

Banking Systems Adoption and Financial Self Sufficiency; A Case for Commercial Banks in Kenya

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Abstract The financial sector has witnessed remarkable growth in the adoption of advanced technologies, decisively shifting from outdated models to more digital and customer-centric approaches. This evolution is a direct response to the inherent limitations of physical bank locations and antiquated systems that no longer satisfy consumer demands. Many tier II and tier III commercial banks are grappling with financial difficulties due to the rising incidence of non-performing loans and an overreliance on foreign debt, clearly exposing their lack of self-sufficiency. The integration of innovative banking technologies is not just beneficial; it is essential for driving development and enhancing competitiveness. This study unequivocally demonstrates how the adoption of these banking systems significantly impacts the financial independence of Kenyan commercial banks, focusing on integrated financial systems, cloud computing, blockchain technology, and generative artificial intelligence. Anchored in financial intermediation theory, the technology acceptance model, and Schumpeter's innovation theory, the research engaged 205 participants from 41 commercial banks. Utilizing a descriptive correlational design, the author gathered data through structured questionnaires, which were subsequently analyzed using SPSS. The findings indicate that the technologies in question, along with specific macroeconomic indicators, have a significant and positive impact on financial self-sufficiency. It is imperative for banking institutions to embrace banking innovations to ensure their success. The study strongly recommends banking system integration as a vital strategy to overcome traditional limitations.

Keywords: Financial Self-Sufficiency, Blockchain technology, Integrated financial systems, Generative Artificial intelligence, Cloud Technology, macroeconomic variables

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1. Introduction

Technological advancements are fundamentally reshaping business operations, driving new growth and innovative ideas across financial sectors. Research indicates an acceleration in the disruption of traditional practices as financial entities increasingly adopt customer-focused and virtual frameworks due to the rise of digital platforms, particularly among the youth in Kenya and globally [1,2]. The emergence of the Internet of Things (IoT) and artificial intelligence (AI) has transformed financial markets, compelling institutions to integrate these advanced technologies to remain competitive in a rapidly evolving digital landscape [3].

Recent studies emphasize the importance of digital financial literacy, which equips individuals with the necessary skills to navigate this new terrain, signifying that technology not only enhances operational efficiency but also necessitates a more educated consumer base in the context of financial services [1]. In addition, the

integration of AI and machine learning in financial forecasting is revolutionizing the sector by improving predictive accuracy and operational resilience [4,5]. Ultimately, advancing technology remains both a challenge and an opportunity for financial service providers to enhance user experience while addressing emerging cybersecurity threats [6]. (Tapscott & Tapscott, 2017).

New entrant international banks have of late increase competition that has forced local banks to embrace process automation as a key way of transforming from the traditional banking to the current complex banking industry with increased customers' needs and issues arising from globalization. A survey conducted by CBK in the year 2023 indicates that Kenyan banking system is considered for its use of the technology in satisfying the customer needs for 'any time anywhere' financial services and in the in pursuant of efficiency gains. Due to alignment, the sector has developed new products that are designed to meet new and ever changing customer needs while improving the competitiveness and financial returns bottom line for the institutions. Despite the fact that some goals of organizational use of technology are achieved,

predominantly as part of the cost reduction, there is a paradigm shift to the tactical currency wherein application of technology as the direct generator of the revenues and profitability.

According to Fatoki and Wanjagi [7], banking systems can help Kenyan banks better control the private sector in a number of ways for instance, digital money facilitates compliance. Dabrowski [8] study also indicated that availability and adoption of financial innovations could be a serious threat to the financial industry business model both the banking components and the non-banking components and therefore could likely have negative implications on Financial self-sufficiency of the Commercial banks.

In the USA, Cortés, Demyanyk, Li, Loutskina, and Strahan, [9] also identified that most firms have enhanced ability to endure after incorporating new product development. While the paper focused on funding stability the current study was based on Financial Self-sufficiency. Kombe, [10] highlighted that empirical fundamentals of adoption of banking systems have received attention and as such, enhanced its empirical credibility among strategic and marketing scholars. However, the study was specific to e-banking only therefore, a separate investigation was necessary to determine the effects of a combined interaction with other factors on financial self-sufficiency.

Research done in more developed economies revealed that characteristics of financial innovation and Financial Self-Sufficiency were positively and significantly related in banking studies [11,12]. Unfortunately, it has been found that some of the banks minimized their profitability after their implementation while there are other banks were put under receivership. It is also important to note that when assessing the commercial banks efficiency, it is unproductive to use financial ratios such as return on assets and returns on equity of equity if costs and revenue have not been calibrated to ideals of financial self-sufficiency [13].

Odhambo, Mose, and Mwalili [14] highlight the remarkable advancements in Kenya's financial and educational sectors, where cloud computing is increasingly being adopted. Their research underscores the Kenyan banking sector's reputation for fostering innovations that meet the evolving needs of consumers, as evidenced by findings from the CBK survey (2021). In response to the COVID-19 pandemic, which has dramatically reshaped various industries since 2020, the banking sector has notably intensified its digital transformation initiatives. The Innovation Survey 2021 reveals that customization stands out as the leading focus of innovation within the Kenyan banking landscape, reflecting a clear understanding of customer demands. Particularly in the realm of microfinance banking, there is a crucial emphasis on innovations that promote self-sufficiency and address climate financing. Additionally, collaboration and partnerships have emerged as vital enablers of this innovation. Yet, with these advancements come significant challenges, including cyber risks and data privacy concerns that demand urgent attention within the financial sector. Notably, the existing cross-sectional surveys in Kenya have overlooked the potential impact of block chain technology, signaling an urgent call for further research. By exploring this vital area, we can

unlock new opportunities for innovation and security in Kenya's financial landscape.

Remer and Kattilakoski (2021) shed light on the vital concept of financial self-sufficiency within commercial banks, explaining that when expressed as a percentage, it serves as a clear gauge of whether these institutions are generating sufficient revenue from interest, fees, and commissions to cover all their associated costs. These costs encompass not only financial obligations but also operational expenses and provisions for loan losses. For commercial banks to achieve a state of financial sustainability, they must strive for a balance of 100% or a ratio of 1:1. This can be accomplished through strategic measures such as increasing their operating income perhaps by expanding their range of services or improving customer acquisition or by diligently decreasing total costs through enhanced efficiency and cost management practices.

Reaching financial self-sufficiency is a landmark achievement for any bank, signifying that it can independently cover all operational expenses, financing costs, and even any subsidies valued at market rates without external assistance. This level of self-sufficiency is indicative of a bank's resilience and robust fiscal management (Balkenhol, 2017). To be classified as truly self-sufficient, a commercial bank must not only cover its costs but also pay for opportunity costs related to all factors of production and assets, which emphasizes the need for a bank to rely on its generated income rather than external sources (Chaves and Gonzalez-Vega, 2016).

Moreover, it's crucial to recognize that profitability parallels the idea of financial self-sufficiency for commercial banks. A bank that consistently operates at a loss and displays a pattern of poor financial performance cannot confidently claim to be financially self-sufficient. This notion extends further, as any commercial bank that requires subsidies to finance even a fraction of its operational expenditures fails to achieve acceptable standards of financial independence (Woller and Schreiner, 2014). This reality highlights the fundamental importance of establishing a solid and self-reliant financial foundation, which is a hallmark of a truly self-sufficiency in banking institution and capable of thriving in a competitive financial landscape.

Consequently, the main objective of the study was to ascertain the effect of banking systems adoptions on financial self-sufficiency of commercial banks in Kenya. The specific objectives for the study were:

- i. To examine the effect of cloud computing on financial self-sufficiency of commercial banks in Kenya
- ii. To evaluate the effect of integrated financial systems on financial self-sufficiency of commercial banks in Kenya
- iii. To determine the effect of block chain technology on financial self-sufficiency of commercial banks in Kenya
- iv. To examine the effect of generative artificial intelligence on financial self-sufficiency of commercial banks in Kenya
- iv. To assess the moderating effect of macroeconomic indicators on the relationship between banking systems adoption and financial self-sufficiency of commercial banks in Kenya

The study was based on the following hypothesis:

Ho1: Cloud computing has no significant effect on financial self-sufficiency of commercial banks in Kenya.

Ho2: integrated financial systems have no significant effect on financial self-sufficiency of commercial banks in Kenya.

Ho3: Block chain technology has no significant effect on financial self-sufficiency of commercial banks in Kenya.

Ho4: Generative artificial intelligence has no significant effect on financial self-sufficiency of commercial banks in Kenya.

Ho5: macroeconomic variables have no significant moderating effect on the relationship between banking systems adoption and financial self-sufficiency of commercial banks in Kenya.

2. Theoretical and Empirical Literature

This section outlines the review of empirical literature, focusing on prior studies and their findings relevant to the scope of this research. This study enhances our understanding of the financial self-sufficiency of Kenyan banks by drawing on a range of established theories. These include the diffusion of innovation theory, the technology adoption model, and financial intermediation theory. While all three theories agree that the adoption of banking systems impacts the financial self-sufficiency of commercial banks in Kenya, they vary in their recommendations for achieving sustainable practices. The literature review examines the influence of four specific types of banking systems adopted in banking sector: cloud computing, blockchain technology, integrated financial systems, and generative artificial intelligence, and their respective effects on the financial self-sufficiency of commercial banks in Kenya.

2.1. Financial Intermediation Theory

The financial intermediation theory has its origin in a study done by Raymond Goldsmith in 1969. Goldsmith in his work offered rich set of information about the system of finance and economic development. In particular, it was discovered that a country's financial system expands at a rate more rapid than that of national income in the course of economic development. The allocation of the task of saving and investment among the different economic units defines the size of a country's financial system (Goldsmith 1969). This conception coined in the 1960s remains valid in today's principal of financial intermediation. Even today, the role of financial intermediation for the development of the economy is understood in society [15]. Theoretical and empirical analysis have employed the theory to show the obvious importance of financial intermediation in the growth of the economy.

The study reveals that low earnings and impoverished asset among some people in the society are matters lead to financial exclusion. Financial intermediation is a function that facilitates the provision of capital throughout the economy with the objective of realizing growth. Inadequate awareness of certain financial characteristics is another problem pointed out as causing financial

exclusion. Information is relayed through the provision of financial instruments to both the suppliers of capital and the users of capital. Financial intermediation practice gives the surplus and deficit units a forum they are unfamiliar with according to Mandell [16].

Scholtens and Van Wensveen [15] pointed out that this approach has several problems: while the notion of participation costs ought to be central and focus on risk management is relatively recent in the financial industry. The research indicates that the identified current phenomena within the financial services industry may require more on development of the theory of financial intermediation. The banks ensure that there is provision for financial intermediation. In this manner, the banks provide coverage on behalf of the numerous economical players to guarantee that there is information spread, financial education and efficiency of the resources in the nation [15]. To be able to cover the risk throughout the financial intermediation processes, the financial institution has to be rewarded through the interest cost. This aspect of financial intermediation is useful to this research because additional information is presented about how financial institutions may earn profit from this role and thus increase their financial self-sufficiency. The various parts of financial intermediation have been portrayed to be key in achieving the objective of providing for financial inclusion therefore such kind of study would aim at assessing if financial inclusion yields profits to the financial institutions in the service of intermediation. This idea is thus relevant to the extent which implementation of financial innovation contributes to the financial self-sufficiency of Kenyan commercial banks.

2.2. Technology Acceptance Model (TAM)

On a global view, it has been suggested that as the years pass, the investment on technology is increasing and thus the organizations should facilitate the import of technology and get the most of it. The best identifiable determinant to measure how diverse companies integrate or adopt technology is an instrument referred to as the Technology Acceptance Model (TAM), which was pioneered by Davis in 1989 and augmented by Luarn and Lin in 2005. TAM is this theory that was designed for providing an explanation of how it is that various people are able to make use of a particular piece of technology that is out there in the world. To it, users follow a number of factors to determine whether or not to employ a certain offered technology [17] (Fishbein & Ajzen, 1975).

TAM states that the user considers two elements before adopting any given technology: technology acceptance model of perceived usefulness (PU) and perceived ease of use (PEOU) as proposed by Davis 1989. The extent to which the user perceives that using a certain system will enhance their capacity to perform their work is called perceived usefulness (PU); the extent that the user perceives that using the certain system will be effortless, is called perceived ease of use (PEOU). The two critical central aspects that build up the framework of the Technology Acceptance Model are perceived utility and perceived facility and why user accept technology (Wright, 2017).

TAM is the perceived economic importance of technology: In fact, the perceived costs associated with

technology by banks would certainly have no doubt about the technology if the cost is within the acceptable limit of the TAM. Consequently, it will enhance efficiency and effectiveness of their data analytics, credit scoring as well as innovation and consequently financial performance.

In this research study, there was the utilization of the Technology Acceptance Model (TAM) in a task to relate block chain study's utility and the simplicity singled out towards the two main factors of use to explain or reject block chain-related services. The extent to which an individual perceives change in performance outcome arising from the use of a certain system within the financial environment or other services relating to company is known as the technology usage.

In the TAM model, perceived benefits of a technology use including the artificial one, and user's attitude toward the technology in question all determine the decision of the user. Perceived beliefs about technology that comprises the perceived usefulness, and perceived ease of use that applies in block chain technology influence the consumer attitude. As explained by Fitriyani and Sfenrianto [18], the TAM model belongs to the list of very important and analyzed theories that shed light upon behavior of the ultimate consumers of technology.

Lule, Omwansa, and Waema [19] provided a list of criticisms for TAM, one of which is that it was designed for application in the organizational environment, not the everyday environment that is ill-suited for empirical studies of financial technologies in banking. First of all, TAM has its shortcomings when it is used for explaining a number of technological advancements, which are characteristic of innovations in commercial banks. Thus, it is suggested that TAM should be expanded, in a manner done by Luarn & Lin, to investigate the acceptance of financial innovations (2004).

2.3. Schumpeter's Theory of Innovation

According to Schumpeter [20], by its innovations, an organization establishes an opportunity to earn new profits. Because of innovation, there emerges new items which makes them more marketable, reduces demand for the other items, lowers their prices and does away with them completely. As soon as the entrepreneurs find success in the market, it is asserted that the competitors in the industry rapidly mimic and adjust the attributes to reap on the super normal earnings, thereby squeezing down on the profit margin. But there comes a new innovation before the supply could meet demand and so restarts the business cycle. He points out that business owners pursue the activities that offer positive values that rise and transform the cycle of the cash flows as well as invention at one pole and innovation and entrepreneurship at the other one.

Scientists are imitative and the Schumpeterian competition brings out imitators who mimic their rivals' actions, direction and innovation that results in investments and a boom. This is a view shared with Porter (1992) who asserts that improvement is paramount in the actualization of a nation's competitive or trade advantage, coupled with economic growth. Still, attempting to do this job, most critics, like Solow (2007), considered Schumpeterian theory of innovation as the phenomenon, which can be considered as the most successful attempt to

boil the whole socio-economic system into a few crude stereotypes.

Futuristic payment methods will go a long way to benefiting society in the retail payment services space. There are many benefits that may come to realization from such systems and as explained by Berger [21] includes reduced cost and also clear up of transactions quickly and many more. The market will expand even more, and the buying capability will increase because of the possibilities of mutating money transfer. Its idea concerns the enhancing of payment means of accessibility, their transactional enablement and processing in the framework of the integrated payment services. Columba (2009) asserts that empirical evidence suggests that massive distribution of integrated payment system has led to the decrease in cost of transaction; hence this variable is rooted.

The theory has been criticized by Lambert and Velardo, [22] in that, the author opines that based on the theory, the implication would be that innovation in the banking sector is a potent engine of growth when in the authors' own view, commercial banks play a very restricted role in fostering innovation while aspects such as the environment and structures have more bearing on the evolution of the banking sector. Intense competition for innovation has characteristics that are borne from the banking industry, which are likely to have negative consequences such as increasing inequality and economic power in the hands of the few large commercial banks.

2.2. Empirical Literature

This section builds from literature as presented by a number of researchers on how banking systems and innovation adoption leads to Financial self-sufficiency of commercial banks in Kenya. This study was contextualized on all commercial banks that were in existence in Kenya by December 2024.

2.2.1. Cloud Computing and Financial Self Sufficiency

A recent analysis by Ali [23] indicates that Software as a Service (SaaS) is the most widely adopted form of cloud service in banking. Banks implement SaaS primarily in non-core and ancillary functions such as customer relationship management and human resources, although there is no single dominating application within this category. To enhance safety and adaptability, the architecture of cloud computing needs further development.

In their comprehensive study focused on the adoption of cloud computing within the Dutch context, Kulmie and Ibrahim [24] delved into a range of facilitators and challenges that organizations encounter. They pointed out that the impactful revelations made by Edward Snowden regarding government surveillance practices have significantly influenced public attitudes and trust towards cloud technologies. To illuminate these dynamics, the researchers employed the Technology-Organization-Environment (TOE) framework, which analyzes how these three intersecting factors affect technology adoption. They conducted an extensive survey involving 101 IT managers from various sectors, gathering insights on their experiences and perspectives. The results of their study revealed a compelling finding: the flexibility of cloud technology emerged as a critical determinant of its

effectiveness in organizational settings. This flexibility encompassing aspects such as scalability, ease of integration, and adaptability to changing needs was found to be more influential than the mere technical specifications of the technology itself. This insight emphasizes the need for organizations to prioritize adaptability when considering cloud solutions, ensuring that their chosen technologies can evolve alongside their operational requirements.

In their insightful analysis of the evolving banking landscape in Kenya, Fatoki and Wanjagi [25] delve into the transformative role of digital currencies, particularly cryptocurrencies. The study contend that these innovative financial instruments empower individuals by providing a means of financial independence, free from the constraints imposed by political oversight or control. The authors argue that cryptocurrencies foster a more interconnected global market by facilitating decentralized financial transactions, which are not subject to the regulatory limitations typical of traditional banking systems. This decentralized approach not only enhances accessibility for users in Kenya but also contributes to greater financial security. Furthermore, the use of smart contracts self-executing contracts with terms directly written into code serves as a crucial mechanism for risk mitigation within Kenya's financial ecosystem, thereby streamlining transactions and reducing the potential for disputes.

Odhiambo, Mose, and Mwalili [14] focused on misconceptions that contributed to the adoption of the cloud computing in a few Kenyan banks. More precisely, this study sought to establish the following research questions; The effects of data security on the adoption of cloud computing among the selected Kenyan banks., The effects of organizational culture on the adoption of cloud computing among the selected Kenyan banks, the effects of supplier lock-in on the adoption of cloud computing among the selected Kenyan banks, the regulatory policy impact on the adoption of cloud computing among the selected Kenyan banks. The study utilized explanatory research paradigm and inferential statistics. The target population was comprised of 366 ICT employees from 42 selected banks. To obtain the foregoing information, a systematic questionnaire was used in the process. In order to analyze the data, the Computer Statistical Package for Social Sciences version 28 (SPSS) application was employed to tabulate, code, and process the questionnaires. The research established that although there are believed to be benefits in cloud computing, there are matters that organization have to sort out to enable the corporate implement cloud computing. The current study adopted Financial Self-sufficiency as the dependent variable thus conceptually departing.

Mugenyi [11] did a study on adoption and benefits of cloud computing services on sustainable growth of commercial banks in Uganda. This paper examined the opportunity of cloud commerce for organizations and how organizations in Uganda might apply same reproductions to attain the condition of meeting the constantly emerging problems that are always emerging. Unfortunately, most of the developing countries including Uganda have not realized the opportunities within cloud computing systems and have not adapted to it. Although the Ugandan government has tried to promote the cloud computing

business in small and medium scale enterprises most institutions do not have any plans or policies to adopt or implement cloud computing and therefore the current uptake of this technology is very low. One of the causes of this utilization range is that there are no legal policies to govern cloud computing system operations in the nation. Therefore, to boost an emulation of the impact of cloud computing on Financial Self-sufficiency, the current study was undertaken in the Kenyan context.

2.3.2. Block Chain Technology and Financial Self Sufficiency

The study conducted by Smith and Johnson [26] focused on the advantages of blockchain technology in the functioning and management of commercial banks, analyzing its implications for asset securitization, cross-border payments, and bill processing. Their research demonstrates that adopting blockchain methods can significantly reduce transaction costs for all stakeholders while enhancing the efficiency of management and operations in commercial banking. The present study aimed to replicate the application of blockchain technology, with a particular emphasis on the Kenyan context.

Research conducted by Mavindu, Wacuka, and Ngugi [27] investigated the influence of blockchain technology on financial markets in Kenya through an explanatory research methodology. The target population comprised respondents from Nairobi County, specifically within commercial banks, where the researchers engaged 205 bank managers employed across various financial roles. The findings indicated that government policy facilitation, internet infrastructure, transaction costs, and risk assessments exhibited positive and significant relationships with the adoption of blockchain technology. The study recommended policy reviews concerning risk analysis to prevent unauthorized financial activities and enhance the performance of financial markets in Kenya.

Additionally, Ndungu and Kibera [28] evaluated the advancements in blockchain integration within developing countries, focusing on financial inclusion in Africa. Their findings underscore the necessity of adopting innovative blockchain technologies to alleviate financial marginalization and improve sustainable development across African nations.

Lastly, Kibet, Thiga, Karume, and Nakuru [29] examined blockchain-based contracts within the Kenyan housing market. They highlighted that the presence of multiple intermediaries has elevated costs and reduced transparency in the housing sector. Their study found that integrating blockchain technology into smart contracts could mitigate vulnerabilities within the existing system and contribute to lowered housing costs.

2.3.3. Generative Artificial intelligence and Financial Self-Sufficiency

In recent literature, several studies have investigated the integration of Artificial Intelligence (AI) within financial services, focusing on its impact on financial self-sufficiency. Fares et al. [30] conducted a systematic review on the utilization of AI in the banking sector. The study aimed to identify the advantages of AI adoption and to explore barriers and motivational factors influencing

customer adoption of digital banking technologies. Utilizing a qualitative methodology, the researchers synthesized findings from various studies and emphasized that while AI enhances operational efficiency, there are prevalent barriers related to customers' perceptions and readiness to embrace digital innovations. The findings indicate that AI can significantly enhance customer interactions and decision-making processes, ultimately contributing to financial self-sufficiency for both institutions and customers.

In another study, Ho et al. [31] examined the relationship between AI implementation and firm performance in the financial sector. The study's objective was to assess whether AI can mitigate financial risks while improving operational performance during uncertain periods, such as during the COVID-19 pandemic. The researchers employed quantitative methods, analyzing stock market performance data, and concluded that AI-driven firms outperformed traditional counterparts, highlighting the potential of AI as a tool for enhancing financial resilience and self-sufficiency.

Further analysis by Iryani & Yulianto [32] explored AI in the context of volatile and uncertain environments. Their findings reveal that AI technologies are critical for identifying risks and optimizing financial decision-making, thereby supporting organizations in achieving sustainable financial self-sufficiency. Through a systematic mapping study, the authors documented various AI applications in finance, emphasizing their importance in mitigating financial vulnerabilities.

In their research, Khailtash and Lindqvist [33] investigated how organizations can mitigate the risks linked to the adoption of artificial intelligence (AI) and the subsequent effects on their risk management practices. The study involved semi-structured interviews with twelve participants who possessed expertise in AI, security, or the banking sector to explore the application of AI within this field. Two theoretical frameworks were employed to analyze the data. The first framework, known as the Dynamic Risk Management Framework, was utilized to assess changes in the risk management process in relation to its specific role within society. The second framework, the Multi-Level Perspective, enabled the researchers to acquire a thorough understanding of AI's role as a driver of socio-technical transformation. The results revealed that the implementation of AI introduces several additional risks. The present study adopted a multi-theoretical approach, with three theories underpinning the study's variables.

A 2018 report by Alzaidi investigates the implementation of artificial intelligence within the banking sector of the Middle East. The regional banking industry is characterized by varying rates of acceptance of new technological tools. To address the research question, a survey was employed as the methodology, collecting essential data from 200 bank employees across several strategically selected institutions in the region. The primary objective of this study is to gather information regarding the application of artificial intelligence in the banking sector and to evaluate its impacts. Quantitative analysis of the collected data was conducted using SPSS21.0 software. Certain sectors have embraced artificial intelligence more extensively than others, with

the banking industry being among the few that has shown a moderate level of acceptance and adoption of this technology.

In their 2020 report, Smith and Nobanee explored the application of artificial intelligence within the banking sector. There exists a variety of differing perspectives regarding artificial intelligence (AI) and its capacity to enhance efficiency across multiple industries, and the banking sector is no exception. It is also possible that artificial intelligence could negatively impact the finance industry, as it is widely acknowledged that metrics, outcomes, data collection, and quality indicators serve as the foundation for any sector. The implementation of these essential components can be made more effective through the use of technology and automated systems. Consequently, the adoption of artificial intelligence is unavoidable, highlighting the necessity to examine its effectiveness in promoting financial self-sufficiency.

2.3.4. Integrated financial systems and Financial Self Sufficiency

Recent literature has provided significant insights into the role of integrated financial systems (IPS) in enhancing the financial self-sufficiency of commercial banks. A study by Chelangat et al. [34] analyzed the effects of payment cards on the financial performance of commercial banks in Kenya. The authors aimed to understand how the adoption of varied payment solutions influences banks' operational efficiency and profitability. Utilizing a quantitative methodology, they assessed the correlation between payment card usage and financial outcomes among several banks. The findings revealed that banks utilizing modern payment card technologies reported higher levels of customer engagement and revenue growth, affirming that integrated financial systems contribute positively to financial performance and self-sufficiency.

Exploring the impact of third-party payment systems on commercial bank profitability, Quan et al. [35] conducted an empirical analysis using data from 38 banks over a span of eight years. Their research objectives included examining the profitability implications of the burgeoning third-party payment services. Results indicated a significant negative correlation between third-party payment platforms and banks' non-interest income, suggesting that these platforms could threaten traditional banking revenue streams. The conclusion posited that while third-party systems can enhance consumer choice and convenience, banks must innovate their payment strategies and services to maintain profitability and financial autonomy.

In the context of the COVID-19 pandemic, Kee et al. [36] investigated the impact of cashless payments at Maybank, one of Malaysia's leading banks. The study aimed to assess how the adoption of electronic payment systems during the pandemic improved customer access and operational efficiency. Through mixed methods, including customer surveys and transactional data analysis, the findings highlighted that cashless payments facilitated quicker and safer transactions, leading to increased customer satisfaction and bank performance. The study recommended that banks continue to invest in IFS to solidify their market position and enhance financial resilience.

The study by Mohammed, Ibrahim, and Muritala [37] investigates how improvements in payment systems impact the performance of commercial banks in Nigeria. Utilizing an ex post facto research methodology, the analysis was based on a dataset that included all banks operating in Nigeria. Findings revealed that Real-Time Gross Settlement (RTGS) has a detrimental effect on the return on assets, while Point of Sale (POS) transactions, online payments, and mobile payment systems have a positive and significant effect on the return on assets of Nigerian commercial banks. The authors recommend that commercial banks in Nigeria undertake extensive public awareness campaigns to inform stakeholders about advancements and activities related to payment systems. Furthermore, there is a need to examine the effects of integrated financial systems in commercial banks in Kenya.

Krishna [38] employed a descriptive research design to investigate the impact of information technology (IT) on the banking industry in India. The study focused on various technological advancements associated with information and communication technology (ICT) in 2015, including services such as telephone banking, automated teller machines (ATMs), mobile banking, and online banking. The results suggest that the adoption of ICT contributes to cost reductions; however, the influence on profitability is uncertain due to factors such as the heightened demand for skilled labor, the reliability of competitiveness in the financial services market, and changes within the information system. The current study also utilized a descriptive research design to examine how the adoption of financial innovations affects financial self-sufficiency.

Gutu [39] employed a descriptive research design to investigate the impact of internet technology on the performance of banks in Romania. The study analyzed a sample of 11 banks over a period from 2003 to 2013. The independent variables included early adoption of technology, the proportion of internet users, and online advertising. The findings highlighted the importance of the internet revolution for both banks and their customers. By automating many of their processes, banks were able to reduce labor and branch costs, while customers benefited from spending less time and money on banking-related activities. The study revealed that these three variables positively influenced bank performance; however, the effect was deemed insufficient to conclude that internet technology plays a critical role in enhancing performance. Ultimately, the study concluded that internet technology did not significantly impact Romanian banks, indicating a need for further investigation in the Kenyan context using an explanatory approach.

Yao et al. [40] investigate the impact of payment technology on the financial performance of China's banking sector, particularly in light of the country's growing economy. They analyze Third-Party Payment (TPP) data from 2007 to 2014 using the Vector Auto-Regression impulse model. The findings indicate that TPP enhances money circulation and positively influences earnings growth within the financial industry. Thus, the results empirically demonstrate that advancements in payment technology foster synergies that contribute to the development of China's financial sector.

In contrast, Vekya [41] identified a significant positive

correlation between ATM transactions and bank profitability in Kenya. Utilizing data from 43 commercial banks and a descriptive research design, this study examined the effects of electronic banking on the financial performance of Kenyan banks. These findings align with those of Muisyo et al. [42], which explored the impact of mobile payments on the financial performance of banks in Kakamega Town, Kenya, revealing that mobile payments have positively influenced the performance of banking institutions. Similarly, Cherotich et al. [43] conducted a study using secondary data from 43 commercial banks operating in Kenya as of December 2013 to assess the effects of payment system innovations on the financial performance of Kenyan banks. Their results indicated that financial performance indicators, such as electronic fund transfers (EFTs), checks, and real-time gross settlement (RTGS), positively affected the return on equity of Kenyan commercial banks. The current study emphasizes that evaluating bank performance solely based on return on assets (ROA) and return on equity (ROE) is inadequate unless expenses and income are accurately adjusted to reflect financial Self-Sufficiency.

3. Research Methodology

The study utilized a positivist research philosophy. The principles of positivism assert that researchers must maintain objectivity towards the subject of observation and that measurements should adhere to objective criteria rather than personal interpretations [44].

A correlational research design was employed in the study. The initial section included a well-organized questionnaire aimed at management and other employee representatives. Consequently, the study adopted a descriptive correlational research design to examine the relationship between the adoption of banking systems innovation and the financial Self-Sufficiency of commercial banks in Kenya. According to Saunders et al., [45], descriptive research provides a detailed profile of events and phenomena, capturing insights from individuals, organizations, and industry perspectives. Therefore, the correlational design enabled the researcher to gather data from a broader participant pool within the study area and to evaluate the current state of affairs by characterizing, assessing, and reporting on existing or past situations. The study did not involve manipulation of variables, and the researcher was not influenced by the research environment. The study was quantitative in nature.

$$FSS = \beta_0 + \beta_1 CC + \beta_2 BCT + \beta_3 GAI + \beta_4 IFS + \epsilon \quad (1)$$

$$FSS = \beta_0 + \beta_1 CC + \beta_2 BCT + \beta_3 GAI + \beta_4 IFS + \beta_5 M*CC + \beta_6 M*BCT + \beta_7 M*AI + \beta_8 M*IFS + \epsilon \quad (2)$$

Where, FSS = Financial Self Sufficiency

CC = Cloud computing

BCT = Block chain technology

GAI = Artificial intelligence

IFS = Integrated financial systems

M = Macroeconomic variables

β_0 = regression coefficients

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

ϵ = Error term

4. Findings and Discussion

This section presents the study inferences, their interpretation, analysis, and their discussion as guided by the specified objectives effect of banking systems adoption and financial self-sufficiency of commercial banks in Kenya. It will henceforth present the regression model derived from the data collected and analyzed.

4.1. Reliability Test

The table presented below regarding the reliability of the research instrument indicates that the data collection tool was stable and able to yield consistent results, thereby facilitating dependable replication under the same procedures and conditions. Importantly, all research variables achieved a Cronbach's Alpha score exceeding 0.70, which meets or exceeds the "acceptable" standard.

Table 1. Reliability Statistics

Variable	Cronbach's Alpha	No of Items
Cloud computing	0.748	22
Blockchain technology	0.832	22
Generative Artificial Intelligence	0.792	22
Integrated financial systems	0.926	22
Macroeconomic Variables	0.761	22

(Source: Survey Data, 2024)

4.2. Validity Test

Table 2. Principal Component Analysis 1

Communalities	Initial	Extraction/ Factor loading
Cloud computing	1	0.6342
Blockchain technology	1	0.8991
Generative Artificial Intelligence	1	0.7239
Integrated financial systems	1	0.9125
Macroeconomic Variables	1	0.7765

(Source: Survey Data, 2024)

Following the collection of data from 22 participants, the researcher calculated communality values, also referred to as item factor loadings, to evaluate the strength and direction of the linear relationships between the questions associated with the research variables. As detailed in [Table 2](#), the average extraction or factor loadings for the topics under consideration cloud computing, blockchain technology, generative artificial intelligence, integrated financial systems, and macroeconomic variables—were 0.6422, 0.8005, 0.7468, 0.9048, and 0.7045, respectively. These results are significant within the context of factor analysis. A variable's loading should approach either -1 or 1 to have a notable impact on the factor, and the communality value must exceed 0.5 to qualify for further analysis. The data clearly indicate that all the items demonstrated moderate to strong correlations with their respective factors, affirming their relevance and significance. Therefore, the weights assigned to these items confirm their validity as effective measures of the intended research variables,

ensuring that the questionnaire is poised to assess accurately what it was designed to evaluate.

4.3. Descriptive Statistics

The author employed purposive sampling and distributed 205 questionnaires, targeting five employees from each bank as outlined in the study methodology. Out of the selected respondents, 186 completed and returned the survey, resulting in a response rate of 90.7%. Twenty-one respondents either declined to participate, submitted incomplete questionnaires, or did not return any questionnaires at all. Respondents were asked to specify their age within the provided ranges to assess their level of work experience and expertise in the banking industry. The results indicated that approximately 21% of the respondents were aged between 20 and 29 years, 43% were between 30 and 39 years, while 23% fell within the 40 to 50-year age range. Additionally, 13% of the respondents were over 50 years old. These findings suggest that the majority of individuals in the banking sector are of middle age, and the majority of employees who provided data for the study are considered to be more experienced. This observation allows for the inference that most employees possess the skills necessary to adapt to banking systems innovation and competitiveness within the banking sector, and they are sufficiently experienced to provide relevant responses to the study questions.

Respondents were also asked to indicate their educational background using the specified categories to determine their level of formal work expertise. The results revealed that approximately 77% of respondents held degrees, 22% had college diplomas or certificates, while only 1% had completed secondary education. These findings underscore that most employees in the banking sector have received formal training, indicating that the majority of those who contributed data to the study are knowledgeable in the banking field. Additionally, respondents were requested to state the number of years they had worked for their organization. Five percent reported having worked for one year or less, 40% indicated employment duration of 1-5 years, 39% had experience ranging from 6-10 years, and 16% had been with the organization for over 10 years. The results presented in [Table 1](#) show that respondents agreed that the adoption of cloud computing, blockchain technology, artificial intelligence, and the use of integrated financial systems have consistently influenced the financial self-sufficiency of commercial banks, with a weighted average exceeding 3.5 and a low variance of less than one.

4.4. Diagnostic Tests

The gathered data underwent a comprehensive series of diagnostic tests to evaluate its suitability for analysis using the chosen multiple linear regression models. This step is critical in ensuring the validity and reliability of the regression results, as deviations from the assumptions of linear regression can lead to misleading conclusions. The classic linear regression model requires several key assumptions to hold true, including linearity, independence of errors, homoscedasticity, and normality of residuals. The researcher meticulously assessed these

assumptions, identifying any potential misspecifications in the model.

To rectify any issues identified, a model with robust standard errors was implemented to guard against problems such as heteroscedasticity, which can occur when the variability of the errors differs across values of an independent variable. Robust standard errors are particularly useful in providing valid hypothesis testing when standard assumptions are not met, thus ensuring more reliable inference despite the presence of variance instability in the data.

In detail, diagnostic tests for the characteristics of the data included evaluations for normality, multicollinearity, heteroscedasticity, and autocorrelation. Normality was assessed using the Shapiro-Wilk test, as suggested by Garson (2012), which is particularly sensitive for smaller sample sizes and provides a powerful method for testing the hypothesis that the data is drawn from a normally distributed population. The Shapiro-Wilk test results indicated that the data was normally distributed, which is vital for the multiple linear regression analysis as it supports the validity of the inferential statistics derived from the model. When assumptions were found to be violated, the researcher utilized models with robust standard errors to ensure that results remained valid. The findings from these diagnostic tests are summarized in Table 5, which presents the results of the normality test,

along with the implications for the data analysis process.

Multicollinearity was examined using the Variance Inflation Factor (VIF) to determine if any of the independent variables were highly correlated with one another, which could distort the estimation process. A VIF value exceeding 5 is commonly interpreted as indicative of problematic multicollinearity. The fundamental rule regarding VIF is that its value should not exceed 10. Since all variables exhibited a VIF of less than 10, the study did not encounter any multicollinearity issues, as illustrated in Table 5.

The Durbin-Watson test was applied in the linear regression model to evaluate autocorrelation. The null hypothesis for the Durbin-Watson test posits that there is no linear autocorrelation in the residuals. The d statistic ranges from 0 to 4; a value between 0 and 2 indicates the presence of autocorrelation, while values between 1.5 and 2.5 suggest the absence of autocorrelation. As shown in Table 6, there were no autocorrelation issues detected.

The Breusch-Pagan test was conducted to assess homoscedasticity, with the null hypothesis stating that homoscedasticity is present. If the null hypothesis is rejected, it implies the existence of heteroscedasticity in the data. A significance level of less than 0.05 leads to the rejection of the null hypothesis. According to Table 7, there were no issues of heteroscedasticity identified.

Table 3. Descriptive Statistics Summary Statements

	Weighted Average	Standard Deviation
Financial Self Sufficiency of Commercial Banks	3.425490196	0.815080206
Macroeconomic variables	3.978823529	0.683146453
Cloud Computing Adoption	3.964705882	0.600977003
Blockchain Technology Adoption	3.976470588	0.801434288
Generative Artificial Intelligence Adoption	3.980343333	0.935056476
Integrated financial systems Usage	3.866666667	0.715382755

Table 4. Normality test

Tests of Normality	Statistic	df	Sig.	Remark
Cloud Computing	0.675	186	0.120	Normally Distributed
Blockchain Technology	0.823	186	0.098	Normally Distributed
Generative Artificial Intelligence	0.714	186	0.067	Normally Distributed
Integrated Payments Systems	0.727	186	0.077	Normally Distributed
Macroeconomic Variables	0.789	186	0.193	Normally Distributed
Financial Self-Sufficiency	0.681	186	0.109	Normally Distributed

a Lilliefors Significance Correction

Table 5. Collinearity Statistics

	Tolerance Limits	VIF	Remark
Cloud Computing	0.434	2.304	No Multicollinearity
Blockchain Technology	0.287	3.484	No Multicollinearity
Generative Artificial Intelligence	0.284	3.521	No Multicollinearity
Integrated Payments Systems	0.166	6.024	No Multicollinearity
Macroeconomic Variables	0.729	1.372	No Multicollinearity

a Dependent Variable: Financial Self-Sufficiency

Table 6. Autocorrelation test

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

Table 7. homoscedasticity test

Chi-Square	Df	Sig.
.074	1	.836

a. Dependent variable: Financial Self Sufficiency

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 + Generative Artificial Intelligence + Integrated financial systems + Macroeconomic variables

4.5. Regression Findings

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 7](#). As per the results above, the R-square value is 0.8574, suggesting that financial innovation (cloud computing, blockchain technology, artificial intelligence, integrated financial systems) account for 85.74% of the financial Self-Sufficiency of commercial banks in Kenya. This summary is shown in [Table 8](#)

Table 8. Regression Model Summary Unmoderated

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.9260	0.8574	0.8557	0.3096

After moderation, the R-square value was 0.7904, suggesting that macroeconomic variables negatively moderated the relationship between financial innovation and financial Self-Sufficiency of commercial banks in Kenya and accounted for 79.04% of the financial Self-Sufficiency of commercial banks in Kenya. There was a negative 6.7% change because of macroeconomic variables effects.

Table 9. Regression Model Summary Moderated

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.8890	0.7904	0.7878	0.3754

4.6. Analysis of Variance

Table 10. ANOVA (b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	49.969	4	12.4922	171.205	.000b
	Residual	5.837	80	0.0730		
	Total	55.806	84			

a. Dependent Variable: Financial Self-Sufficiency

b. Predictors: (Constant), Cloud Computing, Blockchain Technology, Generative Artificial Intelligence, Integrated financial systems

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 financial systems were significant predictors of the financial Self-Sufficiency. The results shown in [Table 10](#) 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 (45.21) in this model is greater than the F critical (at 0.05, 1, 184; F critical= 3.892494384). [Table 4.26](#) shows the results of ANOVA Test.

4.7. Multiple Linear Regression Analysis

Multiple linear regression was computed, and the results are as summarized in [Table 10](#). The coefficients in [Table 11](#) were used to complete the regression equation relating to the dependent and the independent variables as per the below model

$$FSS = 1.0441 + 0.572CC + 0.849CT + 1.9111 GAI + 0.508PS + \epsilon \dots \dots \dots (1)$$

FSS = Financial Self-Sufficiency; CC = Cloud computing; BCT = Block chain technology; GAI = Artificial intelligence; IFS = Integrated financial systems; β_0 = regression coefficients; $\beta_1 - \beta_4$ = Beta Co-efficient of Determination; ϵ = Error term

The coefficients derived from the analysis revealed that cloud computing had a coefficient of 0.572, blockchain technology had a coefficient of 0.849, artificial intelligence exhibited a coefficient of 1.911, and the integrated payment system recorded a coefficient of 0.508. These results indicate that among the variables examined, artificial intelligence exerts the most substantial influence on financial Self-Sufficiency, suggesting that its implementation can significantly enhance operational efficiencies and decision-making processes within financial institutions. Following artificial intelligence, integrated financial systems also play a crucial role in promoting financial Self-Sufficiency, likely due to their ability to streamline transactions and improve cash flow management. Blockchain technology, while impactful, ranks third in terms of contribution, reflecting its potential to enhance transparency and security in financial transactions. In contrast, cloud computing, although beneficial, appears to have the least effect on financial Self-Sufficiency among the variables analyzed.

Furthermore, all independent variables demonstrated a statistically significant impact on financial Self-Sufficiency, as evidenced by p-values that fell below the critical significance level of 0.05. This finding underscores the importance of these technological innovations in shaping the financial landscape and enhancing the Self-Sufficiency of banking operations. The results align with the conclusions drawn by Barbosa and Gracas Murici (2019), who posited that the adoption of advanced technologies enables companies to reduce operational costs and improve customer interactions. This suggests that integrating banking systems innovation not only contributes to cost savings but also enhances service

delivery by minimizing the reliance on human intervention, thereby reducing the potential for errors and inefficiencies.

The implications of these findings are significant for financial institutions seeking to enhance their Self-Sufficiency and competitiveness in an increasingly digital landscape. By prioritizing the adoption of artificial intelligence and integrated financial systems, banks can position themselves to better meet the evolving needs of their customers while simultaneously improving their operational efficiency.

Table 11. Regression Findings Unmoderated

	Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.104	0.2264		4.877	0.00400
	CC	0.572	0.1517	0.12100	3.773	0.03200
	BCT	0.849	0.1776	0.10600	4.778	0.00000
	GAI	1.911	0.2317	0.13800	8.248	0.00000
	IFS	0.508	0.2131	0.23600	2.386	0.00000
a. Dependent Variable: Financial Self sufficiency						

a. Dependent Variable: Financial Self sufficiency

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

$$FSS = -0.876 + 0.289CC + 0.172BCT + 0.204GAI + 0.453IFS - 0.198M + 1.091CC * M + 0.794BCT * M + 0.718GAI * M + 1.012IFS * M + \epsilon$$

Where M is Macroeconomic Indicators

The equation presented above indicates that after incorporating macroeconomic indicators as a moderating variable, the coefficients for cloud computing, blockchain technology, artificial intelligence, and integrated financial systems were 0.289, 0.172, 0.204, and 0.453, respectively.

When macroeconomic indicators were introduced as a moderator, the coefficients changed significantly: cloud computing increased to 1.091, blockchain technology to 0.794, artificial intelligence to 0.718, and integrated financial systems to 1.012. The coefficient for the moderator (M) was recorded at -0.198.

When the values for cloud computing, blockchain technology, artificial intelligence, integrated financial systems, and macroeconomic variables are held constant at zero, the financial self-sufficiency metric remains at a constant value of -0.876.

The findings of the study demonstrated that cloud computing, blockchain technology, artificial intelligence, integrated financial systems, and macroeconomic variables are statistically significant in explaining the financial Self-Sufficiency of commercial banks in Kenya, with p-values less than 0.05. Furthermore, the results indicate that macroeconomic variables exert a negative yet significant influence on financial Self-Sufficiency, as reflected by a coefficient of $\beta = -0.198$ and a p-value of 0.027.

Moreover, the findings suggest that macroeconomic indicators moderated the relationship between banking systems innovation and financial Self-Sufficiency within commercial banks. This is evidenced by the alterations in the coefficients of the independent variables following the introduction of the moderator. Notably, the constant shifted from 1.104 to -0.876, highlighting the impact of moderation in the multiple linear regression model.

These results underscore the complex interplay between

banking innovations and macroeconomic indicators, indicating that while financial technologies can enhance Self-Sufficiency, their effectiveness may be influenced by broader economic conditions. This suggests that banks must consider macroeconomic indicators when implementing banking systems innovation to ensure optimal outcomes. The study emphasizes the importance of a holistic approach to financial Self-Sufficiency, integrating both technological advancements and economic context to foster resilience in the banking sector.

Table 12. Regression Findings for Moderated Model

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-0.876	0.312		-2.808	0.0010
CC	0.289	0.048	0.398	6.021	0.0000
BCT	0.172	0.045	0.194	3.822	0.0030
GAI	0.204	0.031	0.236	6.581	0.0000
IFS	0.453	0.039	0.561	11.615	0.0000
M	-0.198	0.089	0.137	-2.225	0.0290
CC1*M	1.091	0.157	0.372	6.951	0.0200
BCT2*M	0.794	0.101	0.472	7.861	0.0100
GAI3 *M	0.718	0.117	0.389	6.140	0.0000
IFS4*M	1.012	0.329	0.782	3.075	0.0300

a. Dependent Variable: Financial Self sufficiency

a. Dependent Variable: Financial Self sufficiency

The outcomes of this investigation are in agreement with several foundational theoretical concepts, such as financial intermediation theory, the technology acceptance model (TAM), and Schumpeter's theory of innovation. Schumpeter [20] posited that innovation creates new opportunities for profit through the introduction of new products, which subsequently decreases demand for existing products, reduces prices, and eventually makes older products obsolete. This research applied the TAM to assess the acceptance of blockchain technology, demonstrating how perceived usefulness and user-friendliness influence the decision to accept or reject blockchain-based financial services.

The insights gained regarding blockchain technology support the findings of Smith and Johnson [26], who indicated that blockchain technology improves asset securitization, cross-border payments, and bill processing within commercial banks. Their work showed that the adoption of blockchain technology lowers transaction costs and enhances operational effectiveness. In a similar vein, Mavindu, Wacuka, and Ngugi [27] underscored the significant role of government policies, internet accessibility, and transaction expenses in shaping the adoption of blockchain within Kenya's financial landscape. These results reinforce the perspective that blockchain promotes financial self-sufficiency by reducing dependence on centralized systems and advancing financial inclusion.

In terms of generative artificial intelligence, this study aligns with the research conducted by Fares et al. [30], who established that the incorporation of AI in banking improves customer interactions and decision-making processes. However, they also pointed out that customer perceptions and preparedness are critical factors influencing AI's effect on financial self-sufficiency. Ho et al. [31] further demonstrated that AI enhances operational

performance, especially during financial downturns, by alleviating risks and bolstering resilience. Their findings support the claim that companies utilizing AI outperform their traditional peers, thus making AI an essential asset for achieving financial self-sufficiency. Additionally, Iryani and Yulianto [32] emphasized AI's significance in recognizing risks and optimizing financial decisions, highlighting its role in fostering sustainable banking practices.

The discoveries of this study also validate the analysis conducted by Ali [33] regarding cloud computing's application in the banking sector. Ali's study revealed that Software as a Service (SaaS) is the predominant cloud model adopted, mainly utilized for secondary business functions like customer relationship management and human resources. Nonetheless, the research stressed the need to enhance cloud security and flexibility to improve its efficacy in financial services. Similarly, Odhiambo, Mose, and Mwalili [14] looked into the challenges surrounding cloud computing adoption in Kenyan banks, discovering that factors such as data security, organizational culture, supplier dependency, and regulatory frameworks considerably influence the implementation process. Their findings suggest that, while cloud computing presents significant advantages, financial institutions must confront inherent challenges to fully realize its benefits.

In the realm of integrated financial systems, Mohammed, Ibrahim, and Muritala [37] studied the effects of payment innovations on commercial banks in Nigeria. Their findings indicated that mobile payments, online transactions, and Point of Sale (POS) systems have a positive impact on financial self-sufficiency, whereas Real-Time Gross Settlement (RTGS) systems negatively affect returns. These discoveries correspond with the conclusions drawn by Chelangat et al. [34], who found a positive relationship between payment card usage and financial performance among Kenyan banks. Their research highlighted the necessity for ongoing investment in digital payment infrastructure to maintain competitiveness and profitability.

The insights related to macroeconomic indicators resonate with the conclusions made by Emase (2022), who emphasized the need for continuous monitoring of macroeconomic variables owing to their pronounced effects on bank profitability and long-term stability. Similarly, Singh and Sharma (2022) affirmed that effectively managing external economic conditions significantly enhances financial self-sufficiency, reinforcing the idea that commercial banks must integrate both internal and external elements into their strategic decision-making frameworks.

In summary, this study's findings bolster the existing literature on the impact of financial technology in the banking sector while underlining the critical importance of security, strategic alignment, and supportive policies to enhance financial self-sufficiency in Kenya's banking industry.

5. Conclusion and Recommendations

The findings from the regression analysis showed that

financial innovation variables have a strong positive effect on financial Self-Sufficiency. Even when these innovations were examined alongside macroeconomic indicators, their impact remained statistically significant. This supports established theories such as financial intermediation, the technology acceptance model (TAM), and Schumpeter's theory of innovation. Schumpeter (1954) suggested that innovation opens up new profit opportunities by introducing new products, which can reduce demand for older products, lower prices, and ultimately make outdated products obsolete. In this study, TAM was used to evaluate the adoption of blockchain technology, highlighting that perceived usefulness and ease of use are crucial in determining whether users accept or reject blockchain-based financial services.

The results also emphasize that cloud computing provides significant cost advantages, especially when compared to the hefty initial investments needed for traditional IT infrastructure. Cloud solutions allow commercial banks to manage their capacity more effectively, particularly during busy periods when customer demand peaks. The efficiency gained from cloud computing not only helps reduce costs but also mitigates risks and encourages innovation. Additionally, cloud platforms address common technology concerns related to system capacity, redundancy, and resilience. The scalability of cloud computing gives financial institutions better control over security measures, making their operations more secure and adaptable to changing needs.

The adoption of blockchain technology and cryptocurrencies offers financial institutions a chance to reduce risks associated with inaccurate asset valuation and authentication. By integrating digital currencies, all participants in the financial system including individuals, investors, and banks benefit from lower transaction costs and improved financial inclusion. Blockchain technology removes intermediaries, simplifies decision-making processes, and significantly speeds up transaction processing times. Kenyan banks are well-positioned to lead in implementing these technological advancements. As key holders of financial data, banks will not only store and manage vast amounts of information but also leverage blockchain technology beyond just data storage. Furthermore, the adoption of digital currencies will streamline contractual agreements, enabling individuals to participate in financial markets without needing government agencies, intermediaries, or the Central Bank of Kenya (CBK).

While artificial intelligence (AI) is still in its early stages in the banking sector, its potential to optimize financial strategies is substantial. By utilizing advanced AI algorithms, Kenyan banks can improve their ability to manage risks and assets more effectively. AI-driven financial management tools can assist banks in developing revenue models and enhancing operational efficiency. However, the AI systems currently in use tend to be static, primarily focusing on compliance and risk assessment rather than dynamic financial decision-making.

The findings also indicate that the adoption of electronic payment systems has significantly influenced the financial performance of commercial banks. In light of this, the study recommends that the security features of e-payment platforms be continuously reviewed and

improved to boost user confidence. Additionally, transaction fees associated with these platforms should be lowered to encourage wider adoption, and financial institutions should implement awareness campaigns to educate potential users about the benefits of digital payment systems.

According to the study's findings, the adoption of cryptocurrency in Kenya is largely driven by its decentralized nature, as it is not controlled by a single regulatory authority. In a time marked by rising income inequality and financial misconduct, digital currencies promote financial inclusion by bridging gaps in global markets. The implementation of smart contracts in Kenya's banking sector could help mitigate risks associated with financial decision-making for both public and private entities. By removing intermediaries, digital currencies empower private traders to engage in direct transactions, increasing control and flexibility in financial markets. Additionally, technological advancements can help address risks related to inaccurate asset valuation and authentication, ensuring a more secure and transparent financial ecosystem.

To enhance financial self-sufficiency, commercial banks should launch comprehensive media campaigns to educate the public about banking systems innovation and emerging technologies. By raising awareness, banks can encourage consumers to embrace digital financial services. Furthermore, commercial banks, in collaboration with the CBK, should establish a robust dispute resolution framework for electronic payment systems. This initiative would strengthen public confidence in digital banking solutions, ultimately contributing to the long-term financial stability of the banking sector.

Moreover, macroeconomic indicators such as inflation and interest rates were found to significantly influence the financial Self-Sufficiency of commercial banks. The study concludes that financial institutions must pay greater attention to these macroeconomic dynamics and implement strategies to mitigate risks, thereby enhancing their resilience and optimizing risk-adjusted returns.

Policymakers should also work toward simplifying regulations that support financial inclusion initiatives, ensuring broader accessibility and continuous utilization of financial products. Addressing cybersecurity vulnerabilities and reducing reliance on traditional banking processes can further protect customers from risks associated with alternative service delivery channels, such as agency banking, internet banking, and mobile banking.

Given that macroeconomic indicators significantly influence the financial Self-Sufficiency of commercial banks, these institutions must continuously monitor economic indicators and adjust their strategies accordingly. To hedge against interest rate fluctuations and safeguard diverse investment portfolios, banks can adopt financial instruments such as futures contracts on government bonds or interest rate swaps. By proactively managing macroeconomic risks, commercial banks can enhance their profitability and long-term stability.

Future research should build on these findings by incorporating additional contextual variables such as competition, regulatory changes, and portfolio diversification. A comparative analysis of different

regulatory frameworks, including those proposed by the Basel accords, could provide further insights into how financial inclusion policies impact stability. Additionally, further studies should explore the direct role of macroeconomic variables in determining the financial Self-Sufficiency of commercial banks in Kenya. By broadening the scope of research and integrating new contextual factors, future studies can offer a more comprehensive understanding of how banking systems innovations influence financial stability and market dynamics.

For commercial banks to effectively fulfill their role as financial intermediaries, they must remain financially stable, accessible, and available to the market segments they serve. The availability of bank credit and financial services is a key factor in the economic growth of any nation. This underscores the importance of ensuring that banking services are attractive, easily accessible, and free from any form of discrimination. Banking systems innovation play a critical role in achieving this goal. The study established that during the research period, commercial banks in Kenya actively adopted banking systems innovation that influenced their financial Self-Sufficiency. The key drivers of these innovations included cloud computing, artificial intelligence, blockchain technology, and integrated financial systems. The expansion of digital payment platforms and technological advancements in banking services contributed to increased financial penetration. According to the findings, commercial banks have increasingly leveraged financial technologies to enhance service delivery and improve accessibility. This, in turn, resulted in reduced default risk, lower liquidity constraints, and minimized insolvency risks, ultimately promoting financial Self-Sufficiency. The success and survival of commercial banks are, therefore, highly dependent on the efficiency of financial innovation adoption.

6. Limitations of the Study

While this study offers several valuable insights into financial self-sufficiency among Kenyan commercial banks, it is important to acknowledge several limitations that could affect the overall conclusions drawn. Firstly, the research focuses solely on financial self-sufficiency within the context of Kenyan commercial banks, potentially limiting the generalizability of its findings to other financial institutions or regions. This localized focus raises questions about whether the insights can be applied to banks operating in different regulatory or economic environments, making further research in varied contexts essential.

Secondly, although the study utilized primary data collected through questionnaires, the potential biases intrinsic to self-reported data persist. Respondent biases, such as social desirability or misunderstanding of questions, could impact the accuracy and reliability of the responses. Additionally, the results may be influenced by the specific sample of participants selected, as the perceptions and experiences of the respondents may not wholly represent the broader population of financial professionals across all Kenyan banks.

Moreover, while this study acknowledges the significance of regulatory frameworks on the adoption of financial technologies, it does not delve deeply into this essential topic. Regulatory influences significantly shape the environment in which financial innovations are implemented and can either facilitate or hinder the adoption process. Failure to explore these factors thoroughly may overlook important intervening variables that contribute to financial self-sufficiency.

Lastly, although the research applies theoretical models to assess technology adoption, aspects such as user trust, cybersecurity concerns, and cultural resistance to digital transformation warrant further qualitative exploration. These dimensions are vital for understanding the broader implications of financial technology adoption and how they interact with user behavior and institutional practices.

To minimize common method bias, the study incorporated various procedural and statistical measures. The data collection process maintained respondent anonymity and confidentiality to reduce response bias. Multiple authoritative sources were consulted to triangulate the findings, enhancing the validity of the results. bias was not a substantial concern in this research.

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