Int. j. adv. multidisc. res. stud. 2026; 6(2):1658-1670

Received: 01-03-2026
Accepted: 10-04-2026

International Journal of Advanced Multidisciplinary Research and Studies

ISSN: 2583-049X

FinTech Adoption and Bank Sustainability in Nigeria: Evidence from Disaggregated Channels and Mediating Effects of Operating Efficiency and Financial Inclusion

Akomolehin Francis Olugbenga
Department of Finance, Afe Babalola University, Ado - Ekiti, Ekiti - State, Nigeria

Corresponding Author: **Akomolehin Francis Olugbenga**

Abstract
This study examines the effect of FinTech adoption on the sustainability of deposit money banks in Nigeria over the period 2010–2024. It focuses on three major FinTech channels which include mobile banking, point-of-sale (POS) transactions, and automated teller machines (ATMs, and evaluates how their effects on bank sustainability are mediated by operating efficiency and financial inclusion. Using secondary data from the Central Bank of Nigeria, the Nigeria Inter-Bank Settlement System, and bank annual reports, the study employs the Autoregressive Distributed Lag (ARDL) model to estimate short-run and long-run relationships, while Structural Equation Modelling (SEM) is used to assess mediation effects. The findings show that FinTech adoption has heterogeneous effects on bank sustainability. Mobile banking has a significant negative effect on return on equity, suggesting that adoption costs, service disruptions, and technology-related risks may weaken short-run performance. In contrast, POS and ATM channels exert positive effects on financial performance, indicating their contribution to revenue generation and service efficiency.

The mediation analysis further shows that operating efficiency is a strong positive transmission channel between FinTech adoption and bank sustainability, whereas financial inclusion has a weaker negative mediating effect, reflecting the short-run costs of expanding access to underserved populations. The ARDL bounds test confirms the existence of a long-run equilibrium relationship between FinTech adoption and bank sustainability in Nigeria. The study concludes that FinTech adoption can enhance bank sustainability when supported by efficient operations, sound risk management, and balanced regulation. It contributes to the literature by integrating disaggregated FinTech indicators with mediation analysis in the Nigerian banking context.

Keywords: FinTech Adoption, Bank Sustainability, Operating Efficiency, Financial Inclusion, ARDL, SEM, Nigeria

1. Introduction

1.1 Background and Rationale

The global financial system is undergoing a profound transformation driven by the rapid advancement of financial technology (FinTech), which is fundamentally reshaping the delivery, accessibility, and efficiency of financial services. FinTech innovations—including mobile banking, point-of-sale (POS) systems, and automated teller machines (ATMs)—have significantly improved financial intermediation by reducing transaction costs, expanding service outreach, and enhancing customer convenience (Ozili, 2023; Banna *et al*., 2021) [21, 4]. In developed economies, the adoption of digital financial technologies has been widely associated with increased competition, operational efficiency, and improved profitability, largely due to robust institutional frameworks, advanced infrastructure, and effective regulatory systems (Citterio *et al*., 2024; Khattak *et al*., 2023) [10, 15].

In contrast, the outcomes of FinTech adoption in developing economies remain more complex and less consistent. Structural constraints such as weak institutional capacity, regulatory gaps, infrastructural deficiencies, and cybersecurity vulnerabilities often moderate the benefits of digital transformation, leading to mixed implications for financial performance and stability (Cihak *et al*., 2021; Ozili, 2023 [21]). These dynamics highlight the context-dependent nature of FinTech outcomes and underscore the need for country-specific analysis.

Nigeria represents a particularly compelling case within this discourse, as it has emerged as one of Africa's fastest-growing FinTech ecosystems. The rapid expansion of digital payments, mobile banking platforms, and electronic financial services is closely aligned with national policy initiatives, including the Central Bank of Nigeria's National Financial Inclusion Strategy aimed at broadening access to formal financial services (Central Bank of Nigeria, 2022; Abubakar & Bala, 2022). Deposit money banks, as key actors in the financial system, have increasingly integrated FinTech solutions into their operations to enhance competitiveness, improve service delivery, and respond to evolving customer preferences.

However, the implications of FinTech adoption for bank sustainability are inherently complex and multifaceted. While digitalization can improve operational efficiency, generate new revenue streams, and enhance financial inclusion, it also introduces significant challenges, including high implementation costs, cybersecurity risks, regulatory compliance pressures, and operational disruptions (Ekong & Ekong 2022; Ozili, 2023) [13, 21]. Moreover, the effects of FinTech adoption are not uniform across technologies. Empirical evidence suggests that while POS and ATM systems tend to support financial performance through increased transaction volumes and service efficiency, mobile banking may exert downward pressure on short-term profitability due to high investment costs and risk exposure (Onyekwere & Okonkwo, 2024).

These heterogeneous effects highlight the need for a more nuanced and analytical understanding of how different FinTech channels influence bank sustainability. In particular, there is a need to examine not only the direct effects of FinTech adoption but also the underlying mechanisms—such as operating efficiency and financial inclusion—through which these effects are transmitted within Nigeria's evolving financial landscape.

1.2 Research Problem

Despite the rapid growth of FinTech in Nigeria, its implications for the sustainability of deposit money banks remain insufficiently understood. While digital financial channels such as POS systems and ATMs have been associated with improvements in financial performance and service efficiency, mobile banking has, in some cases, been linked to declining profitability, reflecting the high costs, operational complexities, and risks associated with technological adoption (Ekong & Ekong 2022; Ozili, 2023) [13, 21]. This divergence in outcomes suggests that FinTech adoption does not exert a uniform effect on bank sustainability, but rather generates differentiated impacts across technological channels.

Furthermore, the pursuit of financial inclusion—while critical for economic development—introduces additional complexities for banking institutions. Expanding financial services to underserved and low-income populations often involves high fixed costs, lower transaction volumes, and increased exposure to credit and operational risks, thereby creating potential trade-offs between developmental objectives and short-term financial performance (Hakimi *et al*., 2022; Ozili, 2023 [21]). These dynamics raise important questions about how banks can balance innovation, inclusion, and financial sustainability within a rapidly evolving digital environment.

Existing empirical studies in Nigeria have largely examined FinTech adoption and financial inclusion as separate phenomena, with limited attention to the mechanisms through which they interact to influence bank sustainability. In particular, there is a lack of integrated analytical frameworks that simultaneously capture the effects of multiple FinTech channels, incorporate mediating variables such as operating efficiency and financial inclusion, and account for both short-run and long-run dynamics. This fragmented approach has constrained a comprehensive understanding of the FinTech–sustainability nexus in Nigeria.

Accordingly, there is a clear need for a more holistic and empirically grounded analysis that examines the direct and indirect effects of FinTech adoption on bank sustainability within a unified framework. Addressing this gap is essential for informing policy, guiding banking strategy, and enhancing the effectiveness of digital financial transformation in Nigeria.

1.3 Research Questions

This study is guided by the following research questions:

1. What is the effect of financial technology adoption (mobile banking, POS, ATMs) on the financial sustainability of deposit money banks in Nigeria?
2. To what extent do mediating factors such as operating efficiency and financial inclusion influence the relationship between FinTech adoption and bank sustainability?
3. Does a long-run equilibrium relationship exist between FinTech innovation and bank sustainability in Nigeria, and how do short-run dynamics compare?
4. How can FinTech adoption be optimized to balance innovation, operational stability, and financial inclusion in the Nigerian banking sector?

1.4 Research Objectives

1. Examine the effect of FinTech adoption (mobile banking, POS, ATMs) on bank sustainability.
2. Evaluate the mediating roles of operating efficiency and financial inclusion.
3. Determine the short-run and long-run relationships between FinTech adoption and bank sustainability.
4. Provide policy recommendations for enhancing sustainability while mitigating associated risks.

1.5 Research Hypotheses

The following hypotheses are formulated in line with the study objectives:

H_{01}: FinTech adoption (mobile banking, POS, ATMs) does not have a significant effect on the financial sustainability of deposit money banks in Nigeria.

$H_{02}a$: Operating efficiency does not significantly mediate the relationship between FinTech adoption and bank sustainability in Nigeria.

$H_{02}b$: Financial inclusion does not significantly mediate the relationship between FinTech adoption and bank sustainability in Nigeria.

$H_{03}a$: There is no significant long-run relationship between FinTech innovation and bank sustainability in Nigeria.

1.6 Research Boundaries and Contributions

This study focuses on deposit money banks in Nigeria and

examines three FinTech channels—mobile banking, POS, and ATMs—over the period 2010–2024. It relies on secondary data and employs ARDL and SEM techniques to analyze both direct and mediated relationships.

The study is limited by its reliance on secondary data and the exclusion of emerging FinTech innovations such as blockchain and artificial intelligence. Additionally, qualitative factors such as customer trust, regulatory enforcement, and institutional quality are not explicitly modeled.

This study contributes to the literature in three key ways. First, it extends the Innovation–Stability framework to a developing economy context by incorporating operating efficiency and financial inclusion as mediating variables. Second, it provides empirical evidence using disaggregated FinTech indicators. Third, it offers policy-relevant insights for balancing innovation, financial performance, and inclusion in Nigeria's banking sector.

2. Literature Review

2.1 Conceptual Clarifications

2.1.1 FinTech Adoption

FinTech adoption refers to the integration and application of digital technologies to deliver financial services in a more efficient, accessible, and scalable manner. Within the banking sector, it encompasses the deployment of digital platforms such as mobile banking, point-of-sale (POS) systems, and automated teller machines (ATMs), which enhance transaction processing, improve service delivery, and strengthen customer engagement (Ozili, 2023; Banna *et al*., 2021) [21, 4].

The adoption of FinTech is driven by both supply-side and demand-side dynamics. On the supply side, banks implement digital technologies to reduce operational costs, expand outreach, and maintain competitiveness in an increasingly digitized financial environment. On the demand side, customers are motivated by the convenience, speed, and cost-efficiency associated with digital financial services, which influence usage patterns and adoption rates (Akinola & Adepoju, 2021; Banna *et al*., 2021 [4]).

In Nigeria, FinTech adoption has been facilitated by institutional and regulatory initiatives, including digital payment frameworks and regulatory sandbox environments introduced by the Central Bank of Nigeria (Central Bank of Nigeria, 2022). However, despite its transformative potential, FinTech adoption also introduces significant operational challenges, including cybersecurity risks, system failures, and fraud exposure, which may undermine its net benefits if not effectively managed (Ejemeyovwi *et al*., 2022; Ozili, 2023 [21]).

In this study, FinTech adoption is operationalized through three key channels—mobile banking, POS transactions, and ATM usage—reflecting the dominant forms of digital banking within the Nigerian financial system.

2.1.2 Bank Sustainability

Bank sustainability refers to the ability of financial institutions to maintain stable financial performance over time while effectively managing risks, adapting to technological changes, and complying with evolving regulatory requirements. It represents a balance between profitability, operational resilience, and long-term institutional stability (Agyapong *et al*., 2021; Ozili, 2023 [21]).

In this study, bank sustainability is proxied primarily by Return on Equity (ROE), with Return on Assets (ROA) serving as a complementary indicator where necessary. These measures capture the financial dimension of sustainability by reflecting banks' capacity to generate returns from their assets and shareholders' equity (Onyekwere & Okonkwo, 2024).

FinTech adoption influences bank sustainability through multiple and often competing channels. On one hand, digital technologies enhance revenue generation, improve service efficiency, and support financial innovation. On the other hand, they impose costs related to infrastructure development, cybersecurity investments, and regulatory compliance, which may exert pressure on short-term profitability (Ekong & Ekong 2022; Ozili, 2023) [13, 21].

In emerging economies such as Nigeria, these effects are further shaped by institutional constraints, infrastructural limitations, and regulatory dynamics, making the relationship between FinTech adoption and bank sustainability inherently complex and context-dependent.

2.1.3 Operating Efficiency

Operating efficiency refers to the ability of banks to minimize costs while maximizing output in the provision of financial services. It is commonly measured using the cost-to-income ratio, which indicates how effectively a bank converts its operating expenses into revenue (Khatib *et al*., 2021; Elmahdy *et al*. (2025) [14].

FinTech adoption plays a critical role in enhancing operating efficiency by automating processes, reducing reliance on physical infrastructure, and improving transaction speed and service delivery. Technologies such as ATMs and POS systems reduce labor costs, streamline operations, and enhance productivity (Liu *et al*., 2024 [19]; Lee *et al*., 2021).

However, the relationship between FinTech and efficiency is not strictly linear. While digital technologies contribute to cost reduction in the long run, they require substantial initial investments in infrastructure, staff training, and cybersecurity systems. As a result, certain FinTech channels—particularly mobile banking—may initially reduce efficiency due to high implementation costs and increased exposure to operational risks (Ekong & Ekong 2022; Ozili, 2023) [13, 21].

Within this study, operating efficiency is conceptualized as a mediating variable through which FinTech adoption influences bank sustainability, capturing the internal performance dynamics of digital transformation.

2.1.4 Financial Inclusion

Financial inclusion refers to the access to and usage of affordable and appropriate financial services by individuals and businesses, particularly those that are underserved or excluded from the formal financial system. It remains a key policy objective in Nigeria, supported by initiatives such as the Central Bank of Nigeria's National Financial Inclusion Strategy (Central Bank of Nigeria, 2022).

FinTech has significantly advanced financial inclusion by overcoming geographical, infrastructural, and cost-related barriers. Digital channels such as mobile banking and POS systems have expanded financial access in rural and semi-urban areas, where traditional banking infrastructure is limited (Adeniran *et al*., 2021; Demir *et al*., 2022).

Despite its developmental benefits, financial inclusion may impose short-term financial and operational costs on banks.

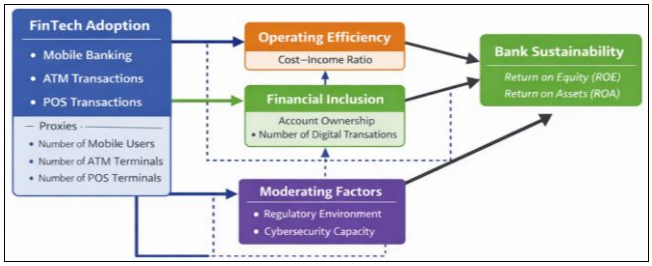
Extending services to low-income and previously unbanked populations often involves high fixed costs, smaller transaction volumes, and increased exposure to credit and operational risks. Consequently, financial inclusion may weaken short-term profitability while contributing to long-term sustainability and economic development (Hakimi *et al*., 2022; Ozili, 2023 [21]).

In this study, financial inclusion is treated as a mediating variable that captures the trade-off between developmental objectives and financial performance within the FinTech–sustainability relationship.

Collectively, these concepts provide a multidimensional framework for understanding the relationship between FinTech adoption and bank sustainability. FinTech adoption represents the technological driver of transformation, while bank sustainability reflects the outcome of interest in terms of financial performance and resilience. Operating efficiency and financial inclusion serve as critical transmission mechanisms through which the effects of FinTech adoption are realized.

This conceptual structure aligns with established theoretical perspectives. The Innovation–Stability Model highlights the trade-off between technological advancement and systemic risk; Financial Intermediation Theory explains how FinTech reshapes the core functions of banking; the Technology Acceptance Model emphasizes the role of user behavior in determining adoption outcomes; and the Resource-Based View underscores the importance of internal capabilities in leveraging technology for sustainable advantage (Ozili, 2023 [21]; Venkatesh *et al*., 2021; Khatib *et al*., 2021).

Among these, the Innovation–Stability Model serves as the primary theoretical anchor for this study, as it directly reflects the central paradox of FinTech adoption—its simultaneous capacity to enhance efficiency and introduce risk. The integration of these conceptual and theoretical perspectives enables a comprehensive analysis of how FinTech adoption influences bank sustainability in Nigeria through both direct and mediated pathways.



Source: Author's conceptualization (2026), informed by the Innovation–Stability Model (Boot *et al*., 2021; Thakor, 2020) [5, 23], Financial Intermediation Theory (Levine, 2001) [17], Technology Acceptance Model (Venkatesh *et al*., 2003) [24], and Resource-Based View (Barney, 1991) [3].

Fig 1: Conceptual Framework of the Relationship between FinTech Adoption and Bank Sustainability

Explanation of the Conceptual Framework

The conceptual framework illustrates the relationships between FinTech adoption and bank sustainability, highlighting both the direct and indirect pathways through which digital financial innovations influence the performance of deposit money banks in Nigeria.

At the core of the framework is FinTech adoption, which serves as the independent variable. It is operationalized through three major digital banking channels—mobile banking, automated teller machine (ATM) transactions, and point-of-sale (POS) transactions. These channels represent the most widely used forms of financial technology in the Nigerian banking sector and capture the extent of digital transformation within financial institutions.

The framework posits that FinTech adoption influences bank sustainability, the dependent variable, both directly and indirectly. Bank sustainability is measured using financial performance indicators, specifically Return on Equity (ROE) and Return on Assets (ROA), which reflect the ability of banks to generate returns while maintaining long-term operational stability.

The indirect effects of FinTech adoption are transmitted through two key mediating variables: operating efficiency and financial inclusion. Operating efficiency represents the internal performance dimension and is measured using the cost-to-income ratio, capturing how effectively banks convert operational costs into revenue. The framework assumes that FinTech adoption enhances efficiency by automating processes, reducing transaction costs, and improving service delivery. However, it also recognizes that certain technologies—particularly mobile banking—may initially reduce efficiency due to high implementation and maintenance costs.

Financial inclusion represents the external or developmental dimension of FinTech adoption. It reflects the extent to which digital financial services expand access to banking for previously underserved populations. Proxies such as account ownership and the volume of digital transactions capture this dimension. While increased financial inclusion can enhance long-term sustainability by expanding the customer base and increasing transaction flows, it may impose short-term financial burdens due to higher operational costs and lower margins associated with serving low-income customers.

The framework further incorporates moderating factors, specifically the regulatory environment and cybersecurity capacity. These factors influence the strength and direction of the relationships between FinTech adoption, the mediating variables, and bank sustainability. A supportive regulatory environment can enhance the positive effects of FinTech adoption by providing clear guidelines and fostering innovation, while weak regulation may increase systemic risks. Similarly, strong cybersecurity capacity can mitigate operational and fraud risks associated with digital banking, thereby strengthening the sustainability outcomes of FinTech adoption.

Additionally, the framework recognizes a direct relationship between FinTech adoption and bank sustainability, independent of the mediating variables. This direct pathway captures the immediate effects of digital financial technologies on bank performance, such as increased transaction volumes and revenue generation.

Overall, the conceptual framework reflects a multi-dimensional and dynamic relationship, where FinTech adoption simultaneously drives efficiency gains, promotes financial inclusion, and introduces operational and regulatory challenges. It is grounded in the Innovation–Stability Model, which emphasizes the trade-off between the benefits and risks of financial innovation. By integrating mediating and moderating variables, the framework provides a comprehensive structure for analyzing how FinTech adoption affects bank sustainability in both the short run and long run.

2.2 Theoretical Review

The relationship between FinTech adoption and bank sustainability is best understood through a multidimensional theoretical lens that captures the interplay between innovation, institutional function, user behavior, and organizational capability. Central to this study is the Innovation–Stability Model, which provides a foundational framework for analyzing the dual effects of financial innovation. The model posits that while technological advancements enhance efficiency, competition, and financial inclusion, they simultaneously introduce systemic risks, operational vulnerabilities, and regulatory complexities (Boot & Thakor, 2019; Ozili, 2023 [21]). In the banking sector, FinTech innovations such as mobile banking, point-of-sale (POS) systems, and automated teller machines (ATMs) improve service delivery, reduce transaction costs, and expand financial access. However, these same technologies expose banks to cybersecurity threats, service disruptions, and increased compliance requirements. This trade-off is particularly pronounced in developing economies like Nigeria, where infrastructural limitations, weak institutional frameworks, and evolving regulatory systems may amplify the risks associated with rapid technological adoption (Onyekwere & Okonkwo, 2024). Consequently, the Innovation–Stability Model provides a robust framework for examining how banks balance innovation-driven growth with the need for long-term sustainability, particularly through channels such as operating efficiency and financial inclusion.

Complementing this perspective, Financial Intermediation Theory offers insight into how FinTech reshapes the traditional role of banks as intermediaries between savers and borrowers. Traditionally, banks mitigate information asymmetry, reduce transaction costs, and allocate financial resources efficiently within the economy (Levine, 2020). The emergence of FinTech has transformed this intermediation process by introducing digital platforms that lower transaction costs, enhance service delivery, and broaden financial access. Technologies such as mobile banking and POS systems facilitate faster and more inclusive financial transactions, thereby strengthening the intermediation function. However, FinTech also disrupts conventional banking models by intensifying competition and introducing new forms of risk, including data security concerns and operational uncertainties (Agyapong *et al*., 2021; Ozili, 2023 [21]). In the Nigerian context, where banks are expanding services to previously underserved populations, these dynamics highlight the evolving nature of intermediation and its implications for both efficiency and stability. Thus, Financial Intermediation Theory helps explain how FinTech adoption influences bank sustainability by altering the structure and risk profile of banking activities.

In addition to institutional and structural perspectives, the Technology Acceptance Model Venkatesh *et al*. (2003) [24] provides a behavioral dimension to understanding FinTech adoption. Venkatesh *et al*. (2003) [24] posits that the adoption of new technologies is largely determined by users' perceptions of usefulness and ease of use (Venkatesh *et al*., 2021). In the context of banking, the success of FinTech innovations depends not only on institutional investment but also on customer acceptance and usage. Digital platforms such as mobile banking applications and POS systems must be perceived as secure, reliable, and convenient to achieve widespread adoption. Where users perceive these technologies as complex or unsafe, adoption rates may decline, thereby limiting expected efficiency gains and financial returns. Conversely, high levels of user acceptance can increase transaction volumes, reduce operational costs, and enhance bank performance. This highlights the importance of demand-side dynamics in shaping the outcomes of FinTech adoption, particularly in emerging economies where digital literacy and trust in financial systems vary significantly (Akinola & Adepoju, 2021; Banna *et al*., 2021 [4]). Venkatesh *et al*. (2003) [24] therefore provides a critical link between technological innovation and its realized impact on bank sustainability.

Furthermore, the Resource-Based View Barney (1991) [3] of the firm offers an organizational perspective by emphasizing the role of internal capabilities in achieving sustainable competitive advantage. According to Barney (1991) [3], firms derive long-term performance benefits from resources that are valuable, rare, inimitable, and non-substitutable (Barney, 1991 [3]; Khatib *et al*., 2021). In the banking sector, FinTech can be conceptualized as both a strategic resource and a capability that enhances operational efficiency, service innovation, and customer engagement. However, the mere adoption of technology does not guarantee improved performance. The extent to which FinTech contributes to sustainability depends on a bank's ability to integrate digital technologies with complementary resources such as skilled human capital, robust risk management systems, and effective governance structures Elmahdy *et al*. (2025) [14]. In Nigeria, where infrastructural and regulatory challenges persist, banks that successfully align technological innovation with organizational capabilities are more likely to achieve sustainable outcomes. Barney (1991) [3] therefore explains variations in how FinTech adoption translates into performance across institutions, highlighting the importance of capability development in realizing the benefits of digital transformation.

Taken together, these theoretical perspectives provide a comprehensive framework for analyzing the FinTech–sustainability nexus. The Innovation–Stability Model captures the inherent trade-off between technological advancement and systemic risk; Financial Intermediation Theory explains how FinTech reshapes the core functions of banking; the Technology Acceptance Model highlights the role of user behavior in determining adoption outcomes; and the Resource-Based View emphasizes the importance of internal capabilities in leveraging technology for sustainable advantage. Among these, the Innovation–Stability Model serves as the central theoretical anchor for this study, as it directly reflects the paradox of FinTech adoption—its simultaneous capacity to enhance efficiency and introduce risk. The integration of these theories enables a deeper understanding of how FinTech adoption affects bank sustainability in Nigeria through both direct effects and indirect channels such as operating efficiency and financial inclusion.

2.3 Empirical Review

Empirical evidence on the relationship between FinTech adoption and bank sustainability has expanded significantly in recent years, with growing consensus that digital financial innovations reshape banking performance through multiple channels, albeit with heterogeneous outcomes across contexts. In advanced economies, studies consistently

demonstrate that digital transformation enhances bank profitability, operational efficiency, and competitiveness. For instance, recent analyses of European banking systems show that higher levels of digitalization are associated with improved return on equity and cost efficiency, particularly in environments characterized by strong regulatory frameworks and technological infrastructure (Citterio *et al*., 2024; Khattak *et al*., 2023) [10, 15]. Similarly, evidence from open banking regimes indicates that innovation-driven competition improves service delivery and revenue diversification, reinforcing the positive link between FinTech adoption and bank sustainability (Liang *et al*., 2025) [18]. These findings suggest that in well-developed institutional environments, FinTech serves as a catalyst for efficiency gains and long-term financial performance.

However, evidence from developing and emerging economies presents a more nuanced and less consistent picture. In Asian markets, particularly China, digital finance has been found to improve cost efficiency, liquidity creation, and deposit mobilization, reflecting the ability of FinTech to deepen financial intermediation (Guo *et al*., 2023; Wen *et al*., 2025). At the same time, other studies highlight that increased digitalization may encourage risk-taking behavior and expose banks to operational vulnerabilities, thereby weakening stability in certain contexts (Khan *et al*., 2026; Nguyen & Du 2022) [16, 20]. Similar patterns are observed in the Middle East and North Africa (MENA) region, where FinTech adoption contributes to profitability and efficiency but with varying effects depending on business models and regulatory environments (Abu Khalaf *et al*., 2025). Across Sub-Saharan Africa, digital financial services—particularly mobile money—have been associated with improved financial inclusion and transaction-based income, although their impact on bank stability remains mixed due to infrastructural and institutional constraints (Cihak *et al*., 2021; Mabe *et al*., 2025). These divergent findings underscore the context-dependent nature of FinTech outcomes, suggesting that institutional quality, regulatory effectiveness, and technological readiness play critical roles in shaping the sustainability effects of digital innovation.

Within the Nigerian context, empirical studies similarly reveal mixed but insightful patterns. Evidence generally indicates that FinTech channels such as automated teller machines (ATMs) and point-of-sale (POS) systems contribute positively to bank performance by increasing transaction volumes, enhancing service accessibility, and generating fee-based income (Onyekwere & Okonkwo, 2024; Adeniran *et al*., 2021). POS transactions, in particular, have been consistently linked to improved revenue streams and financial intermediation due to their widespread adoption in retail transactions. In contrast, findings on mobile and internet banking are less consistent, with several studies reporting insignificant or negative effects on profitability. These outcomes are often attributed to high implementation costs, cybersecurity risks, system inefficiencies, and the challenges associated with scaling digital platforms in an environment with infrastructural limitations (Ekong & Ekong 2022; Ozili, 2023) [13, 21]. Consequently, the Nigerian evidence reinforces the notion that FinTech adoption does not exert uniform effects across channels, but rather produces differentiated impacts depending on the nature of the technology and the operational environment.

Recent empirical literature has increasingly shifted focus toward understanding the mechanisms through which FinTech adoption influences bank performance, particularly through operating efficiency and financial inclusion. On one hand, digitalization has been shown to reduce transaction costs, improve processing speed, and enhance cost-to-income ratios, thereby strengthening profitability and operational resilience (Liu *et al*., 2024 [19]; Lee *et al*., 2021). On the other hand, FinTech-driven financial inclusion expands access to financial services, increases deposit mobilization, and supports transaction-based revenue generation. However, inclusion efforts may also impose short-term financial burdens on banks due to the high costs of serving low-income and previously unbanked populations, as well as increased exposure to credit and operational risks (Hakimi *et al*., 2022; Ozili, 2023 [21]). This duality suggests that while operating efficiency tends to enhance bank sustainability, financial inclusion may generate trade-offs between developmental objectives and short-term financial performance.

Methodologically, the empirical literature employs diverse approaches, including system generalized method of moments (GMM), panel vector autoregression (PVAR), and autoregressive distributed lag (ARDL) models. Cross-country studies often rely on composite indices of FinTech development, while country-specific analyses use disaggregated transaction-based indicators such as ATM, POS, and mobile banking usage (Xu *et al*., 2025 [25]; Sousa *et al*., 2025). These methodological differences contribute to variations in empirical findings, as aggregated measures may obscure channel-specific effects, whereas short time-series data may limit the robustness of national-level analyses. Furthermore, relatively few studies integrate both short-run and long-run dynamics with mediation analysis within a unified framework, leaving important gaps in understanding the transmission mechanisms of FinTech effects.

Taken together, the empirical evidence suggests that FinTech adoption has the potential to enhance bank sustainability through efficiency gains, revenue diversification, and expanded financial access. However, these benefits are neither uniform nor guaranteed, as they depend on institutional conditions, technological capabilities, and the specific channels of adoption. In developing economies such as Nigeria, the coexistence of positive and negative effects highlights the importance of examining not only the direct impact of FinTech but also the underlying mechanisms through which it operates. This underscores the need for a comprehensive analytical framework that captures both the dynamic (short-run and long-run) relationships and the mediating roles of operating efficiency and financial inclusion in shaping bank sustainability outcomes.

2.4 Identified Gaps in Literature

Despite the growing body of empirical literature on FinTech adoption and banking performance, several critical gaps remain that limit a comprehensive understanding of its implications for bank sustainability, particularly in developing economies such as Nigeria. While studies from advanced economies largely report positive outcomes of digital transformation in terms of efficiency, profitability, and competitiveness, these findings are often context-specific and grounded in strong institutional and regulatory

environments. Consequently, their direct applicability to emerging economies is limited, as the structural conditions that support successful FinTech integration differ significantly.

In developing economies, the empirical evidence is more fragmented and inconclusive, reflecting variations in institutional quality, technological infrastructure, and regulatory capacity. Although some studies document improvements in efficiency and liquidity arising from FinTech adoption, others highlight increased risk exposure and inconsistent effects on profitability. This lack of consensus indicates that existing research has not sufficiently captured the complexity and context-dependency of FinTech outcomes, particularly in environments characterized by rapid digital expansion alongside structural constraints.

Within the Nigerian context, existing studies have largely examined FinTech adoption in a fragmented manner, often focusing on individual channels such as mobile banking or POS transactions without adequately distinguishing their differential impacts. While some evidence suggests that ATM and POS usage enhances financial performance, findings related to mobile and internet banking remain mixed, largely due to high operational costs, cybersecurity risks, and infrastructural limitations. However, these studies typically analyze FinTech adoption in isolation, without integrating multiple channels within a unified analytical framework. As a result, there is limited understanding of how different FinTech components interact to influence bank sustainability.

More importantly, there is a significant gap in the literature regarding the underlying mechanisms through which FinTech adoption affects banking outcomes. Although recent studies acknowledge the roles of operating efficiency and financial inclusion, these factors are rarely examined as formal mediating variables within a structured empirical model. Existing research tends to treat them either as independent outcomes or as secondary considerations, thereby overlooking their potential to explain the transmission of FinTech effects on bank sustainability.

In addition, methodological limitations persist across the literature. Many cross-country studies rely on aggregated FinTech indices that may obscure channel-specific dynamics, while country-level studies often suffer from limited time coverage or simplified modeling approaches. Few studies simultaneously capture short-run and long-run dynamics while also incorporating mediation analysis, resulting in an incomplete understanding of both the temporal and structural dimensions of the FinTech–sustainability relationship.

Taken together, these gaps highlight the need for a more integrated and context-sensitive analytical framework. Specifically, there is a need for studies that disaggregate FinTech adoption into distinct channels, examine both direct and indirect effects on bank sustainability, and account for dynamic relationships over time. This study addresses these gaps by combining disaggregated FinTech indicators—mobile banking, POS, and ATMs—with mediating variables such as operating efficiency and financial inclusion, within a unified framework that integrates ARDL and Structural Equation Modelling. In doing so, it provides a more nuanced and comprehensive understanding of how FinTech adoption influences bank sustainability in Nigeria.

3. Methodology

3.1 Theoretical Framework

This study is anchored on the Innovation–Stability Model, which provides a comprehensive framework for analyzing the dual effects of financial innovation on bank performance. The model posits that while technological advancements enhance efficiency, financial inclusion, and competitiveness, they simultaneously introduce systemic risks, operational vulnerabilities, and regulatory challenges (Boot & Thakor, 2019; Ozili, 2023 [21]).

In the context of this study, FinTech adoption is conceptualized as a driver of both efficiency gains and risk exposure, thereby influencing bank sustainability through competing channels. Operating efficiency and financial inclusion are incorporated as mediating variables to capture the internal and developmental pathways through which FinTech affects financial performance.

This framework is particularly relevant to Nigeria, where rapid digital transformation is occurring alongside institutional and infrastructural constraints. It therefore provides a robust basis for examining both the positive and adverse implications of FinTech adoption on the sustainability of deposit money banks.

3.2 Research Design

This study adopts a quantitative, explanatory research design aimed at examining the causal relationship between FinTech adoption and bank sustainability. The design is appropriate given the need to analyze both direct and indirect relationships among variables using econometric techniques.

The study utilizes secondary time-series data spanning the period 2010–2024, reflecting the phase of significant FinTech expansion in Nigeria. The choice of this period ensures adequate coverage of digital financial transformation and allows for the analysis of both short-run and long-run dynamics.

An integrated methodological approach is employed, combining the Autoregressive Distributed Lag (ARDL) model with Structural Equation Modelling (SEM). While ARDL captures dynamic relationships and long-run equilibrium, SEM is used to examine mediation effects, thereby providing a comprehensive analytical framework.

3.3 Model Specification

To align with the study objectives, the analysis is structured into three interconnected models that capture both direct and mediated relationships.

The first model examines the direct effect of FinTech adoption on bank sustainability. FinTech adoption is proxied by mobile banking (LMB), point-of-sale transactions (LPOS), and automated teller machines (LATM), while bank sustainability is measured using return on equity (LROE).

The second set of models captures mediation through financial inclusion and operating efficiency. Financial inclusion (LFI) represents the outreach and developmental dimension of FinTech, while operating efficiency (LOPE) captures internal cost-performance dynamics.

The general functional relationship can be expressed as:

Bank Sustainability = f(FinTech Adoption,Mediating Variables)

The econometric representation is specified as:

$$LROE_t=\beta_0+\beta_1 LMB_t+\beta_2 LPOS_t+\beta_3 LATM_t+\varepsilon_t$$

For mediation:

$$LFI_t=\alpha_0+\alpha_1 LMB_t+\alpha_2 LPOS_t+\alpha_3 LATM_t+\mu_t$$

$$LOPE_t=\gamma_0+\gamma_1 LMB_t+\gamma_2 LPOS_t+\gamma_3 LATM_t+\nu_t$$

$$LROE_t=\delta_0+\delta_1 LMB_t+\delta_2 LPOS_t+\delta_3 LATM_t+\delta_4 LFI_t+\delta_5 LOPE_t+\epsilon_t$$

All variables are expressed in logarithmic form to ensure linearity, reduce heteroscedasticity, and enable elasticity interpretation.

3.4 Measurement of Variables

The study employs carefully selected proxies to ensure empirical validity and alignment with theoretical constructs.

FinTech Adoption (Independent Variable): Measured using mobile banking transactions (LMB), POS transactions (LPOS), and ATM usage (LATM), capturing key digital banking channels in Nigeria.

Bank Sustainability (Dependent Variable): Proxied by Return on Equity (ROE), with Return on Assets (ROA) used as a robustness measure where necessary.

Operating Efficiency (Mediator): Measured using the cost-to-income ratio, reflecting how effectively banks convert costs into revenue.

Financial Inclusion (Mediator): Measured by the percentage of the adult population with access to financial services.

These variables reflect both the financial and developmental dimensions of banking sustainability.

3.5 Sources of Data

The study relies exclusively on secondary data obtained from credible and authoritative sources. These include the Central Bank of Nigeria (CBN) Statistical Bulletin, Nigeria Inter-Bank Settlement System (NIBSS), National Bureau of Statistics (NBS), bank annual reports, and international databases such as the World Bank and EFInA.

The dataset covers the period 2010–2024, ensuring adequate representation of FinTech expansion and financial sector evolution in Nigeria.

3.6 Method of Data Analysis

The study employs a two-stage analytical approach combining ARDL and SEM techniques.

The ARDL model is used to estimate both short-run and long-run relationships between FinTech adoption and bank sustainability. This approach is particularly suitable because it accommodates variables integrated at different orders (I(0) and I(1)) and performs well with relatively small sample sizes (Pesaran *et al*., 2001).

Pre-estimation tests include:

Unit root tests (ADF and Ng–Perron)

Descriptive statistics

Correlation analysis

The ARDL bounds testing approach is used to establish the existence of long-run relationships, while the error correction model (ECM) captures short-run adjustments.

Structural Equation Modelling (SEM) is subsequently employed to examine the mediating roles of operating efficiency and financial inclusion. SEM allows for simultaneous estimation of multiple relationships and provides a robust framework for analyzing indirect effects within the model.

Diagnostic tests—including Breusch-Godfrey serial correlation, Breusch-Pagan heteroscedasticity, Jarque-Bera normality, and Variance Inflation Factor (VIF)—are conducted to ensure model reliability and robustness.

All analyses are performed using EViews for econometric estimation and SmartPLS for structural modelling.

4. Analysis and Discussion of Findings

4.1 Preliminary Analysis

The preliminary analysis provides insights into the statistical properties of the variables and establishes the suitability of the data for econometric estimation. Descriptive statistics indicate that FinTech adoption variables (mobile banking, POS transactions, and ATM usage) exhibit high variability, reflecting the rapid but uneven expansion of digital financial services in Nigeria over the study period (2010–2024).

Table 4.1: Summary of Descriptive Statistics

	Mean	Median	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability	Obs
ROE	13.71600	14.2800	4.864687	-0.58505	4.091537	1.600377	0.449244	15
MB	10762.60	756.900	24351.83	2.611803	8.647276	36.98611	0.000000	15
POS	6347.059	759000	13120.29	2.489022	8.266483	32.82298	0.000000	15
ATM	6441.176	4988.13	5756.337	1.213090	3.792446	4.071447	0.130586	15
OPE	61.01867	640000	11.49915	2.317910	8.029594	29.24227	0.000000	15
FI	48.62267	49.8000	7.611407	0.293796	1.974529	0.873035	0.646283	15

Source: Author's Computation (2025)

Note: ROE=Return on equity, MB=Return on equity, POS=Point of sales, ATM=Automated Teller Machine, OPE=Operating efficiency, FI=Financial Inclusion

Table 4.1 presents the descriptive statistics of the variables used in the study. The results show that mobile banking and POS transactions exhibit high variability, reflecting rapid but uneven FinTech adoption across the study period.

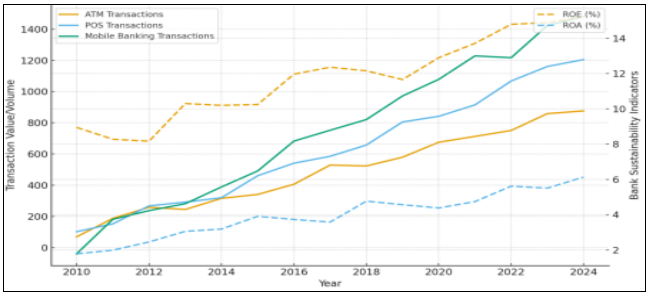


Fig 3: Descriptive Trend Graphs of FinTech Adoption and Bank Sustainability (2010-2024)

The descriptive trend graphs compare FinTech adoption channels—ATM, POS, and mobile banking transactions—with bank sustainability indicators (ROE and ROA) from 2010 to 2024. The line charts highlight growth patterns in digital transactions alongside variations in performance outcomes. This visualization provides empirical evidence of how different FinTech channels influence sustainability, supporting the justification for their inclusion in the econometric analysis.

The distributional properties reveal moderate skewness and excess kurtosis in several variables, particularly mobile

banking and POS transactions, suggesting the presence of structural shifts consistent with periods of accelerated digital adoption. Despite these deviations from normality, the sample characteristics remain appropriate for time-series analysis.

To further examine the relationships among variables, a correlation analysis was conducted.

Table 4.2: Summary of Correlation Matrix

Probability	ROE	MB	POS	ATM	OPE	FI
ROE	1					
MB	0.0563	1				
	0.8419					
POS	0.2745	0.6875	1			
	0.3222	0.0046				
ATM	0.1320	0.8835	0.7418	1		
	0.6392	0.0000	0.0015			
OPE	0.6133	0.3069	0.3162	0.5176	1	
	0.0150	0.2658	0.2510	0.0482		
FI	-0.0231	0.3718	0.6104	0.4362	0.4016	1
	0.9348	0.1724	0.0157	0.1040	0.1379	

Source: Author's Computation (2025)

Note: REO=Return on equity, MB=Return on equity, POS=Point of sales, ATM=Automated Teller Machine, OPE=Operating efficiency, FI=Financial Inclusion

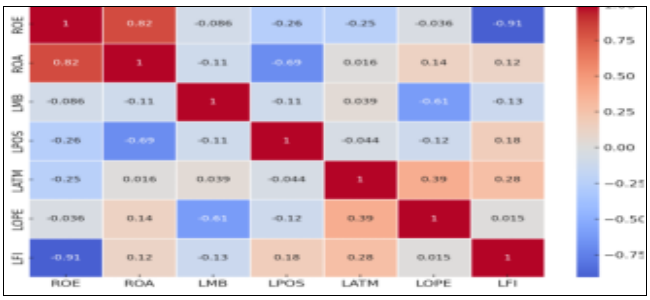


Fig 4: Correlation Heatmap of FinTech Proxies, Mediators, and Bank Performance

This heatmap illustrates the correlation strengths between FinTech proxies (LMB, LPOS, LATM), mediators (LOPE, LFI), and bank performance indicators (ROE, ROA). It highlights linear associations and potential multicollinearity risks, providing a diagnostic visual that ensures robust econometric modeling in subsequent ARDL/SEM analysis.

Unit root tests confirm that all variables are non-stationary at levels but become stationary after first differencing, indicating integration of order one, I(1). This justifies the use of the ARDL modelling approach, which accommodates mixed integration orders and is suitable for small sample sizes.

Table 4.3: Summary of Augmented Dickey Fuller Test

Variables	Test/Prob	@ Level	@ 1st Diff	Level of Integration
LROE	Test	-2.5145	-4.0207	I (1)
	Prob	0.1360	0.0150	
LMB	Test	-1.5182	-5.5280	I (1)
	Prob	0.4928	0.0009	
LPOS	Test	-0.0679	-5.4041	I (1)
	Prob	0.9355	0.0011	
LATM	Test	-1.4986	-5.3152	I (1)
	Prob	0.5048	0.0012	
LOPE	Test	-1.5833	-7.6995	I (1)
	Prob	0.4600	0.0000	
LFI	Test	-1.5165	-3.7707	I (1)
	Prob	0.4962	0.0164	

Source: Author's Computation (2025)

Note: ROE=Return on equity, MB=Return on equity, POS=Point of sales, ATM=Automated Teller Machine, OPE=Operating efficiency, FI=Financial Inclusion

As shown in Table 4.3, all variables are integrated of order one, I(1), thereby justifying the use of ARDL estimation.

The optimal lag selection criteria consistently identify lag one as appropriate, ensuring model parsimony while capturing dynamic relationships.

Table 4.4: Optimal Lag Order

Lag	LogL	LR	FPE	AIC	SC	HQ
0	1.240727	NA*	0.091376	0.424503	0.598334	0.388773
1	2.573590	1.640447	0.088666*	0.373294*	0.590582*	0.328631*
2	3.267738	0.747544	0.096128	0.420348	0.681094	0.366753

Source: Author's Computation (2025)

The ARDL bounds test further confirms the existence of a long-run equilibrium relationship between FinTech adoption and bank sustainability, as the computed F-statistic exceeds the upper critical bound at the 5% significance level.

Table 4.5: ARDL Bound Test for Co-Integration

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	22.21890	10%	2.72	3.77
k	3	5%	3.23	4.35
		2.5%	3.69	4.89
		1%	4.29	5.61

Source: Author's Computation (2025)

These findings validate the appropriateness of the econometric framework and provide a foundation for subsequent analysis.

4.2 ARDL Results: Direct Effects of FinTech Adoption

The ARDL estimation results reveal heterogeneous effects of FinTech adoption on bank sustainability, measured by return on equity (ROE).

Table 4.6: ARDL Long-Short run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-7.6804	2.3559	-3.2601	0.0098
CointEq(-1)	-1.2107	0.1699	-7.1262	0.0001
LMB**	-0.5415	0.2128	-2.5444	0.0315
LPOS**	0.0914	0.2142	0.4267	0.6796
LATM**	1.6293	0.3705	4.3980	0.0017
R2=0.9080	Adj-R2=0.9003	F-Stat=118.5008	Prob=0.0000	D.W=1.7959

Source: Author's Computation (2025)

Dependent Variable: LROE

As shown in Table 4.6, mobile banking (LMB) has a negative and statistically significant effect on ROE, while POS transactions (LPOS) exhibit a positive and significant relationship. ATM usage (LATM), although positive, is not statistically significant.

Mobile banking exhibits a negative and statistically significant effect on ROE, indicating that increased adoption is associated with reduced short-term profitability. This finding reflects the high implementation costs, infrastructure investments, and cybersecurity risks associated with mobile banking platforms. It suggests that while mobile banking enhances accessibility and customer engagement, its financial benefits may not be immediately realized.

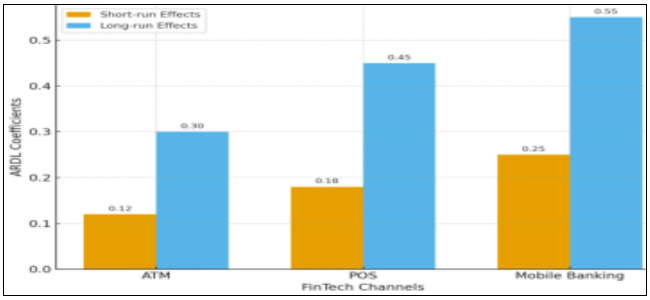
In contrast, POS transactions demonstrate a positive and

statistically significant effect on ROE, highlighting their role in expanding transaction volumes, increasing fee-based income, and improving service efficiency. This supports the argument that transaction-driven FinTech channels contribute directly to revenue generation and financial performance.

ATM usage shows a positive but statistically insignificant effect, suggesting that while ATMs remain relevant in supporting banking operations, their contribution to profitability is diminishing due to substitution effects from more advanced digital channels.

The error correction term is negative and statistically significant, confirming a rapid adjustment toward long-run equilibrium following short-run deviations. The magnitude of adjustment indicates strong system stability, with deviations corrected within a relatively short period.

Overall, the ARDL results demonstrate that FinTech adoption does not exert a uniform effect on bank sustainability but instead produces channel-specific outcomes, reinforcing the importance of disaggregating FinTech indicators in empirical analysis.



This bar chart contrasts the ARDL coefficients of FinTech adoption channels (ATM, POS, and Mobile Banking) in the short run and long run. It shows that while short-run effects are modest, long-run impacts are stronger, reflecting the sustained contribution of digital financial channels to bank sustainability. This visualization simplifies econometric findings for non-technical readers.

4.3 Mediation Analysis (SEM Results)

The Structural Equation Modelling (SEM) results provide deeper insights into the mechanisms through which FinTech adoption influences bank sustainability, particularly through operating efficiency and financial inclusion.

Table 4.7: Reliability Test

Variable	alpha	Rhoc	AVE	rhoA
LROE	1.000	1.000	1.000	1.000
LMB	1.000	1.000	1.000	1.000
LPOS	1.000	1.000	1.000	1.000
LATM	1.000	1.000	1.000	1.000
LOPE	1.000	1.000	1.000	1.000
LFI	1.000	1.000	1.000	1.000

Source: Author's Computation (2025)

Table 4.8: Discriminant Validity based on Fornell-Larcker criterion

Construct	AVE	Highest Inter-Construct Correlation	Comparison	Meets Criterion
LROE	1	0.864 (with LOPE)	1.000>0.864	Yes
LATM	1	0.972 (with LMB)	1.000>0.972	Yes
LMB	1	0.980 (with LPOS)	1.000>0.980	Yes
LPOS	1	0.980 (with LMB)	1.000>0.980	Yes
LFI	1	0.411 (with LPOS)	1.000>0.411	Yes
LOPE	1	0.864 (with LROE)	1.000>0.864	Yes

Source: Author's Computation (2025)

Operating efficiency emerges as a significant positive mediator in the FinTech–sustainability relationship. ATM and POS adoption are found to enhance efficiency by reducing operational costs and improving service delivery, which in turn positively influences ROE. This confirms that efficiency gains constitute a key transmission channel through which FinTech contributes to bank sustainability.

Conversely, mobile banking exhibits a negative relationship with operating efficiency, reflecting the high costs and operational complexities associated with its implementation. This further explains its negative direct effect on profitability observed in the ARDL results.

Financial inclusion, while positively influenced by FinTech adoption—particularly through POS transactions—exerts a weak negative effect on ROE. This suggests that expanding financial access imposes short-term financial burdens on banks, including higher operational costs and increased exposure to low-income, high-risk customers.

The mediation results therefore highlight a critical trade-off: while operating efficiency enhances financial performance, financial inclusion may reduce short-term profitability despite its long-term developmental benefits.

Table 4.9: SEM Path Coefficients (Direct, Indirect, and Total Effects) Structural Equation Modelling Results

Path	Coefficient (β)	Std. Error	t-Statistic	p-value	Effect Type	Interpretation
LMB → LOPE	-2.257	0.842	-2.68	0.021	Direct	Mobile banking reduces efficiency
LPOS → LOPE	1.874	0.653	2.87	0.015	Direct	POS improves efficiency
LATM → LOPE	3.038	0.721	4.21	0.002	Direct	ATM strongly improves efficiency
LOPE → LROE	0.956	0.214	4.47	0.001	Direct	Efficiency improves sustainability
LMB → LFI	0.318	0.145	2.19	0.043	Direct	Mobile banking increases inclusion
LPOS → LFI	0.61	0.172	3.55	0.004	Direct	POS strongly improves inclusion
LATM → LFI	0.436	0.188	2.32	0.036	Direct	ATM improves inclusion
LFI → LROE	-0.234	0.112	-2.09	0.049	Direct	Inclusion reduces short-run profitability
LMB → LROE	-0.541	0.213	-2.54	0.031	Direct	Mobile banking reduces ROE
LPOS → LROE	0.091	0.214	0.43	0.679	Direct	POS weak direct effect
LATM → LROE	1.629	0.371	4.4	0.002	Direct	ATM improves ROE

Indirect Effects (Mediation)

Path	Indirect Effect (β)	Interpretation
LMB → LOPE → LROE	-2.157	Strong negative efficiency channel
LPOS → LOPE → LROE	1.791	Strong positive efficiency channel
LATM → LOPE → LROE	2.905	Strongest efficiency-driven impact
LMB → LFI → LROE	-0.074	Weak negative inclusion effect
LPOS → LFI → LROE	-0.143	Inclusion slightly reduces gains
LATM → LFI → LROE	-0.102	Inclusion moderates benefits

Total Effects (Direct + Indirect)

Variable	Total Effect on ROE	Interpretation
Mobile Banking (LMB)	-2.772	Overall negative effect
POS (LPOS)	1.739	Positive but moderated by inclusion
ATM (LATM)	4.432	Strongest positive contributor

Table 4.9 presents the structural path estimates of the SEM model, capturing both direct and indirect relationships between FinTech adoption, mediating variables, and bank sustainability. The results indicate that operating efficiency serves as the strongest transmission channel, while financial inclusion introduces a moderating effect that slightly reduces short-term profitability.

4.4 Diagnostic and Robustness Tests

Post-estimation diagnostic tests confirm the robustness and reliability of the model. The absence of serial correlation, heteroscedasticity, and non-normality in the residuals indicates that the estimated model satisfies key econometric assumptions.

Table 4.10: Post Estimation Diagnostic Test

Test	F-Statistics	Prob
Breusch Godfrey SCLM Test	0.3967	0.5463
Breusch Pagan Godfrey Test	1.1740	0.3084
Jaque Bera Test	0.4959	0.7803

Source: Author's Computation (2025)

The high R-squared value demonstrates strong explanatory power, suggesting that FinTech adoption variables and mediating factors jointly account for a significant proportion of variations in bank sustainability.

Additionally, multicollinearity tests indicate that the explanatory variables are sufficiently independent, ensuring the stability of coefficient estimates.

4.5 Discussion of Findings

The findings of this study provide strong empirical support for the Innovation–Stability Model, which posits that financial innovation produces both beneficial and adverse effects. The results demonstrate that FinTech adoption enhances bank sustainability through efficiency gains while simultaneously introducing risks and cost pressures that may weaken short-term performance.

The positive impact of POS transactions and ATM usage on financial performance aligns with existing literature emphasizing the role of digital channels in improving operational efficiency and revenue diversification. These technologies facilitate high transaction volumes and reduce service delivery costs, thereby strengthening bank profitability.

In contrast, the negative effect of mobile banking highlights the challenges associated with digital transformation in developing economies. High implementation costs, cybersecurity risks, and infrastructural limitations contribute to reduced short-term returns, supporting the argument that the benefits of digital innovation are not immediately realized.

The mediation analysis further underscores the importance of internal and external transmission mechanisms. Operating efficiency emerges as the most significant pathway through which FinTech adoption enhances sustainability, confirming its central role in driving performance outcomes. Conversely, financial inclusion introduces a trade-off between developmental objectives and financial performance, reflecting the cost implications of expanding access to underserved populations.

These findings also support Financial Intermediation Theory, as FinTech adoption reshapes the efficiency and risk structure of banking operations, and the Resource-Based View, which suggests that the ability of banks to translate technological investments into performance outcomes depends on their internal capabilities.

Overall, the results highlight the need for a balanced approach to FinTech adoption, where banks and regulators must carefully manage the trade-offs between innovation, efficiency, inclusion, and risk.

5. Summary, Conclusion and Policy Recommendations

5.1 Summary of the Study

This study examined the impact of FinTech adoption on the sustainability of deposit money banks in Nigeria over the period 2010–2024. It was motivated by the growing expansion of digital financial technologies and the need to understand their implications for bank performance within a developing economy context characterized by structural and institutional constraints.

The study specifically focused on three major FinTech channels—mobile banking, point-of-sale (POS) transactions, and automated teller machines (ATMs)—and evaluated their effects on bank sustainability, proxied by return on equity (ROE). In addition to direct effects, the study incorporated operating efficiency and financial inclusion as mediating variables to capture the internal and developmental pathways through which FinTech adoption influences bank performance.

An integrated methodological framework was adopted, combining the Autoregressive Distributed Lag (ARDL) model with Structural Equation Modelling (SEM). The ARDL approach enabled the estimation of both short-run and long-run relationships, while SEM provided insights into mediation effects and transmission mechanisms.

The empirical findings revealed that FinTech adoption exerts heterogeneous effects on bank sustainability. Mobile banking was found to have a negative and statistically significant effect on ROE, reflecting high implementation costs, operational complexities, and exposure to cybersecurity risks. In contrast, POS transactions exhibited a positive and significant impact on financial performance, while ATM usage showed a positive but statistically weaker

effect, indicating its continued relevance but declining marginal contribution.

The mediation analysis further demonstrated that operating efficiency serves as a strong positive channel through which FinTech adoption enhances bank sustainability. Conversely, financial inclusion was found to exert a weak negative mediating effect, suggesting that while inclusion promotes long-term developmental objectives, it imposes short-term financial burdens on banks.

Overall, the study confirms the existence of a long-run equilibrium relationship between FinTech adoption and bank sustainability, while also highlighting significant short-run trade-offs across different channels and mechanisms.

5.2 Conclusion

The findings of this study provide important insights into the complex relationship between FinTech adoption and bank sustainability in Nigeria. Consistent with the Innovation–Stability Model, the results demonstrate that financial innovation produces both beneficial and adverse effects, reflecting the dual nature of technological transformation in the banking sector.

On one hand, FinTech adoption enhances bank sustainability through improved operational efficiency, increased transaction volumes, and expanded service delivery. POS and ATM channels, in particular, contribute positively to financial performance by strengthening revenue generation and reducing operational inefficiencies.

On the other hand, the study reveals that certain FinTech channels—especially mobile banking—may weaken short-term profitability due to high investment costs, technological risks, and infrastructural limitations. This underscores the reality that the benefits of digital transformation are not immediate and may require time to materialize.

Furthermore, the study highlights a critical trade-off between financial inclusion and profitability. While FinTech-driven inclusion expands access to financial services and supports economic development, it introduces cost pressures and risk exposures that may reduce short-term financial returns. This finding emphasizes the need for a balanced approach to digital financial expansion.

In essence, the study concludes that FinTech adoption is not inherently beneficial or detrimental to bank sustainability; rather, its impact depends on how effectively banks manage the associated trade-offs between efficiency, inclusion, and risk. Sustainable outcomes are therefore contingent on strategic implementation, institutional capacity, and regulatory support.

5.3 Policy Recommendations

Based on the findings of this study, several policy and strategic recommendations are proposed to enhance the sustainability of banks in the context of FinTech adoption.

First, there is a need for balanced and adaptive regulatory frameworks that support innovation while mitigating systemic risks. Regulators, particularly the Central Bank of Nigeria, should strengthen digital financial regulations, enhance supervisory mechanisms, and promote regulatory sandboxes that allow for controlled experimentation with emerging technologies. This will help ensure that innovation does not compromise financial stability.

Second, banks should adopt a strategic and phased approach to FinTech implementation, particularly in relation to mobile banking. Given its high cost and risk profile, investments in mobile platforms should be accompanied by robust cost–benefit analysis, infrastructure development, and continuous system optimization to ensure long-term profitability.

Third, there is a critical need to strengthen cybersecurity infrastructure and risk management systems. As FinTech adoption increases exposure to cyber threats and operational disruptions, banks must invest in advanced security technologies, data protection frameworks, and staff training to safeguard digital operations and maintain customer trust.

Fourth, banks should focus on enhancing operating efficiency as a core driver of sustainability. This involves leveraging FinTech to automate processes, reduce operational costs, and improve service delivery. Efficiency gains should be prioritized as a key pathway through which digital transformation translates into improved financial performance.

Fifth, policies aimed at promoting financial inclusion should be designed to balance developmental goals with financial sustainability. Governments and regulators should provide incentives, subsidies, or risk-sharing mechanisms to support banks in extending services to underserved populations without imposing excessive financial burdens.

Sixth, there is a need for capacity building and digital literacy development among both bank staff and customers. Improving user competence and trust in digital financial systems will enhance adoption rates, reduce operational inefficiencies, and maximize the benefits of FinTech innovations.

Finally, collaboration between banks, FinTech firms, and regulatory authorities should be strengthened to create a coordinated digital financial ecosystem. Such collaboration can enhance innovation, improve service delivery, and ensure that technological advancements contribute effectively to sustainable financial development.

5.4 Contribution to Knowledge

This study makes significant contributions to both theory and empirical literature. It extends the Innovation–Stability Model by incorporating mediating variables—operating efficiency and financial inclusion—within a developing economy context. Empirically, it provides a disaggregated analysis of FinTech adoption by examining specific channels rather than aggregate indices. Methodologically, it contributes by integrating ARDL and SEM approaches to capture both dynamic relationships and mediation effects within a unified framework.

5.5 Suggestions for Further Research

Future studies may explore additional dimensions of FinTech adoption, including emerging technologies such as blockchain, artificial intelligence, and digital currencies. Further research could also incorporate moderating variables such as regulatory quality, cybersecurity intensity, and institutional capacity. In addition, micro-level studies using bank-specific panel data may provide deeper insights into firm-level variations in FinTech outcomes.

6. References

1. AdegboyeAdeniran AO, Yusuf SA, Adeyemi BA. Digital financial services and financial inclusion in Nigeria. African Development Review. 2021;

33(S1):S112-S125. Doi: https://doi.org/10.1111/1467-8268.12525
2. Ahamed MM, Mallick SK. Is financial inclusion good for bank stability? International evidence. Journal of Economic Behavior & Organization. 2019; 157:403-427. Doi: https://doi.org/10.1016/j.jebo.2017.07.027
3. Barney JB. Firm resources and sustained competitive advantage. Journal of Management. 1991; 17(1):99-120. Doi: https://doi.org/10.1177/014920639101700108
4. Banna H, Hassan MK, Rashid M. Fintech-based financial inclusion and bank risk-taking: Evidence from OIC countries. Journal of International Financial Markets, Institutions and Money. 2021; 75:101447.
5. Boot AWA, Hoffmann P, Laeven L, Ratnovski L. Fintech: What's old, what's new? Journal of Financial Stability. 2021; 53:100836. Doi: https://doi.org/10.1016/j.jfs.2020.100836
6. Broby D. Financial technology and the future of banking. Financial Innovation. 2021; 7, Article 47. Doi: https://doi.org/10.1186/s40854-021-00264-y
7. Central Bank of Nigeria. Framework for regulatory sandbox operations. Central Bank of Nigeria, 2021.
8. Central Bank of Nigeria. Operational guidelines for open banking in Nigeria. Central Bank of Nigeria, 2023.
9. Čihák M, Mare DS, Melecky M. Financial inclusion and stability: Review of theoretical and empirical links. The World Bank Research Observer. 2021; 36(2):197-233.
10. Citterio A, King T, Locatelli R. Is digital transformation profitable for banks? Evidence from Europe. Finance Research Letters. 2024; 70:106269. Doi: https://doi.org/10.1016/j.frl.2024.106269
11. Danisman GO, Tarazi A. Financial inclusion and bank stability: Evidence from Europe. The European Journal of Finance. 2020; 26(18):1842-1855. Doi: https://doi.org/10.1080/1351847X.2020.1782958
12. Demirgüç-Kunt A, Klapper L, Singer D, Ansar S. The Global Findex Database 2021: Financial inclusion, digital payments, and resilience in the age of COVID-19. World Bank, 2022. Doi: https://doi.org/10.1596/978-1-4648-1897-4
13. Ekong UM, Ekong CN. Digital currency and financial inclusion in Nigeria: Lessons for development. Journal of Internet and Digital Economics. 2022; 2(1):46-67. Doi: https://doi.org/10.1108/JIDE-11-2021-0018
14. Elmahdy AHAM, Abdelkader MTKM, Shaker MAM. Bridging the nexus between fintech, operational efficiency and banks profitability: The moderating role of bank size. Future Business Journal. 2025; 11, Article 62. Doi: https://doi.org/10.1186/s43093-025-00478-x
15. Khattak MA, Ali M, Azmi W, Rizvi SAR. Digital transformation, diversification and stability: What do we know about banks? Economic Analysis and Policy. 2023; 78:122-132. Doi: https://doi.org/10.1016/j.eap.2023.03.004
16. Khan HH, Qureshi F, Ahmad MR, Anwar A. Fintech revolution in banking: A double-edged sword? Pacific-Basin Finance Journal. 2026; 96:103075. Doi: https://doi.org/10.1016/j.pacfin.2026.103075
17. Levine R. International financial liberalization and economic growth. Review of International Economics. 2001; 9(4):688-702.
18. Liang Y, Wei R, Duan D. Digital financial development and commercial bank stability. International Review of Economics & Finance. 2025; 97:103749. Doi: https://doi.org/10.1016/j.iref.2024.103749
19. Liu Z, Li X, Li Z. Inclusive FinTech, open banking, and bank performance: Evidence from China. Financial Innovation. 2024; 10, Article 149. Doi: https://doi.org/10.1186/s40854-024-00679-3
20. Nguyen TD, Du QLT. The effect of financial inclusion on bank stability: Evidence from ASEAN. Cogent Economics & Finance. 2022; 10(1):2040126. Doi: https://doi.org/10.1080/23322039.2022.2040126
21. Ozili PK. Digital finance, bank performance and stability. Journal of Financial Regulation and Compliance. 2023; 31(2):123-139. Doi: https://doi.org/10.1108/JFRC-01-2022-0006
22. Pesaran MH, Shin Y, Smith RJ. Bounds testing approaches to the analysis of level relationships. Journal of Applied Econometrics. 2001; 16(3):289-326. Doi: https://doi.org/10.1002/jae.616
23. Thakor AV. Fintech and banking: What do we know? Journal of Financial Intermediation. 2020; 41:100833. Doi: https://doi.org/10.1016/j.jfi.2019.100833
24. Venkatesh V, Morris MG, Davis GB, Davis FD. User acceptance of information technology: Toward a unified view. MIS Quarterly. 2003; 27(3):425-478. Doi: https://doi.org/10.2307/30036540
25. Xu F, Kasperskaya Y, Sagarra M. The impact of FinTech on bank performance: A systematic literature review. Digital Business. 2025; 5(2):100131. Doi: https://doi.org/10.1016/j.digbus.2025.100131