

Predicting The Barriers Of Digital Transformation And Financial Inclusion In African Enterprise Growth

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Abstract

Over the past decade, digitalization and digital financial inclusion have driven global resilience, yet Sub-Saharan African enterprises face severe structural hurdles. Extending Onukwuli and Ndife (2026), this paper investigates growth barriers within the Nigerian entrepreneurial ecosystem. Specifically, this study evaluates infrastructural and operational barriers preventing MSMEs from adopting digital tools, analyzes divergences between advanced digital public infrastructure and local infrastructural decay, creates an analytical framework predicting how digital literacy and cash-heavy supply chains dictate business survival, and builds a predictive model for enterprise digital maturity. Adopting a desk-based design, this research synthesizes peer-reviewed studies and institutional reports (2021–2026) using thematic content analysis. Results indicate that chronic power instability, high broadband expenses, and cash preferences undermine digital tools; consequently, Nigeria's vibrant fintech sector coexists with systemic infrastructure deficits, where digital literacy, operating costs, and institutional friction emerge as core mediating vectors of enterprise scaling. Recommendations include deploying localized renewable energy micro-grids, providing hands-on digital literacy training, streamlining regulatory compliance via sandboxes, and offering targeted data subsidies for micro-enterprises.

Keywords: Digital Transformation, Digital Financial Inclusion, MSMEs, Fintech, Predictive Modeling

1. INTRODUCTION

Over the past ten years, the architecture of international trade has shifted dramatically, propelled by the merging of digitalization and digital financial inclusion (DFI) as essential catalysts for sustainable economic progress (World Bank, 2024). Developed nations and advanced emerging markets typically rely

on cloud-based enterprise systems, predictive data analytics, and streamlined payment networks to modernize workflows, connect to global supply chains, and access alternative funding. Yet, across Sub-Saharan Africa, adopting a tech-driven commercial framework faces unique structural obstacles. Expanding upon the framework created by Onukwuli and Ndife (2026) regarding fintech-enabled financial inclusion, this study explores the cumulative hurdles limiting digital transformation and business expansion throughout Africa, examining both global macroeconomic trends and the practical realities of the Nigerian business sector.

On a global scale, digital financial inclusion has transitioned from an alternative banking method into the foundation of contemporary business activity. Regions that have successfully implemented advanced digital public infrastructure (DPI) consistently benefit from higher business output, broader market penetration, and greater credit absorption capabilities (Oyedotun & Makoni, 2026). Conversely, Nigeria highlights a distinct contradiction mirroring broader regional patterns. On one hand, the country features a thriving, internationally recognized fintech ecosystem centered in Lagos, which has popularized mobile money and agent banking in semi-urban and rural areas. On the other hand, everyday operators—particularly micro, small, and medium-sized enterprises (MSMEs) in the informal economy—still struggle with major systemic barriers. Unreliable power supplies, expensive internet access, high merchant fees, and a heavy reliance on cash transactions continue to restrict long-term business growth (Lottu et al., 2023; Arendse & Berg, 2024).

Identifying and removing these growth barriers is critical for the future of African commerce. Informal micro-enterprises represent the backbone of local economies, driving employment and supporting livelihoods across the region. When these businesses remain cut off from digital resources and formal financial channels due to low digital literacy, poor infrastructure, or shifting compliance rules (PECB, 2025; Nomico, 2026), the wider macroeconomy suffers from slowed capital movement and stagnant productivity. Building on the research started by Onukwuli and Ndife (2026), this paper models the key factors influencing enterprise technology adoption. By evaluating these systemic limitations, the study offers practical recommendations for lawmakers, financial institutions, and industry professionals working to maximize the economic potential of African businesses in a digital economy.

Addressing the structural challenges that hinder digital integration and enterprise scaling in Sub-Saharan Africa while expanding on the insights of Onukwuli and Ndife (2026) this research aims to:

- i. Critically assess the core infrastructural, financial, and operational challenges that prevent African enterprises, particularly MSMEs, from embracing digital transformation and financial inclusion tools.
- ii. Examine the differences between international digital public infrastructure (DPI) models and the socio-economic environment in Nigeria, focusing on the contrast between rapid fintech growth and underlying infrastructural decay.
- iii. Create an analytical framework using recent literature to forecast how factors like digital literacy, internet expenses, cash-heavy supply chains, and regulatory requirements influence business survival and scalability.
- iv. Build upon the findings of Onukwuli and Ndife (2026) by moving past simple descriptions of fintech adoption to construct a predictive model for enterprise digital maturity.

2. REVIEW OF RELATED LITERATURE

Establishing a robust academic framework to evaluate obstacles facing digital transformation and financial inclusion among African enterprises requires analyzing existing scholarly discourse. Over recent years, extensive empirical literature has explored the operational frictions small businesses encounter when

implementing digital innovations.

Focusing on the informal economy, Arendse and Berg (2024) explored systemic hurdles restricting digital financial inclusion among small-scale merchants in Southern Africa. Utilizing a qualitative exploratory design, they examined 78 informal traders selected through purposive and snowball methods, analyzing interview data via NVivo. Their findings indicated that poor digital literacy, apprehension regarding hidden fees, and entrenched cash reliance significantly hinder digital transitions. They advised launching simplified, vernacular-friendly interfaces alongside targeted educational campaigns. While this study mirrors our focus on informal commerce, Arendse and Berg relied on descriptive qualitative exploration, whereas the current study constructs an explicit predictive framework linking structural constraints directly to business growth metrics.

Broadening the geographic scope to Nigeria, Lottu, Abiola, and Daraojimba (2023) evaluated the evolution and bottlenecks of digital banking within the nation's commercial sector. Employing a desk-based descriptive review of secondary policy documents, their findings demonstrated that despite rapid electronic payment expansion, frequent power outages, expensive internet data, and network instability continuously disrupt enterprise workflows. They recommended large-scale public-private investments in energy and broadband infrastructure. Although both studies center on the Nigerian context and infrastructure decay, Lottu et al. focused broadly on banking sector progression, whereas this paper models enterprise growth barriers, building directly upon Onukwuli and Ndife (2026).

Adopting quantitative econometric modeling, Nomico (2026) investigated the relationship between digital literacy, financial inclusion, and sustainable enterprise expansion. Utilizing a macro-level panel dataset spanning 35 emerging economies across a decade, Nomico applied Structural Equation Modeling (SEM) and the Generalized Method of Moments (GMM). The econometric results proved that digital literacy serves as an indispensable prerequisite, noting that financial inclusion fails to drive business performance independently of foundational digital proficiencies. Nomico recommended embedding digital training into business support frameworks. While both studies share a quantitative approach to digital literacy and scaling, Nomico utilized international macro-panels, whereas this research targets micro- and meso-level enterprise barriers within Africa and Nigeria.

Complementing this technological emphasis, Nurmasari and Bilad (2026) analyzed the implementation of modern digital solutions and artificial intelligence in sustainable financial frameworks. Utilizing a mixed-methods sequential explanatory design with 150 technology-adopting SMEs across developing economies, they combined regression statistics with qualitative thematic analysis. Their results revealed that while advanced technologies improve efficiency, prohibitive implementation expenses and intricate compliance mandates discourage resource-constrained operators, leading to recommendations for subsidized software licensing. Although Nurmasari and Bilad examined AI and green finance more broadly, both studies investigate the transformation hurdles experienced by growing firms.

At the center of this inquiry is the foundational study by Onukwuli and Ndife (2026), published in the British Journal of Contemporary Research. Their research investigated how financial technology fosters financial inclusion tailored to African SMEs, establishing that fintech solutions significantly enhance capital access and transaction speeds, though persistent structural roadblocks restrict universal adoption. They advocated for expanded regulatory harmonization and public-private partnerships. This paper serves as a direct continuation of that work, sharing identical contextual parameters regarding African enterprise growth while advancing from descriptive fintech assessments to a forward-looking predictive model of transformation barriers.

Exploring regional financial integration, Oyedotun and Makoni (2026) analyzed the dynamic panel nexus

between fintech and financial inclusion across 28 Sub-Saharan African economies from 2012 to 2024. Using a System GMM estimator, their results confirmed a significant positive cointegration between fintech adoption and regional inclusion, though institutional friction suppressed potential gains. They advised regional bodies to streamline cross-border digital financial policies. While both studies address macro-financial dynamics across Sub-Saharan Africa, Oyedotun and Makoni applied a multi-country macroeconomic panel, whereas the present study integrates these insights into an enterprise-level growth barrier framework.

Addressing regulatory and institutional constraints, the Professional Evaluation and Certification Board (PECB, 2025) evaluated compliance pressures associated with digital transformation across Africa. Surveying 450 corporate executives and enterprise consultants via convenience sampling, their findings indicated that unpredictable tax enforcement, strict data localization rules, and heavy cybersecurity compliance expenses disproportionately penalize small businesses, forcing many to stay informal. They recommended simplifying compliance structures and supplying affordable security toolkits. While PECB approached the topic from an institutional compliance and professional training standpoint, this study focuses explicitly on enterprise growth and financial inclusion bottlenecks.

Similarly, Sodokin, Koriko, and Couchoro (2022) examined the relationship between digital transformation, banking stability, and financial inclusion across 40 Sub-Saharan African nations over a 15-year period using a Two-Step System GMM estimator. Their findings demonstrated that digital transformation drives inclusion and banking stability provided underlying telecommunication infrastructure meets minimum operational thresholds, prompting calls for prioritized universal broadband access. Although Sodokin et al. concentrated on macroeconomic banking stability, the present study centers on commercial scaling and enterprise growth constraints.

Examining global developmental impacts, Tay, Tai, and Tan (2021) explored digital financial inclusion as a gateway to sustainable development across more than 100 developing nations using Ordinary Least Squares (OLS) regression. Their results indicated that digital financial inclusion rapidly accelerates developmental outcomes, though persistent digital divides between urban and rural business sectors restrict comprehensive participation, prompting recommendations for public sector investments in digital public infrastructure (DPI). While Tay et al. adopted a broad global development perspective, the present study maintains a focused lens on African enterprise growth in furtherance of Onukwuli and Ndife (2026).

Finally, Zenodo (2026) investigated the effect of financial technology on financial inclusion and SME performance in Ibadan, Oyo State, Nigeria. Utilizing an empirical survey design with 250 SME operators analyzed via multiple regression ($\$R = 0.614$, $p < 0.05$ for mobile banking and growth; $\$R = 0.572$, $p < 0.05$ for digital payments and inclusion), they recommended enhancing foundational infrastructure and digital literacy. Zenodo (2026) focused on positive performance outcomes of fintech adoption, the present study centers on predicting and mitigating the structural barriers hindering such transformations, directly advancing the scholarly dialogue initiated by Onukwuli and Ndife (2026).

The reviewed literature consistently demonstrates that digital transformation and digital financial inclusion act as primary engines for entrepreneurial productivity, capital access, and economic resilience (Tay et al., 2021; Sodokin et al., 2022; Onukwuli & Ndife, 2026). Prior studies confirm that when MSMEs successfully integrate mobile money, digital payments, and alternative credit scoring, performance metrics improve significantly (Zenodo, 2026; Oyedotun & Makoni, 2026). Furthermore, empirical consensus highlights infrastructural stability, digital literacy, and regulatory alignment as core foundations determining whether enterprises cross the digital divide (Lottu et al., 2023; Nomico, 2026; PECB, 2025).

Despite these valuable contributions, important gaps remain in the existing body of knowledge: While

prior works such as the foundational study by Onukwuli and Ndife (2026) effectively evaluate current fintech penetration and descriptive inclusion metrics, there is a distinct lack of forward-looking predictive modeling connecting specific structural barriers (such as broadband costs, cash-flow mismatches, and compliance friction) directly to enterprise growth outcomes. Many existing macro-level econometric studies overlook the distinct operational realities of informal sector enterprises, which comprise the vast majority of commercial activity in nations like Nigeria. Empirical research rarely integrates digital literacy capacity, infrastructural deficits, and regulatory burdens into a unified predictive framework tailored specifically to African enterprise scaling.

This study addresses these gaps by adopting an integrative analytical and predictive framework that moves beyond descriptive assessments to model how infrastructural, educational, and institutional barriers impede digital adoption, offering actionable pathways for sustainable enterprise growth across Sub-Saharan Africa in furtherance of Onukwuli and Ndife (2026). Provide evidence-backed strategies for policymakers, regulators, and financial institutions to ease compliance burdens, improve digital education, and broaden formal financial inclusion for informal businesses across Africa.

3. METHODOLOGY

This investigation adopts a secondary, desk-based research design founded on systematic review methodologies and qualitative synthesis. Instead of conducting primary field surveys, this approach concentrates on compiling, appraising, and integrating published empirical research, institutional working papers, and governmental assessments from entities such as the World Bank. Such a research framework is well-suited for advancing existing theoretical models—particularly expanding upon the contributions of Onukwuli and Ndife (2026) by identifying macro-level thematic patterns, exposing systemic impediments, and developing a predictive structure for the challenges impacting digital transformation and financial inclusion across African businesses.

The geographic and thematic scope encompasses scholarly literature regarding business scaling, financial technology integration, and digital exclusion throughout Sub-Saharan Africa, with particular emphasis on the Nigerian commercial environment. To uphold strict academic standards, literature was sourced from recognized academic repositories including Scopus, Web of Science, Springer, SAGE Journals, and Google Scholar. To capture recent post-pandemic economic developments and contemporary financial trends, the review prioritizes literature published between 2021 and 2026.

Data collection was executed through a targeted document-screening protocol using specific keyword strings, including "digital transformation barriers," "financial inclusion in African SMEs," "fintech adoption in Nigeria," and "enterprise growth bottlenecks." Inclusion parameters required that each examined source met specific benchmarks: presented verifiable empirical evidence through qualitative, quantitative, or mixed methodologies; directly examined core thematic dimensions, including infrastructural deficiencies, digital literacy divides, cash-dependent supply chains, or regulatory friction; detailed transparent methodological designs, sample sizes, and analytical outcomes suitable for critical cross-examination; and extracted data was examined using thematic synthesis and conceptual content analysis. This procedure categorized qualitative insights and secondary statistical findings into primary analytical domains: infrastructural decay, educational gaps, cash-preference behaviors, and regulatory friction. By systematically cross-comparing these thematic areas, the study establishes an integrative framework demonstrating how these overlapping constraints impede digital maturity and financial inclusion for African enterprises, providing a conceptual foundation for subsequent policy design and scholarly inquiry.

4. RESULTS AND DISCUSSION

This section evaluates the research findings in alignment with the five core objectives established in the introduction. Using a secondary synthesis of empirical literature, academic whitepapers, and institutional reports published between 2021 and 2026, the analysis assesses the predictive variables governing digital transformation and financial inclusion, building directly upon the foundational insights of Onukwuli and Ndife (2026).

When assessing the core hurdles preventing African enterprises particularly Micro, Small, and Medium-Sized Enterprises (MSMEs) from adopting digital tools, the literature demonstrates an overwhelming consensus. Prior research indicates that infrastructural decay and operational rigidity represent primary constraints. Studies by Lottu et al. (2023) and Sodokin et al. (2022) establish that chronic power grid failures and exorbitant internet bandwidth expenses undermine digital reliability, compelling operators to rely on expensive, fuel-dependent generators. At the grassroots level, Arendse and Berg (2024) show that cash-flow mismatches and ingrained cash preferences within informal markets create severe friction during transitions to digital platforms. Furthermore, Nurmasari and Bilad (2026) and PECB (2025) note that steep implementation expenses and complex operational mandates discourage resource-constrained firms from deploying advanced enterprise architectures. These challenges form an interconnected matrix of physical and operational barriers that render digital transformation economically taxing.

Analyzing the divergence between advanced international digital public infrastructure (DPI) ecosystems and the socio-economic environment in Nigeria reveals a distinct operational paradox. Global perspectives outlined by Tay et al. (2021) demonstrate that mature DPI in developed economies facilitates seamless credit scoring, frictionless international trade, and automated accounting. Conversely, the African context exhibits starkly different conditions. While Onukwuli and Ndife (2026) and Zenodo (2026) highlight a thriving fintech sector anchored in Lagos alongside extensive agent-banking networks driving surface-level inclusion, Lottu et al. (2023) and Oyedotun and Makoni (2026) emphasize that this growth coexists with grassroots infrastructural decay, network outages, and power instability. High fintech availability does not automatically translate to a fully functioning digital ecosystem; local infrastructural deficits create unique obstacles largely absent in advanced economies.

To construct an integrative framework predicting how factors like digital literacy, broadband cost, cash-dependent supply chains, and regulatory compliance influence business survival, our synthesis incorporates the econometric models of Nomico (2026) and Oyedotun and Makoni (2026). Nomico (2026) establishes that digital literacy serves as an indispensable cognitive prerequisite, noting that financial inclusion indices fail to stimulate enterprise revenue growth without adequate digital competencies. Concurrently, Oyedotun and Makoni (2026) and Sodokin et al. (2022) validate via dynamic panel estimations that institutional friction and high data costs act as negative dampening coefficients on enterprise credit absorption. Additionally, Zenodo (2026) confirms positive statistical correlations between mobile banking and SME growth ($SR = 0.614\$$), provided these negative variables are managed. Enterprise scaling in Africa is thus governed by a predictive vector where literacy, infrastructure expenses, and institutional friction mediate the translation of fintech tools into commercial success.

This study bridges the gap between descriptive fintech assessment and predictive enterprise maturity, advancing the dialogue established by Onukwuli and Ndife (2026). While the foundational study provided an essential baseline confirming that fintech solutions enhance capital access and transaction speeds, evaluating those findings alongside Nurmasari and Bilad (2026) and PECB (2025) demonstrates that static descriptions are insufficient to address persistent enterprise failures. By integrating these recent

perspectives, this paper shifts the scholarly focus from cataloging available fintech tools to predicting the structural variables that determine whether an African enterprise achieves sustainable digital maturity.

Addressing the final governance objective requires translating these empirical insights into actionable frameworks. Evaluating Nurmasari and Bilad (2026) alongside PECB (2025) exposes a regulatory paradox: governments across the continent frequently digitize tax collection and enforce strict data compliance laws without accounting for MSME resource constraints. As PECB (2025) highlights, complex legal mandates often drive informal enterprises deeper into the shadow economy to escape high administrative costs. True digital maturity requires regulatory sandbox models that lower entry barriers while safeguarding data integrity.

Synthesizing these governance needs with the predictive variables identified by Nomico (2026) and Oyedotun and Makoni (2026), our framework establishes three core intervention pillars:

- i. Subsidizing reliable, localized renewable energy micro-grids for enterprise clusters to insulate small businesses from national grid failures.
- ii. Shifting micro-grants and capacity-building initiatives from generic financial inclusion to hands-on digital competency training.
- iii. Streamlining compliance mechanisms to protect micro-enterprises while encouraging formalization.

5. CONCLUSION AND RECOMMENDATIONS

Synthesizing the empirical evidence, theoretical frameworks, and contemporary literature from 2021 to 2026 yields several core conclusions concerning financial technology, infrastructure, and enterprise expansion in developing economies.

First, chronic power outages, expensive broadband access, and deeply rooted cash preferences across informal markets combine to form an interconnected network of structural hurdles. These barriers significantly diminish the anticipated commercial advantages of digital financial instruments. Second, a profound structural paradox defines the modern digital ecosystem: although high-profile fintech innovations and mobile-money agent networks particularly in commercial hubs like Lagos successfully advance surface-level financial inclusion, they operate alongside severe grassroots infrastructural decay. Platform availability alone does not ensure a functional or resilient digital economy. Third, enterprise scaling and credit absorption among Micro, Small, and Medium-Sized Enterprises (MSMEs) are dictated by a predictive vector in which digital literacy, operating costs, and institutional friction serve as essential mediating variables. Without proper digital competencies and reduced institutional friction, fintech tools fail to generate sustainable revenue growth. Finally, building upon the baseline established by Onukwuli and Ndife (2026), this research successfully bridges the divide between descriptive fintech utility and predictive enterprise maturity, demonstrating that static frameworks are inadequate for resolving ongoing business failures without targeted structural reforms.

Translating these empirical insights into practical governance strategies for policymakers, financial institutions, and industry leaders requires implementing the following measures:

- i. Governments and private stakeholders must partner to establish subsidized, localized renewable energy micro-grids (such as solar-powered commercial clusters) to protect small businesses from recurring national grid collapses.
- ii. Capacity-building initiatives managed by development agencies and fintech providers should shift from generic financial inclusion campaigns to practical, hands-on digital literacy programs tailored directly to informal market operators (Onukwuli & Ndife, 2026).

- iii. Regulatory authorities, including central banks and financial watchdogs, ought to ease compliance obligations and adopt flexible regulatory sandboxes that encourage informal businesses to formalize without incurring excessive administrative expenses.
- iv. Telecommunications regulators should introduce specialized tariff tiers or data subsidies for verified micro-enterprises to lower the burdensome costs of mobile and broadband connectivity, thereby facilitating smooth supply chain digitization.

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