1.010
The benefit of adopting cloud computing outweighs its cost for the bank's organizational structure	3.930	0.990
Cloud computing adoption enhances customer interactions in bank operations	3.780	0.860
Cloud computing ensures data security in commercial banks	3.000	0.570
Accurate data processing on the operations of banks leads to a higher score in customer satisfaction.	3.030	0.370
Overall Mean Score = 3.552; SD=0.76; N=184		

From the findings, the respondents agreed that; Cloud computing has been adopted in banking operations thus enhancing sustainability (WA=4.02, SD=1.01); The benefit of adopting cloud computing outweighs its cost on the structure of the bank (WA=3.93, SD=0.99); Cloud computing adoption improves customer relationship in bank operations (WA=3.78, SD=0.86). The respondents were neutral that cloud computing protects commercial banks' data. (M=3.00, SD=0.57). A greater customer satisfaction rating is the result of accurate data processing regarding bank activities. (M=3.03, SD=0.37).

From the findings, of cloud computing, the overall weighted average was 3.552 with a weighted variation of 0.76. This reflected that the respondents were in agreement that adoption of cloud computing affected financial sustainability positively with a smaller variation from the mean. The outcome derived from the study was in conformity with Anca Apostu et al. (2012) said that a cloud computing architecture must be established for the businesses' operations to be more safe, adaptable, and structured in a modern manner. The study deviated from Odhiambo, Mose, and Mwalili (2022) who examined the factors that led to the adoption of cloud computing in a few Kenyan banks. The study discovered that

even while cloud computing is thought to have advantages, there are concerns that need to be resolved before commercial banks can completely adopt cloud computing. According to the results of the current study, cloud computing provides advantages that help Kenyan commercial banks become financially sustainable.

4.6.3 Blockchain Technology

Respondents were first asked to select how blockchain technology has been applied by commercial banks operation and management. The results were as below table 4.12. 41% of the respondents which formed the majority indicated that the most used form of blockchain technology is asset securitization. Bill operation was suggested by 25% as the most adopted form of blockchain technology. 20% of the respondents indicated that Cross border payment operation was adopted by most commercial banks. 12% of the respondents indicated that the most used form of blockchain technology is transaction information safety and transparency. Two of the respondents did not understand adoption of blockchain technology usage in commercial banks in Kenya.

Table 4.12: Most used Blockchain technology

Answer Choices	Responses	Number of Respondents
Bill Operations	25%	46
Cross border payment operation	20%	37
Transaction information safety and transparency	12%	22
Asset securitization	41%	75
Did not Know	2%	4
TOTAL	100%	184

(Source: Survey Data, 2024)

Respondents were tasked to indicate how much they agreed or disagreed with various assertions about blockchain technology. The findings are presented in Table 4.13.

Table 4.13: Blockchain Technology

Statements	Weighted Average	Standard Deviation
Blockchain has been adopted and thus the cost in Bill Operation outweighs cost	4.01	0.97
Blockchain has been adopted in Cross border Payment Operations by the bank	4.06	0.99
There has been utilization of cryptocurrencies in Asset Securitization Business	4.04	0.89
Using blockchain technology in commercial banking can lower transaction costs and increase the operational sustainability of banks	3.89	0.86
Overall Mean Score = 4.00; SD=0.9275; N=184		

From the findings, the respondents agreed that; Blockchain has been adopted and thus the cost in Bill Operation outweighs cost (WA=4.01, SD=0.97); Blockchain has been adopted in Cross border Payment Operations by the bank (WA=4.06, SD=0.99); There has been utilization of cryptocurrencies in Asset Securitization Business (WA=4.04, SD=0.89). The application of blockchain in commercial banks can effectively reduce transaction costs and improve the operational efficiency of banks (M=3.89, SD=0.86).

From the findings of blockchain technology, the overall weighted average was 4.00 with an overall variation of 0.9275. This reflected that the respondents agreed that adoption of blockchain technology had a positive influence on financial sustainability with a minimal variation from the mean. The outcome derived from the study was in conformity with Fatoki and Wanjagi (2019) highlighted that using cryptocurrency and blockchain technology helps to reduce financial risk. Instead of supporting a dominating market player or authority, digital money promotes individual investors. Mavilia and Pisani (2019) further alluded that Africa still lacks access to financial inclusion and weakness in the present financial system as reported by the World Bank Survey. This can be attributed to

the existence of Bitcoins, which have disrupted markets and produced new entities. According to the study's conclusions, African states can only experience sustainable development with the help of the new wave of blockchain technology, which holds the key to ending financial marginalization. The study therefore supported adoption of blockchain technology for financial sustainability of the financial system in Kenya.

4.6.4 Artificial Intelligence

Respondents were first asked to state whether commercial banks have deployed artificial intelligence in providing financial services. The results were as below table 4.14. 94% of the respondents' adoption while 6% which comprised eleven respondents indicated non adoption. The twelve respondents who indicated that artificial intelligence has not been adopted did not proceed to the next part of this section about artificial intelligence.

Table 4.14: Adoption of Artificial Intelligence

Answer Choices	Responses	Number of Respondents
Yes	94%	173
No	6%	11
TOTAL		184

(Source: Survey Data 2024)

Respondents were requested to indicate to what extent they agreed or disagreed with various questions about artificial intelligence. The findings are presented in Table 4.15.

Table 4.15: Artificial Intelligence

Statements	Weighted Average	Standard Deviation
Detection and prevention of cyber security threats is practiced in the banking industry	4.080	0.940
Financial innovations pose a threat to cyber-attacks, wallet theft and pyramid schemes that draw a large pool of fraudsters.	3.930	0.990
Artificial intelligence systems like robotics are adopted in banks	4.030	0.850
Artificial intelligence is primarily applied for automation of the processes through robotics	3.880	0.960
Overall Mean Score = 3.98; SD=0.935; N=184		

From the findings, the respondents agreed that; detection and prevention of cyber security threats is practiced in the banking industry (WA=4.08, SD=0.94); Financial innovations pose a threat to cyber-attacks, wallet theft and pyramid schemes attracting a large pool of fraudsters. (WA=3.93, SD=0.99); Artificial intelligence systems like robotics are adopted in banks (WA=4.03, SD=0.85). Artificial intelligence is mainly applied for automation of the processes through robotics (M=3.88, SD=0.96).

From the findings of artificial intelligence, the overall weighted average was 3.98 with a small variation of 0.935. This reflected that the respondents agreed that adoption of artificial intelligence positively impacted financial sustainability of commercial banks in Kenya. The outcome derived from the study was in tandem with Alzaidi, (2018) highlighted that some industries have adopted artificial intelligence more widely than others; the banking industry being one of the few that has demonstrated a modest level of acceptance and adoption of this technology. The study therefore supported adoption of blockchain technology for financial sustainability of commercial banks in Kenya. Barbosa and Gracas Murici (2019) concluded that while implementing artificial intelligence in banking, ethical issues must also be considered. In a survey on how the general public views artificial intelligence in the sector, the respondents reacted favorably to how artificial intelligence speeds up financial operations. The study also found that the respondents had

doubts about how the industry would be impacted socially by the lack of human control in decision-making.

4.6.5 Integrated Payment Systems

Respondents were first asked to state whether commercial banks use E-Payment Systems in providing financial services. The results were as the below table 4.16. 98% of the respondents stated there was adoption while 2% which comprised four respondents indicated non-adoption. The four respondents who indicated that integrated payment systems have not been adopted did not proceed to the next part of this section about integrated payment systems.

Table 4.16: Integrated Payment Systems

Answer Choices	Responses	Number of Respondents
Yes	98%	180
No	2%	4
TOTAL		184

(Source: Survey Data 2024)

Respondents were then asked to indicate the duration of E-payment adoption. The results were as below table 4.15. 10% indicated that integrated payment systems had been adopted for less than one year, 12% indicated integrated payment systems had been adopted for a period between one and five years, 50% of the respondent's indicated adoption for a period between six and ten years, 28% of the respondents indicated adoption of integrated payment systems for a duration of above 10 years.

Table 4.17: Adoption of Integrated Payment Systems

ANSWER CHOICES	RESPONSES	Number
Less than 1 year	10%	18
1-5 Years	12%	22
6-10 years	50%	90
over 10 years	28%	50
TOTAL		180

Source: Survey Data 2024)

Respondents articulated the degree of their agreement with statements associated with integrated payment systems and financial sustainability of commercial banks in Kenya. The outcome is tabulated in Table 4.18.

Table 4.18: Integrated payment Systems and Financial Sustainability

Statements	Weighted Average	Standard Deviation
Volumes of Agency banking, POS transactions and ATM transactions has increased over time in commercial banks	3.950	0.789
Size of revenue from Agency banking, POS transactions and ATM transactions has increased over time in commercial banks	3.970	0.794
Volumes of RTGS, mobile payment and internet payment has increased over time in commercial banks	4.050	0.810
Size of revenue from RTGS, mobile payment, and internet payment has increased over time in commercial banks	4.070	0.814
Overall Mean Score = 4.01; SD=0.8018; N=184		

On integrated payment systems, the study found that respondents agreed that; Volumes of Agency banking, POS transactions and ATM transactions has increased over time in commercial banks (M=3.95, SD=0.78), and that Size of revenue from Agency banking, POS transactions and ATM transactions has increased over time in commercial banks

(M=3.97, SD=0.7942). Respondents agreed that Volumes of RTGS, mobile payment and internet payment has increased over time in commercial banks (M=4.05, SD=0.8096) and that size of revenue from RTGS, mobile payment, and internet payment has increased over time in commercial banks (M=4.07, SD=0.8138).

From the findings of integrated payment systems, the overall weighted average was 4.01 with a small variation of 0.8018. The result supported claims made by Yao et al. (2018), who researched on how payment technology affected China's banking industry's financial performance. They found that TPP raises money turnover and has a beneficial impact on the financial sector's earning growth. Therefore, the results of the empirical research show that advancements in payment technology support industrial synergies in the development of the financial sector. China also validated the results. Vekya (2017) used data from 43 commercial banks and a descriptive research design to investigate the impact of electronic banking on the financial performance of Kenyan banks. The results showed a significant positive link between ATM transactions and bank profitability. This result supported the conclusions of a study by Muisyo et al. (2014) on the effect of mobile payments on the financial performance of banks in Kakamega Town, Kenya, which showed that mobile payments have benefited banking institutions' performance. In a similar vein, Cherotich et al. (2015) found that the return on equity of Kenyan commercial banks was positively impacted by financial performance proxies such as electronic fund transfers (EFTs), checks, and RTGS.

4.6.6 Macroeconomics Variables

Table 4.19 displays the respondents' levels of agreement or disagreement with several statements regarding the macroeconomic variables pertaining to the relationship between financial innovations and the financial sustainability of Kenyan commercial banks.

Table 4.19: Macroeconomics Variables

Statements	Weighted Average	Standard Deviation
Increasing interest rates affects negatively Financial Sustainability of commercial banks in Kenya	3.850	1.220
Country's interest rates have increased over the years	3.960	1.066
Inflation rate is not constant, and it has negatively affected Financial Sustainability of commercial banks	3.990	0.787
Country inflation has increased over the years	3.999	1.098
Overall Mean Score = 3.95; SD=1.0428; N=184		

Regarding macroeconomic variables, there was universal agreement that increasing interest rates affects negatively financial sustainability of commercial banks in Kenya (M=3.85, SD=1.220) and that the Country's interest rates have increased over the years (M=3.960, SD=1.066). The study also discovered that inflation rate is not constant, and it has negatively affected Financial Sustainability of commercial banks (M=3.990, SD=0.787) and that the Country inflation has increased over the years (M=3.999, SD=1.098).

The study outcome conforms with Kanwal and Nadeem (2017) who indicated that inflation rate, GDP, and interest rates were found to be the three main external factors affecting the profitability of commercial banks in Pakistan.

4.7 Diagnostic Tests

4.7.1 Normality Test

Linear regression assumptions further require that data collected, and residuals of the model fitted to adhere to a normal distribution. To ascertain this, the study employed Shapiro Wilks analysis as suggested by Garson, (2012). This tests the null hypothesis that data does not significantly deviate from the normal distribution, hence a p-value of greater 0.05 is required to fail to reject the null hypothesis of the study.

Table 4.20 Normality Test

Tests of Normality	Statistic	df	Sig.	Remark
Cloud Computing	0.675	184	0.120	Normally Distributed
Blockchain Technology	0.823	184	0.098	Normally Distributed
Artificial Intelligence	0.714	184	0.067	Normally Distributed
Integrated Payments Systems	0.727	184	0.077	Normally Distributed
Macroeconomic Variables	0.789	184	0.193	Normally Distributed
Financial Sustainability	0.681	184	0.109	Normally Distributed

a Lilliefors Significance Correction

Source: Survey Data (2024)

4.7.2 Multicollinearity Test

The challenge of multicollinearity arises when two or more of the independent variables have a very strong association which is greater than 70 percent. Assumption of the linear regression requires that independent variables should not be highly correlated, hence it is necessary to test for multicollinearity before fitting a linear regression model. In this research, the Variance Inflation factor (VIF) was adopted as the test for multicollinearity. The core rule of VIF is that the VIF value must not exceed 10. Because all the variables had a VIF of less than 10, there was no risk of multicollinearity in the study, as shown in Table 4.21.

Table 4.21 Multicollinearity Test

	Collinearity Statistics		Remark
	Tolerance	VIF	
Cloud Computing	0.448	2.232	No Multicollinearity
Blockchain Technology	0.232	4.310	No Multicollinearity
Artificial Intelligence	0.248	4.032	No Multicollinearity
Integrated Payments Systems	0.177	5.649	No Multicollinearity
Macroeconomic Variables	0.734	1.362	No Multicollinearity

a Dependent Variable: Enterprise Performance

Source: Survey Data (2024)

4.7.3 Autocorrelation Test

In a linear regression model, the Durbin-Watson test was used to examine autocorrelation. The null hypothesis for the Durbin-d Watson's tests is that there is no linear autocorrelation in the residuals. The d value is a number that spans from 0 to 4; if it is found to be between 0 and 2, it indicates that there is no autocorrelation. If the d values are 1.5 d 2.5, the data does not have any autocorrelation. From Table 4.22, there is no problem of autocorrelation.

Table 4.22: Durbin-Watson test

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.839a	.703	.612	.57963	1.953

Source: Survey Data (2024)

2.4.5 Homoscedasticity

The Breusch-Pagan test was used to determine homoscedasticity. The null hypothesis in the Breusch-Pagan test is homoscedasticity. If the null hypothesis is rejected, it is concluded that there is heteroscedasticity in the data. If the level of significance is less than 0.05, the null hypothesis is rejected. As indicated in table 4.23, there was no problem of Heteroscedasticity.

Table 4.23: Breusch-Pagan Test for Heteroskedasticity

Chi-Square	Df	Sig.
.062	1	.803

a. Dependent variable: Financial Sustainability

b. Tests the null hypothesis that the variance of the errors is not dependent on the values of the independent variables.

c. Predicted values from design: Intercept + Cloud Computing + Blockchain Technology + Artificial Intelligence + Integrated Payment Systems + Macroeconomic variables

Source: Survey Data (2024)

4.8 Regression Findings

4.8.1 Model Summary

This section shows the model summary findings which is a representation of the coefficients of determination as a contribution of the predictors towards the dependent variable. The R-squared coefficient of determination illustrates how changes in the predictor variables impact the response variable, as seen in Model Summary Table 4.20. As per the results above, the R-square value is 0.7775, suggesting that financial innovation (cloud computing, blockchain technology, artificial intelligence, integrated payment systems) account for 77.75% of the financial sustainability of commercial banks in Kenya. This summary is shown in Table 4.24

Table 4.24: Regression Model Summary Unmoderated

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.882	0.7775	0.762	0.293

After moderation, the R-square value was 0.543, suggesting that macroeconomic variables negatively moderated the relationship between financial innovation and financial sustainability of commercial banks in Kenya and accounted for 54.3% of the financial sustainability of commercial banks in Kenya. There was a 23.45% change because of macroeconomic variables effects.

Table 4.25: Regression Model Summary Moderated

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.737	.543	0.293	0.5051

4.8.2 Analysis of Variance

An analysis of variance (ANOVA) was conducted to see if the entire regression model matched the data well and if cloud computing, blockchain technology, artificial intelligence, integrated payment systems were significant predictors of the financial

sustainability. The results shown in Table 4.26 indicate the relationship between the study variables as well as the reliability of the model. The model was tested at 5% significance level with a 2-tailed test. The F-value which is computed at 5% significance level was 5.002 with the significance value of 0.010 which is less than the critical value at 5% level derived from a 2-tailed test. The F calculated (5.0002) in this model is greater than the F critical (at 5, 25, F critical= 2.09). Table 4.26 shows the results of ANOVA Test.

Table 4.26: ANOVA (b)

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	7.4944	5	1.4988	5.0002	.010(a)
Residual	2.145	25	0.0858		
Total	9.6394	30			

4.5.3 Multiple Linear Regression Analysis

Multiple linear regression was computed, and the results are as summarized in Table 4.27. The coefficients in Table 4.27 were used to complete the regression equation relating to the dependent and the independent variables as per the below model

$$FSS=1.0441+0.3294 CC +0.3467CT+0.5496 AI+0.3551PS + \epsilon.....(1)$$

FSS = Financial Sustainability; CC = Cloud computing; BCT = Block chain technology; AI = Artificial intelligence; IPS = Integrated Payment Systems; β_0 = regression coefficients; $\beta_1 - \beta_4$ = Beta Co-efficient of Determination; ϵ = Error term

Based on the output obtained coefficients of cloud computing was 0.3294, blockchain technology variable had 0.3467, artificial intelligence variable had 0.5496, and integrated payment system variable had 0.3551. From these results, artificial intelligence contributes the most to the financial sustainability followed by integrated payment systems, then blockchain technology while cloud computing contributes the least. All the independent variables significantly influenced financial sustainability since the p-values were less than

the critical value of 0.05. The outcome collaborated Barbosa and Gracas Murici (2019) who concluded that companies could cut expenses and enhance customer interactions and thus adoption of financial innovations will contribute by cutting additional costs associated with human interventions.

Table 4.27: Regression Findings Unmoderated

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	0.3294	0.1226		2.69	0.008
CC	0.3467	0.1536	0.112	2.26	0.025
BCT	0.5496	0.1155	0.092	4.76	0.000
AI	0.3551	0.1209	0.114	2.94	0.004
IPS	1.0441	0.1525	0.186	6.85	0.000

a. Dependent Variable: Financial Sustainability

The researcher adopted macroeconomic variables as a moderator and the resultant model was as below.

$$FSS=0.954 + 0.280CC + 0.107BCT + 0.206AI + 0.438PS - 0.308M + 0.764 CC*M + 0.986CT*M + 0.795AI*M + 0.873IPS*M+ \epsilon \dots\dots\dots (2)$$

Where M is Macroeconomic variables

The equation above reveals that introducing macroeconomic factors as a moderator, Cloud computing variable had 0.280; blockchain technology had 0.107.; artificial intelligence had 0.206; integrated payment system had 0.438 and the moderator had -0.308. When moderated by macroeconomic factors, Cloud computing variable had 0.764; blockchain technology had 0.986; artificial intelligence had 0.795; integrated payment system had 0.873 and the moderator had -0.308. Holding cloud computing, blockchain technology,

artificial intelligence, integrated payments system, and macroeconomic variables to a constant zero, financial sustainability will be at a constant value of constant 0.954.

The study findings established that cloud computing, blockchain technology, artificial intelligence, integrated payments system, and macroeconomic variables are statistically significant in explaining financial sustainability of commercial banks in Kenya (p-values < 0.05). From the findings, macroeconomic variables had a negative but significant influence on financial sustainability of commercial banks in Kenya ($\beta = -0.308$, p-value = 0.023). The findings also reveal that microeconomic variables moderated the relationship between financial innovations and financial sustainability of commercial banks in Kenya. This was revealed by the changes in the coefficients of the independent variables after moderation. The constant also changed from 0.3294 to -0.764 signifying moderation in the multiple linear regression.

Table 4.28: Regression Findings Moderated

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	-0.764	0.1504		-5.08	0.000
CC	0.280	0.035	0.374	7.912	0.000
BCT	0.107	0.043	0.132	2.511	0.012
AI	0.206	0.020	0.255	10.440	0.000
IPS	0.438	0.035	0.543	12.679	0.000
M	-0.308	0.1188	0.177	-2.592	0.023
CC1*M	0.986	0.1510	0.322	6.53	0.000
BCT2*M	0.795	0.1200	0.492	5.6	0.014
AI3 *M	0.873	0.1349	0.446	6.47	0.019
IPS4*M	0.954	0.3862	0.854	2.47	0.003

a. Dependent Variable: Financial Sustainability

The findings of this study collaborated the conclusions by Anca Apostu et al. (2012) on cloud computing. The study suggested that the most widely used form of cloud services, SaaS (Software as a Service), is being adopted by banks. SaaS is primarily used in non-

core, peripheral solution areas like collaboration, customer relationship management, and human resources, but there are some exceptions. Anca Apostu et al. (2012) said that a cloud computing architecture must be established for the businesses' operations to be more safe, adaptable, and structured in a modern manner.

The outcome on blockchain technology reflected assertions by Fatoki and Wanjagi (2019) empirical study on the future of Kenyan banks. Using cryptocurrency and blockchain technology to reduce financial risk Instead of supporting a dominating market player or authority, digital money promotes individual investors. Cryptocurrencies can facilitate the capacity of the Kenyan banks to contain the private sectors in multiple ways. Firstly, digital money empowers compliance. Any risks associated with the imbalance of the market can be addressed using cryptocurrencies (Wright & De Filippi 2015).

Artificial intelligence outcome reflected findings by Barbosa and Gracas Murici (2019) conclusions that companies can cut expenses and enhance customer interactions with the aid of artificial intelligence. The report does, however, address issues with the human component, suggesting that strong strategic alignment and cultural adaption are necessary for a successful digital transition. This means that while implementing AI in banking, ethical issues must also be considered. In a survey on how the general public views artificial intelligence in the sector, the respondents reacted favorably to how AI sped up financial operations.

This study findings contradicted Krishna (2015) study which showed that using ICT lowers costs, but the impact on profitability is never certain because there may be side effects from the high demand for skilled labor, the reliability of the financial services market competitiveness, and changes in the information system. Gutu (2014) findings demonstrated the significance of the Internet revolution for both banks and customers. By automating the majority of their processes, banks are able to cut labor and branch costs, while customers spend less time and money on activities related to banking. China, Yao et

al. (2018) findings revealed that financial innovations increases money turnover and positively affect the financial sector earning growth. Hence, the results empirically indicate that innovations of payment technology contribute to industry synergist in the evolution of the financial industry.

The adverse effects of macroeconomic variables conformed to findings by Kanwal and Nadeem (2017) who concluded that commercial banks must concentrate more on other external factors that affect them and create strategies to improve internal elements if they want to maximize risk-adjusted returns. The findings were collaborated by the current study as it revealed that if managed well, macroeconomic variables can contribute positively to financial sustainability of commercial banks in Kenya which additionally was echoed by Singh and Sharma (2016). Additionally, Emase (2017) recommended that macroeconomic variables should be continuously monitored as they have a significant effect on profitability of commercial banks and hence their financial sustainability.

The findings are consistent with theoretical propositions brought forth by the theory of financial intermediation, technology acceptance model and Schumpeter's theory of innovation. Schumpeter (1954) asserts that organizations create an opportunity for new profits with their innovations. Due to innovation, new items enter the market, which reduces demand for existing ones, drives down their price, and ultimately eradicates them. TAM was used in this research study to tie the blockchain study's utility and the simplicity pinned on to the two primary variables in explaining users' acceptance or rejection of blockchain-related services.

4.9 Chapter Summary

This chapter has addressed presentation of research findings, study inferences, their interpretation, analysis, and their discussion. The study findings established that cloud computing, blockchain technology, artificial intelligence, integrated payments system, and macroeconomic variables are statistically significant in explaining financial sustainability of commercial banks in Kenya. From the findings, macroeconomic variables had a negative but significant influence on financial sustainability of commercial banks. The findings also revealed that microeconomic variables moderated the relationship between financial innovations and financial sustainability of commercial banks in Kenya.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The chapter provided an overview of the study's findings, drawn conclusions, highlighted recommendations, and offered suggestions for more research that could be undertaken. This section was organized based on the specific study goals that were stated in the first chapter, the conclusions that were drawn, and the suggestions that came from the analysis carried out in the fourth chapter. The study's contribution to the library of existing knowledge was adequately recognized in the chapter.

5.2 Summary

Previous reviews on the relationship between financial innovations and financial sustainability noted that conclusions on the impact of variables operationalizing commercial banks' financial sustainability were conflicting. Several studies supported the conclusion that there is a synergy between financial innovation and financial sustainability, whereas other studies found a trade-off between financial innovation and financial sustainability. Kenya's Vision 2030 was a strategy for economic development that aimed to make Kenya a mid-income country where its citizens could live well. It can be accomplished by enhancing product accessibility and financial availability through financial innovations, which will support Kenya's commercial banks' financial sustainability. From the findings, of financial sustainability, the outcome reflected that the respondents strongly agreed that most banks were financial sustainable with a smaller variation from the mean.

From the findings on cloud computing, the study indicated that that the respondents strongly agreed that adoption of cloud computing affected financial sustainability positively with a smaller variation from the mean. Based on the output obtained coefficients of cloud computing was positive and significant and contributed to financial

sustainability. Cloud computing architecture therefore must be established for the businesses' operations to be more safe, adaptable, and structured in a modern manner.

From the findings of blockchain technology the study reflected that the respondents strongly agreed that adoption of blockchain technology had a positive influence on financial sustainability with a minimal variation from the mean. Based on the model summary obtained, coefficients of blockchain technology indicated a positive and significant influence on financial sustainability. Using cryptocurrency and blockchain technology reduces financial risk and consequently enhances survival of commercial banks thus digital money promotes individual investors.

Artificial intelligence had a positive and significant influence on financial sustainability and as well reflected that the respondents strongly agreed that adoption of artificial intelligence positively impacted financial sustainability of commercial banks in Kenya. it was found that some industries have adopted artificial intelligence more widely than others; the banking industry being one of the few that has demonstrated a modest level of acceptance and adoption of this technology.

Integrated payment systems were found to have a significant and a positive effect on financial sustainability. The overall weighted average indicated an agreement with small variation that integrated payment systems affected financial sustainability positively. The outcome suggested that IPS raises money turnover and has a favorable impact on the growth of earnings in the financial sector. Therefore, the results of the empirical research show that advancements in payment technology support industrial synergies in the development of the financial sector.

Regarding macroeconomic variables represented by inflation and interest rates was found to have a significant moderating effect on the linkage between financial innovations and financial sustainability of banking institutions that operates in Kenya with an overall mean

score of strongly agreeing with a small variation on macroeconomic effect on the relationship between financial innovation adoptions and financial sustainability.

The financial industry, and commercial banks in particular, play a major role in the rapid growth of any country's economy. They are typically acknowledged for their contributions to economic operations, employment generation, innovation, and the development of a country's wealth. Through the apex bank, the Kenyan government creates a supportive legal and regulatory framework, such as the Banking Amendment Act of 2015. As a result, it guaranteed that commercial banks would keep offering financial accessibility and participate in bringing Vision 2030 to reality. Therefore, this study emphasized the need to investigate the impact of financial innovation on the long-term viability of Kenyan commercial banks. The study specifically attempted to determine how blockchain technology, artificial intelligence, cloud computing, and integrated payment systems affect the long-term viability of Kenya's commercial banking sector. The study also sought to establish the moderating effect of macroeconomic variables on the relationship between financial innovations and financial sustainability of commercial banks in Kenya.

Cloud computing, blockchain technology, artificial intelligence, integrated payment systems were found to have a statistically substantial impact on financial sustainability of commercial banks operationalized by the ratio of operating income to operating expenses.

5.3 Conclusions

Banking institutions must be financially stable, reachable, and available to the market share they service to carry out their intermediation obligation with regard to liquidity provision. Any country that wants to thrive must have access to bank loans as well as other financial services. This justifies the necessity of ensuring that banking solutions are appealing, accessible, and available to all without any kind of prejudice. Financial innovations can help achieve this. The study found that over the study period, commercial banks expedited

financial innovations that influenced the financial sustainability of commercial banks in Kenya. The major driving force of financial innovations among them included cloud computing, artificial intelligence, blockchain technology and integrated payments systems. More billers and channels along with an increase in information systems innovations were linked to higher penetration. According to the study's findings, commercial banks have stepped up their use of financial technologies and deliberately improved their accessibility and level of service. As a result, it translated to lower default risk, liquidity vulnerability, and insolvency risk for commercial banks, resulting in financial sustainability. The survival and success of commercial banks depend critically on the efficiency of financial innovations adoption.

Based on results, it can be emphasized that cloud computing delivers significant cost savings for public cloud solutions, especially when compared to the initial capital expenditure requirements of conventional IT infrastructure. Moreover, cloud computing could aid commercial banks in better managing their computer resources during periods of heavy client demand. Cost savings result from higher business efficiency when cloud computing is utilized for risk mitigation and innovation. Using the cloud can help reduce traditional technology risks related to capacity, redundancy, and resilience. Additionally, because cloud computing is scalable, organizations have more control over issues like security.

By using cryptocurrency, the state can lessen the chance of losing money due to erroneous asset valuation and authentication. All participants in the financial system, including households, investors, and even banks, will benefit from the facilitation. Value distribution will significantly lower transaction costs. The advancements will be predicated on the removal of middlemen and enhanced ability to make decisions. Additionally, there will be a significant boost in the speed at which transactions and payments are processed. The Kenyan banks will lead the way in putting the different adjustments into practice in a number of ways. First, the institutions serve as the main repositories of financial data.

Blockchain adoption will go above and beyond just supplying relevant data. Additionally, the use of digital currency will allow for customized contract optimization. It implies that everyone will be able to profit from any financial market niche without intervention from the government, middlemen, or CBK.

Even though artificial intelligence is still in its early stages of adoption in the banking industry, Kenyan banks can further optimize their financial strategies by using the advanced algorithms of artificial intelligence to enable effective risk and asset management. The region's banks can create revenue generation models and begin utilizing intelligent financial management solutions by utilizing fast and effective artificial intelligence technologies. However, the artificial intelligence systems that banks now deploy are primarily static and focus heavily on requirement and risk assessment.

Thus, the study's conclusions suggest that the financial performance of the state's commercial banks, and other institutions is significantly impacted by the implementation of e-payment systems. Based on these results, the study suggests that in order to increase user base, e-payment systems should have their security reviewed and improved. Additionally, fees related to using the platforms should be decreased, and prospective customers should be made more aware of their options.

The study showed that macroeconomic factors (inflation and interest rates) had a significant effect on the commercial banks' financial sustainability. The study therefore concludes that commercial banks must concentrate more on these macroeconomic factors that impacts them and come up with mitigation measures to improve their efficacy if they want to maximize on returns that are adjusted for risks.

The financial innovations variables as per the regression findings had a significant positive effect on financial sustainability and even the interactive terms where the moderating variables were multiplied with the financial innovations (independent variables) there was

a significant and positive effect on financial sustainability hence the study concluded that theoretical propositions brought forth by the theory of financial intermediation, technology acceptance model and Schumpeter's theory of innovation. Schumpeter (1954) were validated by asserting that, organizations create an opportunity for new profits with their innovations. Due to innovation, new items enter the market, which reduces demand for existing ones, drives down their price, and ultimately eradicates them. TAM was used in this research study to tie the blockchain study's utility and the simplicity pinned on to the two primary variables in explaining users' acceptance or rejection of blockchain-related services.

5.5 Recommendations for Policy and Practice

Based on its findings, this study suggests that the main reason cryptocurrencies are applicable in Kenya is that they are not governed by a single entity. The global markets, which are characterized by rising inequality and financial malpractices, are brought together by digital money. Smart contracts could be used by Kenya's banking sector to mitigate the numerous risks associated with the financial decisions made by both public and private entities. Banks can do away with middlemen by using digital currency, which frequently limits the ability of private traders to strike contracts. The user-to-user nature of cryptocurrencies allows for greater control and flexibility for individual traders. By using technology, the state can lower the risk of loss from erroneous asset valuation and authentication.

Based on the study's findings, commercial banks in Kenya should launch more extensive mass media education campaigns about all financial innovations and initiatives. This will help them maintain their financial sustainability by encouraging consumers to use payments system technology. Additionally, a trustworthy payments system dispute arbitration framework must be established by commercial banks working with Kenya's

central bank. This will boost public confidence in the use of electronic payment system channels and, consequently, the financial sustainability of the whole financial sector.

Based on the observed inferences, it was suggested that governing bodies should simplify policies that support the implementation of financial inclusion measures in order to increase accessibility and ongoing use of financial products. Additionally, it becomes necessary to manage security holes and divest from internal banking procedures to protect clients from risk exposure that may result from using alternative service delivery channels including agency banking, the internet, and mobile.

Commercial banks in Kenya must concentrate more on Macroeconomic factors as they derive a significant effect on their financial sustainability. Commercial banks also need to develop modalities to improve internal elements if they want to maximize risk-adjusted returns. To lock in interest rates and hedge their diverse portfolios, the banks can use techniques such as buying more futures contracts on government bonds or interest rate futures. Since macroeconomic factors have a big impact on commercial banks' profitability and their capacity to remain financially stable, it is important to regularly monitor them.

5.6 Limitations of the Study

Mitigation procedures were implemented to ensure that the limitations did not have an adverse effect on the findings in order to accomplish the objectives. Kenya's commercial banks are subject to strict regulations, fierce competition, and external influence. Therefore, some respondents expressed reluctance to divulge information due to concerns about potential legal ramifications and exposure. As a result, several respondents indicated that they were unable to complete the questionnaire due to personal, busy, and information confidentiality concerns. The study's limitations were lessened by the generalization of the questions' structure.

The study's scope was limited because it was intended solely to evaluate the banks. Microfinance banks and other financial institutions like investment banks and insurance companies were not included in the study. However, this served as a recommendation for further study which future scholars can focus on.

5.7 Suggestions for Further Study

More comparative analysis must be done while taking into account the different regulatory framework modifications that BASEL has proposed. It could additionally explain more about financial inclusion policies and how stability is impacted by them. Future studies could consider additional factors including tightening regulations, shifting economic environments in which clients operate, or shifting household income levels. An additional suggestion for further research is scrutinizing the direct role of macroeconomic variables on financial sustainability in the banks domiciled in Kenya.

More research should be focused on broadening the current study's scope by incorporating relevant contextual elements, such as competition and portfolio diversity, into the research concepts. This would help to explain some of the study's findings.

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APPENDICES

Appendix I: Letter of Introduction

KEZIAH WAMBUI KIARIE

STRATHMMORE UNIVERSITY

P.O. BOX 59857, 00200, CITY SQUARE,

NAIROBI, KENYA.

Dear Valued Respondent,

I am carrying out important research on *THE EFFECT OF FINANCIAL INNOVATIONS ADOPTION ON FINANCIAL SUSTAINABILITY OF COMMERCIAL BANKS IN KENYA*. This is in partial fulfillment of the requirement for the award of the degree Master of Commerce at the Strathmore University.

Attached is a questionnaire, please answer all the questions with your own true agreement to each. There are no wrong responses to any of these statements. All information given in the questionnaire will be treated with strict confidentiality and used for the purpose of this research only.

Thank you for taking your time to fill in the questionnaire.

Thank you in advance,

Yours sincerely,

Appendix II: Questionnaire Consent Form

I hereby give my permission to Keziah Wambui Kiarie to allow me to respond to questionnaire and quote my responses in a scholarly research project. I understand that her work is for academic purpose only.

I also understand that I waive any claim for copyright to this research project should the researcher publish it in scholarly journals or in electronic format online.

I also understand that the research title is THE EFFECT OF FINANCIAL INNOVATIONS ADOPTION ON FINANCIAL SUSTAINABILITY OF COMMERCIAL BANKS IN KENYA

I also understand that the researcher will maintain my anonymity with regard to my responses to questionnaire questions.

I hereby give my consent in the form of my signature below.

Signature:

Date:

Appendix III: Questionnaire

This questionnaire is concerned with investigation of the effect of financial innovations adoption on Financial Sustainability of commercial banks in Kenya. It is divided into five parts.

Part I: General Information

1. Gender of respondents

Male Female

2. How old are you? (Years)

21-30: 30-40:

40-50: Above 50:

3. Level of education?

University College

Secondary Primary

4. How long have you served in your current position?

less than 1 year 2 to 5 years

6 to 10 years Above 10 years

5. Adaptation of financial innovations?

Can't say Yes No

6. If number 5 is Yes, tick as applicable

Cloud Computing Blockchain Technologies
 Artificial Intelligence Integrated payment systems

Part II: Financial Sustainability

1. Has the commercial bank been financially sustainable?

Yes No

Instructions: This subsection is concerned with Financial Sustainability of commercial banks. Please mark with a **tick** (✓) in the box which best describes your agreement or disagreement. Use the following Likert scale; Strongly Agree (SA)=5, Agree(A)=4, Neutral(N)= 3, Disagree(D)=2 and strongly disagree (SD)=1

		SD	D	N	A	SA
#	Financial Self Sustainability	1	2	3	4	5
1	The bank has a lower non-performing loan indicating it is financially self-sustainable					
2	Financial innovations have improved sustainability in commercial banks					
3	The benefit of adopting financial innovations outweighs its cost on the structure of the bank					
4	Increasing interest rates is clearly associated with improved level of financial sustainability					
5	Loan intensity through alternate channels affects positively ratio of operating income to operating expenses					

PART III: CLOUD COMPUTING

Instructions: This subsection is concerned with cloud computing adoption in commercial banks. It will constitute both open ended and closed questions. Please mark with a **tick (√)** in the box which best describes your agreement or disagreement. For the likert scale; Strongly Agree (SA)=5, Agree(A)=4, Neutral(N)= 3, Disagree(D)=2 and strongly disagree (SD)=1

1. Has Cloud computing been adopted in banking operations?

Yes No

If Yes, State how cloud computing has been adopted to enhance financial sustainability.

#	Cloud Computing	SD	D	N	A	SA
	A) Monitoring and reporting	1	2	3	4	5
1	Cloud computing has been adopted in banking operations thus enhancing sustainability					
2	The benefit of adopting cloud computing outweighs its cost on the structure of the bank					
3	Cloud computing adoption improves customer relationship in bank operations					
#	B) Storage of Data	1	2	3	4	5
1	Cloud computing ensures data security in commercial banks					

2	Accurate data processing on the operations of banks leads to a higher score in customer satisfaction.					
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PART III: BLOCKCHAIN TECHNOLOGY

1. Select how blockchain technology has been applied by commercial bank operation and management.

- Bill operation
- Cross-border payment operation
- Transaction information safety and transparency
- Asset securitization

2. Most used Blockchain technology _____

3. State the reasons for choice _____

This subsection is concerned with Block Chain technology. Please mark with a **tick (√)** in the box which best describes your agreement or disagreement. Use the following likert scale; Strongly Agree (SA)=5, Agree(A)=4, Neutral(N)= 3, Disagree(D)=2 and strongly disagree (SD)=1

#	Blockchain Technology	SD	D	N	A	SA
	C) Digital money	1	2	3	4	5
1	Blockchain has been adopted and thus the cost in Bill Operation outweighs cost					
2	Blockchain has been adopted in Cross border Payment Operations by the bank					
#	D) Crypto currency	1	2	3	4	5
1	There has been utilization of cryptocurrencies in Asset Securitization Business					
2	The application of blockchain in commercial bank, can effectively reduce transaction costs and improve the operational sustainability of banks					

PART IV: ARTIFICIAL INTELLIGENCE

1. Has the Commercial bank deployed artificial intelligence in providing Financial Services?

Yes No

If Yes, State how artificial intelligence has been adopted _____

2. Most used form of artificial intelligence_____

4. Reasons for Choice _____

This subsection is concerned with artificial intelligence. Please mark with a **tick (√)** in the box which best describes your agreement or disagreement. Use the following likert scale; Strongly Agree (SA)=5, Agree(A)=4, Neutral(N)= 3, Disagree(D)=2 and strongly disagree (SD)=1

	Artificial intelligence	SD	D	N	A	SA
#	Cyber security	1	2	3	4	5
1	Detection and prevention of cyber security threats is practiced in the banking industry					
2	Financial innovations pose a threat to cyber-attacks, wallet theft and pyramid schemes attracting a large pool of fraudsters.					
#	F) Robotics	1	2	3	4	5
1	Artificial intelligence systems like robotics are adopted in banks					
2	Artificial intelligence is mainly applied for automation of the processes through robotics					

PART IV: INTEGRATED PAYMENT SYSTEMS

1. Banks Use E-Payment Systems in providing Financial Services?

Yes No

If Yes, State the type of payment system adopted. _____

2. Duration of E-payment Adoption

1 Year 2 Years
 3 Years 4 Years

3. Most use integrated payment system _____

4. Reasons for Choice _____

This subsection is concerned with integrated payment systems. Please mark with a **tick (√)** in the box which best describes your agreement or disagreement. Use the following likert scale; Strongly Agree (SA)=5, Agree(A)=4, Neutral(N)= 3, Disagree(D)=2 and strongly disagree (SD)=1

Integrated Payment Systems		SD	D	N	A	SA
#	G) Billers	1	2	3	4	5
1	Volumes of Agency banking, point of sale transactions and ATM transactions has increased over time in commercial banks					
2	Size of revenue from Agency banking, point of sale transactions and ATM transactions has increased over time in commercial banks					
#	G) Channels	1	2	3	4	5
1	Volumes of RTGS, mobile payment and internet payment has increased over time in commercial banks					
2	Size of revenue from RTGS, mobile payment, and internet payment has increased over time in commercial banks					

PART V: MACROECONOMIC VARIABLES

This subsection is concerned with macroeconomic variables. Please mark with a **tick** (✓) in the box which best describes your agreement or disagreement. Use the following likert scale; Strongly Agree (SA)=5, Agree(A)=4, Neutral(N)= 3, Disagree(D)=2 and strongly disagree (SD)=1

#	Macroeconomic variables	SD	D	N	A	SA
	H) Interest Rates					
1	Increasing interest rates affects negatively financial sustainability of commercial banks in Kenya					
2	Country's interest rates have increased over the years					
	I) Inflation					
1	Inflation rate is not constant, and it has negatively affected Financial Sustainability of commercial banks					
2	Country inflation has increased over the years					

Appendix IV: Study Population: List of Commercial Banks in Kenya

NAME OF THE BANK	YEAR LICENSED
1. ABC Bank (Kenya)	1984
2. Bank of Africa	1980
3. Bank of Baroda	1953
4. Bank of India	1953
5. Barclays Bank Kenya	1953
6. CFC Stanbic Holdings	1955
7. SBM	1991
8. Citibank	1974
9. NCBA	1967
10. Consolidated Bank of Kenya	1989
11. Cooperative Bank of Kenya	1965
12. Credit Bank	1986
13. Development Bank of Kenya	1973
14. Diamond Trust Bank	1946
15. Dubai Bank Kenya	1982
16. Eco-bank Kenya	2005
17. Equatorial Commercial Bank/Spire Bank	1995
18. Equity Bank	2004
19. Family Bank	1984
20. Fidelity Commercial Bank Limited	1992
21. First Community Bank	2008
22. Guardian Bank	1992
23. Gulf African Bank	2007
24. Housing Finance Company of Kenya	2010
25. I&M Bank	1974
26. Imperial Bank Kenya	1992
27. Jamii Bora Bank	1999
28. Kenya Commercial Bank	1896
29. K-Rep Bank/Sidian Bank	1999
30. Middle East Bank Kenya	1980
31. National Bank of Kenya	1968
32. Oriental Commercial Bank	1991
33. Paramount Universal Bank	1993
34. Prime Bank (Kenya)	1992
35. Standard Chartered Kenya	1910
36. Access Bank	1985
37. United Bank for Africa	2009
38. Victoria Commercial Bank	1987

(Source: Central Bank of Kenya, 2023)

Appendix V: Factor Loading Tables

Principal Component Analysis for Cloud Computing

Communalities		
	Initial	Extraction/ Factor loading
Cloud computing has been adopted in banking operations thus enhancing sustainability	1.000	.577
The benefit of adopting cloud computing outweighs its cost on the structure of the bank	1.000	.544
Cloud computing adoption improves customer relationship in bank operations	1.000	.813
Cloud computing ensures data security in commercial banks	1.000	.523
Accurate data processing on the operations of banks leads to a higher score in customer satisfaction.	1.000	.754

Principal Component Analysis for Blockchain Technology

Communalities		
	Initial	Extraction/ Factor loading
Blockchain has been adopted and thus the cost in Bill Operation outweighs cost	1.000	.933
Blockchain has been adopted in Cross border Payment Operations by the bank	1.000	.490
There has been utilization of cryptocurrencies in Asset Securitization Business	1.000	.933
The application of blockchain in commercial bank, can effectively reduce transaction costs and improve the operational efficiency of banks	1.000	.846

Principal Component Analysis Artificial Intelligence

Communalities		
	Initial	Extraction/ Factor loading
Detection and prevention of cyber security threats is practiced in the banking industry	1.000	.492
Financial innovations pose a threat to cyber-attacks, wallet theft and pyramid schemes attracting a large pool of fraudsters.	1.000	.813
Artificial intelligence systems like robotics are adopted in banks	1.000	.813
Artificial intelligence is mainly applied for automation of the processes through robotics	1.000	0.869

Principal Component Analysis for Integrated Payments System

Communalities		
	Initial	Extraction/ Factor loading
Volumes of Agency banking, POS transactions and ATM transactions has increased over time in commercial banks	1.000	.953
Size of revenue from Agency banking, POS transactions and ATM transactions has increased over time in commercial banks	1.000	.765
Volumes of RTGS, mobile payment and internet payment has increased over time in commercial banks	1.000	.953
Size of revenue from RTGS, mobile payment, and internet payment has increased over time in commercial banks	1.00	.948

Principal Component Analysis for Macroeconomic Variables

Communalities		
Items	Initial	Factor loading
Increasing interest rates affects negatively Financial Sustainability of commercial banks in Kenya	1.000	0.672
Country's interest rates have increased over the years	1.000	0.587
Inflation rate is not constant, and it has negatively affected Financial Sustainability of commercial banks	1.000	0.799
Country inflation has increased over the years	1.000	0.760

Appendix VI: University Approval



11th September 2023

Ms Kiarie Keziah Wambui,
keziah.kiarie@strathmore.edu

Dear Ms Kiarie,

RE: Effects of Financial Innovations Adoption on Financial Sustainability of Commercial Banks in Kenya

This is to inform you that SU-ISERC has reviewed and approved your above SU-masters research proposal. Your application reference number is SU-ISERC1807/23. The approval period is from 11th September 2023 to 10th September 2024.

This approval is subject to compliance with the following requirements:

- i. Only approved documents including (informed consents, study instruments, MTA) will be used.
- ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by SU-ISERC.
- iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to SU-ISERC within 72 hours of notification.
- iv. Any changes anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to SU-ISERC within 72 hours.
- v. Clearance for the export of biological specimens must be obtained from relevant institutions.
- vi. Submission of a request for renewal of approval at least 60 days prior to the expiry of the approval period. Attach a comprehensive progress report to support the renewal.
- vii. Submission of an executive summary report within 90 days of completion of the study to SU-ISERC.

Before commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology, and Innovation (NACOSTI) <https://research-portal.nacosti.go.ke/> and obtain other clearances needed.

Yours sincerely,

A handwritten signature in blue ink, appearing to read "Ambrose Rachier".

Mr Ambrose Rachier,
Chairperson; SU-ISERC



Old Sazale Rd, Madaraka Estate, PO Box 59857-00200, Nairobi, Kenya. Tel +254 (0)703 034000
Email admissions@strathmore.edu www.strathmore.edu

Appendix VII: NACOSTI Approval



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

Date of Issue: 28/September/2023

RESEARCH LICENSE



This is to Certify that Ms. Kenah Wambui Kirie of Strathmore 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: The Effect of Financial Innovation: Adoption On Financial Sustainability of Commercial Banks in Kenya for the period ending : 28/September/2024.

License No: NACOSTI/P/23/29775

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Director General
NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY & INNOVATION

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