



THE EFFECTS OF DIGITALIZATION ON OPERATIONAL PERFORMANCE OF COMMERCIAL BANKS IN ZAMBIA

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ABSTRACT: *This study examined the effects of digitalization on the operational performance of commercial banks in Zambia, focusing on key performance indicators such as cost efficiency, profitability, and service delivery. The primary objective was to analyze how digital banking technologies—such as mobile banking, internet banking, and automated payment systems—impacted operational performance in the banking sector. The study's specific objectives included evaluating the correlation between digitalization and operational performance, studying the relationship between these variables, and assessing the effects of macroeconomic control factors. A quantitative research design was employed, utilizing secondary monthly time-series data from 2018 to 2023, with 72 observations collected from the Bank of Zambia and the Zambia Statistics Agency. Data analysis was conducted using Pearson's correlation analysis and multiple regression analysis to determine the relationship between digitalization, macroeconomic factors, and operational performance. Key regression analysis findings indicated a strong positive and statistically significant relationship between digitalization and operational performance (coefficient for digitalization = 3.004). In contrast, GDP growth exhibited a negative relationship (coefficient = -1.344), while inflation and non-performing loans had statistically insignificant effects. The model explained 49.8% of the variation in operational performance. The study concluded that digitalization had significantly improved the efficiency and customer service of Zambian banks, helping them mitigate the adverse effects of economic downturns. The study's implications emphasized the importance of continued investment in digital banking technologies, cybersecurity, and digital literacy programs. Recommendations for commercial banks include enhancing digital infrastructure and expanding digital banking accessibility in underserved areas. Policymakers were encouraged to support digital innovation while ensuring consumer protection. Future research should explore the long-term effects of digitalization and emerging technologies such as AI and blockchain in the banking sector.*

KEYWORDS: Digitalization, Operational Performance, Commercial Banks, Zambia, Digital Banking.



INTRODUCTION

Background

Digitalization in banking refers to the integration of digital technologies into all aspects of banking operations, transitioning from traditional models to digital services that improve efficiency, reduce costs, and enhance customer experiences (Agarwal, 2010). This shift has been accelerated by advancements in financial technology (FinTech), artificial intelligence (AI), big data analytics, and blockchain, enabling various digital channels such as internet and mobile banking, ATMs, and electronic payments (Zhang et al., 2021). The COVID-19 pandemic further accelerated this transformation, with global mobile banking transactions growing by 121% from 2019 to 2022, reflecting a significant shift in consumer banking behavior (McKinsey & Company, 2023). Across the globe, digital-only banks and mobile money platforms like M-Pesa in Kenya have disrupted traditional banking models and provided financial services to previously unbanked populations in Africa, facilitating financial inclusion (GSMA, 2022).

In Zambia, digital banking has progressively enhanced operational performance and financial inclusion, supported by a high mobile phone penetration rate of 96.8% by 2022 (BoZ, 2023). Major commercial banks have introduced mobile banking applications, internet banking services, and agent banking networks, facilitating easier financial transactions (Hermuningsih et al., 2022). Mobile money services, such as MTN Mobile Money and Airtel Money, have led to an increase in digital transactions, rising from 30% in 2017 to 67% in 2022 (BoZ, 2023). Despite these advances, challenges such as limited digital literacy, cybersecurity risks, and inadequate internet access in rural areas continue to hinder the full-scale adoption of digital banking in Zambia (Munyanyi & Goredema, 2023). Furthermore, regulatory uncertainties surrounding digital financial services create additional barriers for financial institutions and FinTech startups (Mwanza & Chisanga, 2022). These barriers limit the capacity of digital banking to reach its full potential, despite the significant strides made.

While Zambia's banking sector has made notable progress in embracing digitalization, it still faces significant hurdles that prevent it from fully realizing the potential of digital banking (Kabwe & Phiri, 2022). Limited digital infrastructure, cybersecurity concerns, and regulatory gaps remain key challenges (BoZ, 2023). This study aims to bridge the existing knowledge gap by examining the effects of digitalization on the operational performance of commercial banks in Zambia, focusing on the role of digital banking in enhancing efficiency and financial inclusion while addressing the associated challenges (Berger et al., 2021).

Statement of the Problem

While digitalization has generally been associated with improved banking operations and service delivery, its actual impact on operational performance in Zambia remains unclear. Some commercial banks have reported increased profitability and enhanced customer engagement due to digital banking innovations, with mobile banking services contributing a 37% increase in customer transactions between 2017 and 2022 (BoZ, 2023), while others face persistent challenges such as system downtimes, cybersecurity threats, and compliance with evolving regulatory frameworks (Kabwe & Banda, 2023). Additionally, the high cost of digital infrastructure and the digital divide—where a significant portion of the population lacks access to smartphones (48% of Zambians) or stable internet (approximately 43% rural coverage)—



pose barriers to the effectiveness of digital banking solutions (Munyanyi & Goredema, 2023). These inconsistencies highlight the need for a comprehensive analysis of how digitalization influences key performance indicators such as cost efficiency, revenue generation, and service quality in the Zambian banking sector. Despite the increasing adoption of digital banking in Zambia, with 67% of the population using mobile banking services by 2022 (BoZ, 2023), there is limited empirical evidence on its impact on banking efficiency, customer satisfaction, and financial inclusion. While studies such as Vives (2019) have explored global digital banking trends and Makumba & Phiri (2023) have examined digital banking adoption in Zambia, there remains a gap in understanding how digitalization specifically influences operational efficiency, cost reduction, and customer experience in commercial banks. The extent to which digital banking contributes to financial inclusion, particularly among underserved populations in Zambia, has also not been fully determined. Without this knowledge, banks may struggle to develop and optimize digital banking strategies that maximize efficiency and customer satisfaction while ensuring financial accessibility.

Research Objectives

The primary objective of this study was to study the effects that digitalization has on the operational performance of commercial banks in Zambia from 2018 to 2023. Specific objectives of the study were to:

- i) analyze the strength of correlation between digitalization and operational performance in Zambia for the period 2018 to 2023.
- ii) analyze the connection between digitalization and operational performance in Zambia for the period 2018 to 2023.
- iii) study the effects of model control variables on operational performance in Zambia for the period 2018 to 2023.

LITERATURE REVIEW

Digitalization Level

The global banking sector is undergoing a significant transformation driven by advancements in digital technologies such as artificial intelligence (AI), blockchain, big data analytics, cloud computing, and mobile banking applications (Berger et al., 2021; Zhang et al., 2021). These technologies are reshaping banking operations, improving efficiency, customer experience, and competitive advantage. The shift towards digitalization has been fueled by changing consumer expectations for tailored, instantaneous banking experiences, and the competitive dynamics within the industry, where fintech firms and tech-centric banks are gaining ground (Kumar & Patel, 2021). In Zambia, mobile banking services like Airtel Money and MTN MoMo have seen significant adoption, improved financial transactions, and enhanced financial inclusion through agency banking, which connects urban and rural areas (GSMA, 2022; BoZ, 2023). However, Zambia's digital transformation faces several challenges, including inadequate infrastructure, poor internet connectivity, and insufficient digital skills, especially in rural areas (Munyanyi & Goredema, 2023). These barriers hinder the full potential of digital banking. Additionally, cybersecurity threats and unreliable power supply pose risks to the stability of



digital platforms (Mwanza & Chisanga, 2022). To overcome these challenges, Zambian banks must invest in robust digital infrastructure, promote digital literacy, and strengthen cybersecurity measures (BoZ, 2023). Revising regulatory frameworks to foster innovation while protecting consumers is also crucial. By addressing these issues, Zambia's banking sector can leverage digital transformation to improve operational efficiency, expand financial access, and drive economic growth (Berger et al., 2021).

Operational Performance

Operational efficiency is a core element of sustainable banking, essential for enhancing resource utilization, reducing costs, and improving customer service, all of which shape a bank's profitability and competitiveness (Agarwal, 2010). Metrics such as the efficiency ratio, branch productivity, and transaction processing time are commonly used to evaluate performance (Teck-Hong & Waheed, 2011). Digitalization has significantly improved operational efficiency by automating routine tasks, reducing human error, and speeding up transaction processing (Berger et al., 2021). Mobile banking platforms allow customers to perform seamless transactions, while AI-powered chatbots enhance customer service by managing inquiries efficiently, reducing reliance on call centers (Kabwe & Phiri, 2022). In Zambia, digital solutions like mobile banking and agency banking have greatly improved loan application processes, transaction speed, and service delivery, leading to better customer experiences (Hermuningsih et al., 2022).

However, the path to achieving full operational efficiency through digital transformation presents challenges, including high upfront costs for technology infrastructure and cybersecurity measures, particularly for smaller banks (Mwanza & Chisanga, 2022). Additionally, resistance to change from staff and customers, coupled with regulatory complexities, hinders the smooth implementation of digital solutions (BoZ, 2023). To overcome these challenges, Zambian banks must invest in employee training to enhance digital skills, promote digital literacy among customers, and adopt scalable technologies like cloud computing and AI (Munyanyi & Goredema, 2023). Collaboration with fintech firms can also provide access to advanced solutions without the need for internal development (Gomber et al., 2021). By leveraging digital tools, banks can enhance service delivery, build customer relationships, and drive sustainable growth while staying competitive in a rapidly evolving financial landscape (Kumar & Patel, 2021).

The Relationship Between Digitalization Level and Operational Performance

The relationship between the level of digitalization and operational performance in banking has been widely explored in contemporary literature, with a clear consensus that higher levels of digitalization contribute significantly to improving operational efficiency, service delivery, and customer satisfaction. Digital technologies such as mobile banking, AI, big data, and blockchain are integral to transforming banking operations, automating routine tasks, reducing human errors, and streamlining transaction processes. These advancements allow banks to enhance the speed and accuracy of services, lower operational costs, and provide customers with seamless, 24/7 access to financial services. Studies such as Berger et al. (2021) and Manasseh et al. (2023) have shown that digital banking adoption leads to higher profitability, improved resource utilization, and stronger competitive advantage by shifting banks away from traditional models to more efficient, technology-driven platforms. In Zambia, the adoption of mobile banking and agency banking has similarly improved customer access to banking



services, especially in rural areas, further driving financial inclusion and contributing to better operational performance.

However, while the benefits of digitalization in improving operational performance are evident, challenges remain in fully leveraging these technologies, particularly in developing economies like Zambia. Factors such as inadequate digital infrastructure, cybersecurity threats, and limited digital literacy continue to hinder the widespread adoption of digital banking solutions. As noted by Mwansa and Chileshe (2023), these barriers affect the efficiency of banking operations, as many potential customers and staff lack the skills or resources to fully engage with digital platforms. Moreover, high upfront costs for technology infrastructure and regulatory challenges related to data protection and financial security add complexity to the process. Despite these hurdles, studies emphasize the importance of investing in digital skills training, robust cybersecurity measures, and regulatory frameworks that support innovation while ensuring consumer protection. As banks in Zambia continue to adopt and scale digital solutions, the relationship between digitalization and operational performance will likely deepen, improving both customer satisfaction and financial performance in the long run.

Empirical Review

Globally, Davis (2022) conducted a study to assess the impact of digital banking on operational efficiency in the U.S. banking sector. Utilizing a quantitative analysis of data from 50 banks, the study found that the adoption of digital banking technologies resulted in a significant 30% reduction in operational costs. This reduction was primarily due to the automation of tasks, such as customer service, transaction processing, and back-office operations, which led to reduced labor and infrastructure costs. Digital banking also streamlined service delivery, allowing banks to serve more customers with fewer resources, further enhancing efficiency. However, while the study effectively demonstrated the cost-saving benefits of digital banking, it did not address the potential risks associated with cybersecurity, which is a critical concern in the digital era. As banks increasingly rely on digital platforms, they become more vulnerable to cyber threats, including data breaches, hacking, and fraud. Cybersecurity risks could potentially offset the operational gains if not properly managed, making it an essential factor to consider in any comprehensive analysis of digital banking's impact.

Lee & Chen (2021) analyzed the relationship between mobile banking and revenue generation, with a particular focus on Chinese banks. Through a case study methodology, the research revealed a notable 25% increase in revenue as a result of mobile banking adoption. The study emphasized how mobile platforms have enabled banks to reach a broader customer base and offer services more efficiently, leading to higher revenue. However, the study's limitation lies in its exclusive focus on large banks, neglecting the experiences of smaller financial institutions. Smaller banks may face unique challenges, such as limited resources and lower technology adoption rates, which could result in different outcomes regarding mobile banking. This gap suggests that future research could benefit from examining a more diverse range of banking institutions.

Singh et al. (2023) explored the role of AI adoption in enhancing banking efficiency in Europe through a mixed-method study. The research highlighted AI's positive impact on key areas such as fraud detection and loan processing, which helped improve operational efficiency and reduce errors. By automating these complex processes, AI has the potential to significantly enhance the overall performance of banks. However, the study's limitations include a lack of



long-term data on AI's effects, particularly regarding its sustained impact on banking operations and the broader banking ecosystem. Without a deeper understanding of how AI evolves and integrates over time, it is difficult to fully assess its long-term effectiveness and potential risks.

Kumar & Patel (2021) examined the adoption of blockchain technology in the banking sector through qualitative interviews. Their findings suggested that blockchain significantly improved the security of banking systems by offering a decentralized ledger that enhances transparency and reduces fraud. Despite these advantages, the study pointed out the high adoption costs associated with implementing blockchain technology, including the need for specialized infrastructure and training. The study's critique lies in its reliance on qualitative data, which, while insightful, lacks the empirical evidence needed to conclusively validate blockchain's operational benefits and challenges. A more quantitative approach, backed by real-world case studies, could provide stronger evidence of the technology's true potential in banking.

From an African perspective, Abor et al. (2023) conducted a study on the adoption of fintech solutions in Ghanaian banks, using a quantitative analysis to assess the efficiency gains from fintech integration. The study concluded that fintech adoption improved operational efficiency by 20%, demonstrating the potential of digital technologies in enhancing service delivery and streamlining banking operations. However, the research did not account for the regulatory challenges faced by fintech companies in Ghana, such as compliance with financial regulations and the lack of clear guidelines for digital banking products. These challenges could significantly impact the long-term effectiveness and sustainability of fintech solutions, making it crucial for future studies to examine the regulatory environment alongside technological adoption.

Ngugi (2022) assessed the impact of digital lending platforms in Kenya through a case study of three major banks. The study found that digital lending platforms played a pivotal role in expanding access to financial services, particularly for underserved populations that had limited access to traditional banking. By providing faster and more convenient loan application processes, these platforms made financial services more accessible to a broader segment of society. However, a key critique of the research is its narrow focus on the platforms themselves, without addressing the issue of high-interest rates often associated with digital lending. These rates can pose financial risks to consumers, leading to over-indebtedness and undermining the positive outcomes of expanded access.

Adeyemi & Ibrahim (2021) explored the impact of internet banking in Nigeria through a longitudinal study, which revealed that internet banking reduced transaction costs by enabling remote access to banking services. However, this reduction in costs was accompanied by an increase in fraud risks, as digital platforms became attractive targets for cybercriminals. Despite these insights, the study lacked a deep dive into customer experience, which could provide valuable information about how users interact with internet banking services and how they perceive the security and reliability of these platforms. Future research could benefit from incorporating customer feedback to offer a more holistic view of internet banking's impact on Nigerian users.

From the Zambian perspective, Kabwe & Phiri (2022) conducted a case study on mobile banking in Zambia, revealing that mobile banking services have seen increased adoption among Zambian consumers. The study found that the convenience and accessibility of mobile



banking made it an attractive option for users, especially in rural areas. However, the research also identified significant security challenges, such as fraud and data breaches, which undermine the trust and safety of these platforms. A key critique of the study is its failure to assess customer satisfaction, which is essential for understanding the broader user experience and determining how mobile banking can be improved to meet consumer needs.

Mwanza & Chisanga (2022) analyzed the impact of digital lending platforms in Zambia through a survey-based study, which found that these platforms had improved loan accessibility, particularly for those who were previously excluded from traditional financial services. However, the study also noted a challenge in the form of high default rates, which could affect the sustainability of digital lending in Zambia. A major critique of the research was its limited focus on the regulatory frameworks governing digital lending, which are crucial in addressing the risks associated with high default rates and ensuring that these platforms operate within a safe and sustainable environment.

Banda (2021) explored the impact of digital financial inclusion in Zambia using a mixed-methods study, which concluded that digital banking services had improved access to banking for many Zambians, particularly in urban areas. Despite these positive outcomes, the study highlighted that rural areas still face challenges in accessing digital financial services, limiting the reach of digital banking initiatives. A key critique of the research was its limited discussion on financial literacy, which is essential for ensuring that individuals can effectively use digital financial services. Without proper financial education, users may struggle to navigate digital platforms and fully benefit from the opportunities they provide.

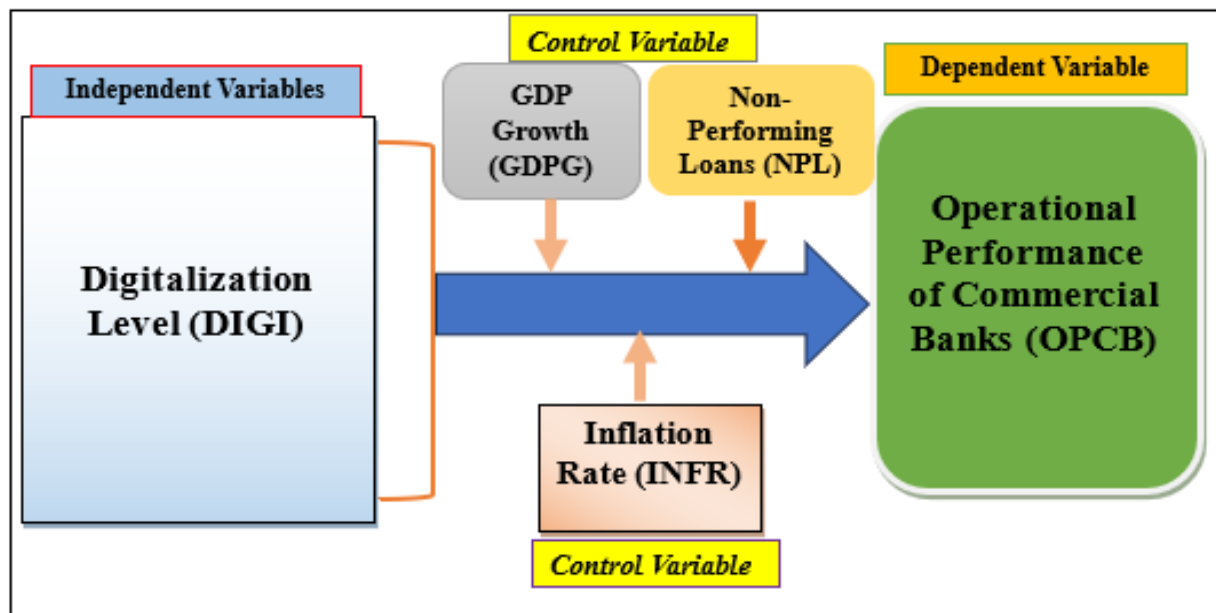
Zulu & Tembo (2022) evaluated the adoption of e-banking in Zambia through a quantitative study, which found that e-banking enhanced convenience for users, making banking services more accessible and faster. However, the study also pointed out the need for improved cybersecurity measures to protect users' personal and financial data, as cyber threats remain a significant concern. A critique of this research is its failure to address the cost implications of e-banking adoption, both for banks and customers. While the convenience and efficiency of e-banking were clear, the associated costs, including the investment in technology and ongoing maintenance, pose challenges for the long-term sustainability of e-banking services in Zambia.

Theoretical Framework and Conceptual Model

This study was based on the Technology Acceptance Model (TAM), which explained how users accept and adopt new technologies, with perceived usefulness (PU) and perceived ease of use (PEU) being key factors in this process. In the context of digital banking, PU refers to how digital platforms improve banking efficiency and service delivery, while PEU pertains to the simplicity and accessibility of these systems. TAM has been widely applied in banking digitalization, with research indicating that user perception, trust, and regulatory support are critical for adoption. In Zambia, digital banking platforms like mobile banking and internet banking are increasingly used to enhance operational performance, but challenges such as cybersecurity risks and infrastructure limitations affect adoption. This study also incorporates the Diffusion of Innovations Theory (DoI), which explores how innovations spread within organizations and societies, considering factors like relative advantage and compatibility. By integrating TAM and DoI, the study provides a comprehensive framework to assess digitalization in Zambia's banking sector.

The conceptual framework for this study examines how digitalization in the banking sector affects operational performance in commercial banks. Digitalization, represented by the shift to technology-driven services like mobile banking, internet banking, electronic payments, and automated services, aims to improve customer experience, reduce costs, and enhance service accessibility. The dependent variable, operational performance, is measured primarily by return on assets (ROA), which reflects a bank's efficiency in generating earnings. The study also considers the number of mobile banking accounts as an indicator of digitalization and includes the capital adequacy ratio to assess the impact of financial stability. The relationship between digitalization and operational performance is moderated by factors such as bank size, GDP growth, and inflation, which influence the effectiveness of digital strategies and the overall performance of banks.

Figure 1: Conceptual Model



Source: *Author's Compilation, 2025*

Research Hypotheses

The research hypotheses for this study are formulated based on the research objectives and are stated as follows:

Hypothesis 1 (Correlation between Digitalization and Operational Performance, 2018–2023)

H₀: There is no significant correlation between digitalization and the operational performance of commercial banks in Zambia from 2018 to 2023.

H₁: There is a significant correlation between digitalization and the operational performance of commercial banks in Zambia from 2018 to 2023.

Hypothesis 2 (Connection between Digitalization and Operational Performance, 2018–2023)

H₀: Digitalization does not have a significant relationship with operational performance in commercial banks in Zambia from 2018 to 2023.



H₁: Digitalization has a significant relationship with operational performance in commercial banks in Zambia from 2018 to 2023.

Hypothesis 3 (Effect of Model Control Variables on Operational Performance, 2018–2023)

H₀: Model control variables do not have a significant impact on the operational performance of commercial banks in Zambia from 2018 to 2023.

H₁: Model control variables have a significant impact on the operational performance of commercial banks in Zambia from 2018 to 2023.

Operationalization of Study Variables

The study variables for this study are operationalized as follows:

- Digitalization: Measured by the adoption rate of digital banking channels (e.g., number of active mobile banking users).
- Operational Performance: Assessed using the metric return on assets (ROA), and customer satisfaction indices.
- Gross Domestic Product Growth: Measured by GDP growth rate (%) as reported by the Bank of Zambia (BoZ) or Zambia Statistics Agency.
- Inflation Rate: Measured by the annual inflation rate (%) as reported by the Bank of Zambia (BoZ) or Zambia Statistics Agency (ZamStats).
- Non-Performing Loans: It is the total number of loans in default or even close to being in default as reported by the Bank of Zambia (BoZ).

METHODOLOGY

The study adopts a positivity research philosophy, which emphasizes objectivity, empirical measurement, and the use of quantitative methods to analyze relationships between variables (Saunders et al., 2019). This philosophy aligns with the study's aim of assessing the impact of digitalization on the operational performance of commercial banks in Zambia through statistical analysis and hypothesis testing. Following a deductive research approach, the study begins with a theoretical foundation based on existing literature and empirical findings, from which specific hypotheses are formulated (Creswell & Creswell, 2023). These hypotheses are then tested using quantitative data collected from commercial banks, ensuring a structured and systematic examination of causal relationships. By employing quantitative methods, the study ensures replicability, reliability, and generalizability of findings, which are essential for drawing objective conclusions about the influence of digitalization on banking performance. This approach allows for statistical validation of hypotheses, minimizing bias and enhancing the rigor of the research process.

This study uses a descriptive and explanatory research design to both provide a detailed account of digitalization trends and performance indicators in the banking sector and identify causal relationships between digitalization and operational performance, allowing for a



comprehensive understanding of how digital initiatives impact efficiency, service delivery, and financial outcomes.

Model Specification

The multiple regression model is as specified below:

$$OPCB = \beta_0 + \beta_1 LNDIGI + \beta_2 GDPG + \beta_3 INFR + \beta_4 LNNPL + \varepsilon$$

Where:

- $OPCB$ = Operational Performance of Commercial Banks (*Dependent Variable*)
- $LNDIGI$ = Natural Log of Digitalization Level (*Independent Variable*)
- $GDPG$ = GDP Growth (*Control Variable*)
- $INFR$ = Inflation Rate (*Control Variable*)
- $LNNPL$ = Natural log of Non-Performing Loans (*Control Variable*)
- β_0 = Intercept
- $\beta_1, \beta_2, \beta_3, \beta_4$ = Coefficient of the predictors
- ε = Error term

The target population for this study includes all registered commercial banks in Zambia, as listed by the Bank of Zambia (BoZ, 2024). However, the study specifically focuses on top-tier banks with well-established digital banking services, as these institutions are leading the digital transformation in Zambia's banking sector. Secondary monthly time-series data from BoZ and the Zambia Statistics Agency (ZamStats) covering 2018 to 2023 is used to provide a comprehensive longitudinal analysis of digitalization trends and their impact on operational performance. The use of secondary data ensured accuracy, consistency, and objectivity in the analysis, minimizing respondent bias and offering a broad perspective on the banking sector.

The sample size consists of 168 observations (12 months per year for 14 years) derived from secondary data provided by BoZ and ZamStats. This dataset allows for robust econometric analysis, including correlation, regression modeling, and time-series diagnostics. The study's data collection involves retrieving publicly accessible data from these agencies, ensuring its reliability and comparability across the study period. The data undergoes cleaning and validation processes to ensure accuracy and consistency before being used for econometric tests. Once prepared, the data is analyzed using various methods such as descriptive statistics, multiple regression, and diagnostic tests to examine the relationship between digitalization and banking performance, ensuring that the study provides credible insights into the role of digital transformation in Zambia's banking sector.



Post Diagnostic Tests

Post-diagnostic tests were essential for ensuring the robustness, reliability, and validity of the econometric models in this study. These tests assessed assumptions such as autocorrelation, heteroskedasticity, and multicollinearity to ensure that the results were not distorted. Autocorrelation tests, such as the Durbin-Watson test, checked for bias in residuals, while heteroskedasticity tests, like the Breusch-Pagan test, ensured constant variance in errors. Multicollinearity tests, including the Variance Inflation Factor (VIF), identified high correlations among independent variables. Additionally, normality tests (e.g., Jarque-Bera) ensured residuals were normally distributed, and model specification tests (e.g., Ramsey RESET) verified that the correct model was used. Goodness-of-fit tests, such as R-squared and F-statistics, were also applied to evaluate the model's explanatory power and statistical significance. These diagnostics helped refine the models, by ensuring that the findings were valid and reliable for drawing conclusions.

Ethical considerations in this study were crucial to ensure integrity, reliability, and societal benefit. Since the study used secondary data from sources like the Bank of Zambia and Zambia Statistics Agency, maintaining data privacy and confidentiality was essential. The research ensured transparency, avoided manipulation or selective reporting, and remained objective to prevent bias. Additionally, the study respected intellectual property rights and aimed to prevent harm, particularly regarding policy recommendations. The outcomes focused on positively impacting financial inclusion and banking efficiency, with proper acknowledgment of data sources to uphold academic integrity.

RESEARCH RESULTS

Descriptive Statistics

Table 1 presented the descriptive statistics for four key variables: Operational Performance of Commercial Banks (OPCB), Level of Digitalization (LNDIGI), Gross Domestic Product Growth (GDPG), and Inflation Rate (INFR). The Operational Performance of Commercial Banks (OPCB) variable has values ranging from 44.915 to 103.913, with an average of 60.846 and a standard deviation of 10.873, indicating moderate variation in the operational efficiency of banks within the sample. The LNDIGI variable spans from 8.490 to 13.405, with a mean of 10.847 and a standard deviation of 1.413, reflecting a moderate adoption of digital technologies across the banks studied. The GDPG variable ranges from -5.000 to 8.900, with a mean of 3.296 and a standard deviation of 3.688, showing significant fluctuations in economic growth within the sample period. The INFR variable varies from -6.100 to 24.600, with a mean of 12.717 and a standard deviation of 5.173, indicating substantial variation in inflation levels across the data. These statistics reveal the extent of variability and the distribution characteristics of the key variables in the study.

**Table 1: Descriptive Statistics Presentation**

Variable Name	Min	Max	Mean	Std. Dev.	Skewness	Kurtosis
OPCB	44.915	103.913	60.846	10.873	1.016	2.004
LNDIGI	8.490	13.405	10.847	1.413	0.330	-0.733
GDPG	-5.000	8.900	3.296	3.688	-0.476	-0.339
INFR	6.100	24.600	12.717	5.173	0.949	-0.190
LNNPL	8.256	12.310	10.95301	0.871	-1.401	2.334

Source: Author's Compilation from SPSS 25

Correlation Analysis

The Pearson's correlation matrix in Table 2 below revealed several key relationships between the OPCB and the study's variables. A strong positive correlation of 0.622 (p-value = 0.000) exists between the LNDIG and OPCB, indicating that increased digitalization was significantly associated with improved operational performance. In contrast, the correlation between GDP Growth and OPCB was negative (-0.587, p-value = 0.000), suggesting that lower GDP growth was linked to better operational performance, possibly due to a greater reliance on digital innovations during economic downturns. The relationship between the INFR and OPCB was weak and statistically insignificant (-0.127, p-value = 0.288), implying that inflation had a minimal direct impact on operational performance. Similarly, the correlation between the LNNPL and OPCB was also weak and insignificant (-0.125, p-value = 0.340), indicating that non-performing loans did not significantly affect the operational performance of commercial banks during the study period.

Furthermore, the negative correlation between LNDIG and INFR (-0.280, p-value = 0.017) suggested that increased digitalization may help mitigate the effects of inflationary pressures on banks. The relationship between LNDIG and LNNPL was also negative (-0.124, p-value = 0.346), implying that banks with higher levels of digitalization could be more effective in managing loan defaults through automated systems. Additionally, the negative correlation between LNDIG and GDPG (-0.399, p-value = 0.001) indicated that banks tend to increase digitalization efforts when economic growth slows, likely as a strategy to maintain operational efficiency. Finally, the weak positive correlation between INFR and LNNPL (0.071, p-value = 0.589) showed no significant relationship between inflation and non-performing loans.

Table 2: Pearson's Correlation Matrix

VARIABLE		OPCB	LNDIGI	GDPG	INFR	LNNPL
OPCB	Pearson Correlation	1.000				
	Sig. (2-tailed)					
LNDIG	Pearson Correlation	0.622**	1.000			
	Sig. (2-tailed)	0.000				
GDPG	Pearson Correlation	-0.587**	-0.399**	1.000		
	Sig. (2-tailed)	0.000	0.001			
INFR	Pearson Correlation	-0.127	-0.280*	-0.185	1.000	
	Sig. (2-tailed)	0.288	0.017	0.120		
LNNPL	Pearson Correlation	-0.125	-0.124	-0.038	0.071	1.000



Sig. (2-tailed)	0.340	0.346	0.776	0.589	
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**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Source: Author's Compilation from SPSS 25

Multiple Regression Analysis

Table 3 below presented the model summary from the regression analysis examining the effects of digitalization and control variables on the operational performance of commercial banks in Zambia from 2018 to 2023. The model showed a strong positive relationship with an R value of 0.706, indicating that digitalization and the control variables (GDPG, INFR, and LNNPL) collectively explained a substantial portion of the variation in operational performance. The R-squared value of 0.498 revealed that 49.8% of the variation in operational performance was explained by the model, while the adjusted R-squared value of 0.461 accounted for multiple predictors.

Table 3: Model Summary

Model	R	R-Square	Adj. R-Square	Std. Error Est.	Durbin-Watson
1	0.706 ^a	0.498	0.461	8.140216	2.198

a. Predictors: (Constant), LNNPL, GDPG, INFR, LNDIGI

b. Dependent Variable: OPCB

Source: Author's Compilation from SPSS 25

Table 4 below presents the Analysis of Variance (ANOVA) results, which assessed the overall significance of the regression model examining the impact of LNDIG and control variables (GDPG, INFR, and LNNPL) on OPCB in Zambia from 2018 to 2023. The F-statistic value of 13.631 indicated a strong fit of the model, explaining a substantial portion of the variation in operational performance. The p-value of 0.000 was statistically significant at the 0.01 level, confirming that at least one independent variable significantly influenced operational performance.

Table 4: Analysis of Variance Results

Model		Sum of Squares	df	Mean Square	F	P-Value
1	Regression	3612.921	4	903.230	13.631	0.000 ^b
	Residual	3644.471	55	66.263		
	Total	7257.392	59			

a. Dependent Variable: OPCB

b. Predictors: (Constant), LNNPL, GDPG, INFR, LNDIG

Source: Author's Compilation from SPSS 25

Table 5 below presented the regression coefficients and collinearity statistics for the model analyzing the impact of digitalization and control variables on the OPCB in Zambia. The constant (B = 47.409, p = 0.015) suggested positive baseline operational performance, even without the influence of digitalization or macroeconomic variables. The coefficient for LNDIGI was 3.004 (p = 0.002), indicating a positive and statistically significant relationship with OPCB. This means that for every one-unit increase in digitalization, operational performance improves by 3.004 units, suggesting that digital transformation played a crucial



role in enhancing the operational efficiency of commercial banks. The coefficient for GDPG was -1.344 ($p = 0.000$), indicating a negative and statistically significant relationship with OPCB. This suggested that as GDP growth increases, operational performance decreased by 1.344 units, which could imply that during periods of economic growth, competition and operational costs may rise, reducing overall efficiency.

The coefficient for INFR was -0.180 ($p = 0.436$), showing a negative but statistically insignificant relationship with OPCB. This suggested that inflation had a minimal impact on the operational performance of commercial banks during the study period, and its effect was not significant enough to influence performance. The coefficient for LNNPL was -1.155 ($p = 0.352$), indicating a negative but statistically insignificant relationship with OPCB. This suggests that non-performing loans do not significantly impact the operational performance of commercial banks, likely due to the digital monitoring systems that mitigated the effects of loan defaults. Furthermore, the VIF values range from 1.023 to 1.374, and tolerance values range from 0.728 to 0.978, confirming no significant multicollinearity between the independent variables.

Table 5: Regression Coefficients and Collinearity Statistics

Model	Unstandardized Coefficients			T-Stats	P-Value	Collinearity Statistics	
	B	Std. Error				Tolerance	VIF
1	(Constant)	47.409	18.966	2.500	0.015		
	LNDIGI	3.004	0.900	3.336	0.002	0.728	1.374
	GDPG	-1.344	0.314	-4.279	0.000	0.761	1.314
	INFR	-0.180	0.229	-0.785	0.436	0.787	1.271
	LNNPL	-1.155	1.231	-0.939	0.352	0.978	1.023

Source: Author's Compilation from SPSS 25

Post Model Diagnostic Tests

The Ramsey RESET test in Table 6 below was used to check for model misspecification by assessing whether the functional form of the regression model was correctly specified. In this study, the test evaluated the relationship between LNDIG, GDPG, INFR, LNNPL, and OPCB in Zambia. Table 4.6 showed that the p-values from the test exceeded conventional significance levels (0.01, 0.05, and 0.10), indicating that the test failed to reject the null hypothesis of correct model specification. This suggested no misspecification errors in the regression model, supporting its validity for addressing the study's research objectives.

Table 6: Ramsey RESET Test

	Value	df	Probability
t-statistic	1.099	54	0.277
F-statistic	1.208	(1, 54)	0.277
Likelihood ratio	1.328	1	0.249

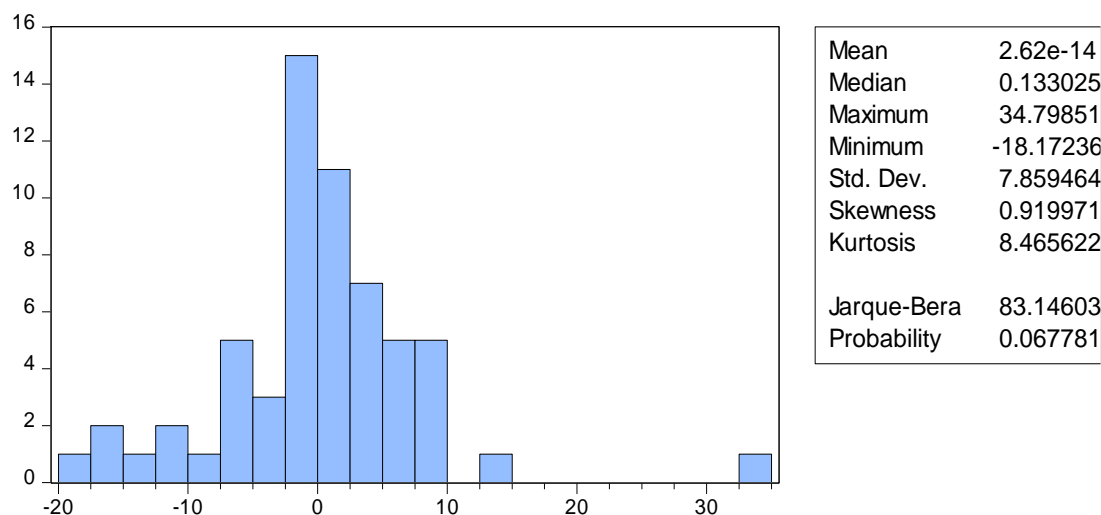
Source: Author's Compilation from EViews 10, 2025

The Jarque-Bera (JB) test in Figure 2 below showed a JB statistic of 83.14603 with a p-value of 0.0678, indicating a marginal deviation from normality. Since the p-value exceeded 0.05,



we failed to reject the null hypothesis that the residuals were normally distributed, though the result was marginally significant at the 10% level.

Figure 2: Normality Test Results of Residues



Source: Author's Compilation from EViews 10, 2025

The Breusch-Pagan-Godfrey test results in Table 7 below showed no evidence of heteroskedasticity, with an F-statistic of 1.944 and a p-value of 0.116, which failed to reject the null hypothesis of homoskedasticity. The Obs*R-squared value of 7.432, with a p-value of 0.115, further supported this, confirming that the assumption of constant variance held ensuring the reliability of hypothesis testing and confidence intervals.

Table 7: Breusch-Godfrey Serial Correlation LM Test

F-statistic	1.116	Prob. F (2,53)	0.335
Obs*R-squared	2.425	Prob. Chi-Square (2)	0.298

Source: Author's Compilation from EViews 10, 2025

The Breusch-Godfrey Serial Correlation LM Test results in Table 8 below showed no evidence of autocorrelation, with an F-statistic of 1.116 and a p-value of 0.335, which failed to reject the null hypothesis of no serial correlation. The Obs*R-squared value of 2.425 ($p = 0.298$) further supported this, confirming that serial correlation was not a concern in the model.

Table 8: Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.944	Prob. F (4,55)	0.116
Obs*R-squared	7.432	Prob. Chi-Square (4)	0.115
Scaled explained SS	23.310	Prob. Chi-Square (4)	0.000

Source: Author's Compilation from EViews 10, 2025



DISCUSSION OF RESULTS

The results of this study provided valuable insights into the relationship between digitalization and operational performance in Zambian commercial banks, addressing the research objectives and hypotheses formulated for the study. The first objective, which aimed to analyze the strength of the correlation between digitalization and operational performance, was clearly supported by the findings. The correlation analysis revealed a strong positive and statistically significant relationship between LNDIG and OPCB (0.622, $p = 0.000$). This result aligned with Hypothesis 1 (H_1), which posited that there was a significant correlation between digitalization and operational performance. The finding reflected a broad body of literature that suggested that digitalization enhanced operational efficiency, reduced costs, and improved service delivery (Berger et al., 2021). In the context of Zambia, the increased adoption of digital banking platforms such as mobile banking and internet banking had led to better resource utilization and greater customer satisfaction, validating the theoretical framework rooted in the Technology Acceptance Model (TAM) and the Diffusion of Innovations Theory (DoI).

The second objective, which explored the connection between digitalization and operational performance, was also supported by the regression analysis. The coefficient for LNDIG was 3.004 ($p = 0.002$), indicating a significant and positive relationship with operational performance. This result directly supported Hypothesis 2 (H_1), which hypothesized a significant relationship between digitalization and operational performance. The findings suggested that as digitalization in the banking sector increased, commercial banks experienced improvements in operational performance. This outcome was consistent with previous research, including studies by Kabwe and Phiri (2022), which found that digital banking innovations, such as mobile banking, enhanced operational outcomes by improving customer engagement and streamlining services.

In addressing the third objective, the study studied the effects of control variables, including GDPG, INFR, and LNNPL, on operational performance. The results showed that GDPG had a negative and statistically significant relationship with OPCB (coefficient = -1.344, $p = 0.000$), supporting Hypothesis 3 (H_1), which suggested that macroeconomic factors would influence operational performance. This finding indicates that during periods of economic growth, the operational performance of banks may decrease, possibly due to rising competition and higher operational costs. However, the relationships between INFR and LNNPL with OPCB were statistically insignificant, with p -values of 0.436 and 0.352, respectively. This suggests that inflation and non-performing loans do not have a significant impact on operational performance in the study period. These results imply that while macroeconomic factors play a role, digitalization efforts may mitigate their negative effects, particularly in terms of maintaining operational efficiency during economic slowdowns.

Overall, the study confirmed the critical role of digitalization in enhancing the operational performance of Zambian commercial banks, with digitalization proving to be the most significant predictor of performance. The study's findings also support the theoretical frameworks of TAM and DoI, which emphasize the importance of technological adoption in improving organizational efficiency and competitiveness. These results suggested that the Zambian banking sector, while facing challenges such as limited infrastructure and cybersecurity risks, can continue to enhance operational performance through further investments in digital banking technologies.



CONCLUSION AND RECOMMENDATION

Conclusion

This study aimed to examine the effects of digitalization on the operational performance of commercial banks in Zambia, focusing on key performance metrics such as cost efficiency, profitability, and service delivery. The findings revealed a positive and statistically significant relationship between digitalization and operational performance, confirming that the adoption of digital banking technologies, such as mobile banking, internet banking, and automated payment systems, significantly enhanced operational efficiency and customer service within Zambian banks. The study also found an inverse relationship between GDP growth and operational performance, suggesting that economic downturns lead to increased digitalization efforts as banks look for cost-effective solutions to maintain efficiency. However, macroeconomic variables such as inflation and non-performing loans had a limited impact on operational performance, indicating that digitalization may help banks buffer some of these external pressures.

The hypotheses of the study were tested and supported, with the null hypotheses being rejected. The research found that digitalization was positively correlated with operational performance (Hypothesis 1), digitalization had a significant relationship with operational performance (Hypothesis 2), and control variables had an impact on operational performance (Hypothesis 3). The study's objectives were achieved by providing empirical evidence on how digitalization had influenced the banking sector in Zambia, emphasizing the role of digital financial services in improving operational efficiency and financial inclusion.

Therefore, the findings of this study have significant implications for banks, policymakers, and researchers. For banks, the study highlighted the importance of investing in digital technologies to enhance operational efficiency, reduce costs, and improve customer satisfaction. It also suggested that banks should focus on improving digital infrastructure, particularly in underserved regions, to increase accessibility to digital banking services and promote financial inclusion. Policymakers were encouraged to create an enabling environment for digital innovation, ensuring that regulations supported the growth of digital banking while addressing risks like cybersecurity threats. From a research perspective, this study laid a foundation for further investigation into the long-term effects of digitalization on customer satisfaction, financial inclusion, and the use of emerging technologies in the banking sector.

Recommendations

Based on the findings of this study, the following recommendations were made:

- *To Commercial Banks:* Invest in scalable and inclusive digital banking platforms—such as mobile and agency banking—to improve operational performance and reach underserved areas.
- *To Commercial Banks and Financial Institutions:* Implement targeted digital literacy programs for both customers and employees to enhance adoption and effective use of digital services.
- *To Commercial Banks and IT Departments:* Strengthen cybersecurity and data protection systems to safeguard digital banking operations and maintain customer trust.



- *To Policymakers and Regulators (e.g., Bank of Zambia):* Develop supportive and flexible regulatory frameworks that encourage digital innovation while ensuring consumer protection.
- *To Commercial Banks and Fintech Partners:* Adopt and integrate emerging technologies like AI, blockchain, and big data to boost efficiency, improve service delivery, and ensure long-term competitiveness.

LIMITATIONS OF THE STUDY

This study had several limitations. First, it relied on secondary data from the Bank of Zambia and the Zambia Statistics Agency, which may not capture bank-specific factors or the varying levels of digitalization adoption across banks. Second, the focus on quantitative analysis excluded qualitative aspects, such as customer satisfaction or employee perspectives, which could provide deeper insights into the digitalization process. Third, while macroeconomic factors like GDP growth and inflation were considered, other external variables, such as political instability or global economic shifts, were not explored, potentially limiting the scope of the findings. These limitations suggested the need for further research incorporating more diverse data sources and broader economic factors.

RECOMMENDATIONS FOR FUTURE RESEARCH

Future research should also incorporate qualitative and customer-centric approaches to provide a more comprehensive understanding of the effects of digitalization on banking. Exploring customer experiences with digital banking platforms, such as mobile banking and internet banking, can reveal insights into satisfaction levels, usability challenges, and the perceived value of digital services. Interviews, focus groups, and surveys could be used to capture customer perspectives, which are crucial for understanding barriers to adoption, especially in underserved or rural areas. Furthermore, future studies could delve deeper into the socio-cultural factors that influence digital banking adoption, such as trust in technology, financial literacy, and the digital divide, to develop targeted strategies for increasing adoption across various demographic segments. By integrating both quantitative and qualitative methods, future research can provide a more holistic view of how digitalization affects not only operational performance but also customer satisfaction and inclusion in Zambia's banking sector.



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