Institutional Quality, Entrepreneurship, and Economic Outcomes in Low- and Middle-Income Economies

Adedeji Daniel GBADEBO[1]

[1]Research Fellow, Department of Accounting Science, Walter Sisulu University, Mthatha, Private Bag X1, UNITRA, 5117, South Africa, gbadebo.adedejidaniel@gmail.com

ARTICLE DETAILS	ABSTRACT
	Purpose This study examines the effect of digital financial inclusion on the growth of micro-enterprises in low- and middle-income economies, with particular focus on gender disparities and the mediating role of institutional trust.

Methodology
The study uses primary panel survey data from 1,240 micro-entrepreneurs collected across several developing economies between 2018 and 2023. A panel probit model is applied to analyse the determinants of the adoption of digital financial services. At the same time, a dynamic system Generalised Method of Moments (GMM) estimator assesses the impact of digital financial inclusion on enterprise growth, accounting for endogeneity and unobserved heterogeneity.

Findings
The findings indicate that digital financial inclusion significantly enhances micro-enterprise growth by improving liquidity management, expanding market access, and increasing operational efficiency. Institutional trust partially mediates this relationship, reinforcing both the adoption and effectiveness of digital financial services. The interaction between digital financial inclusion and gender is negative, indicating that women entrepreneurs derive comparatively lower growth benefits.

Conclusion
The study concludes that digital financial inclusion can support micro-enterprise development, but its growth-enhancing effects depend critically on institutional trust and gender dynamics. Addressing trust deficits and gender-specific barriers is essential to ensure that digital financial ecosystems promote inclusive and equitable entrepreneurial growth in developing economies.

Corresponding author's email address: gbadebo.adedejidaniel@gmail.com

1. Introduction

Digital financial inclusion has become a key theme in development economics because it can transform the ways individuals and businesses engage with financial systems in low- and middle-income nations. Mobile banking, agency networks, and platforms powered by FinTechs have been transforming access to savings, credit, insurance, and payment services. Such innovations could help narrow historical gender gaps in the financial sector, particularly for women, who have long been constrained by limited access to formal credit and control over financial resources. Although digital finance can be viewed as a means of increasing the number of people in the economic system, its benefits may be more available across countries and institutional settings, depending on decisions about its adoption, which are shaped by behavioral, structural, and regulatory factors (Demirgüç-Kunt et al., 2022).

Despite these advances, micro-entrepreneurs in developing economies continue to face persistent barriers, including limited institutional capacity, unequal digital access, and weak trust in formal financial systems, which constrain the effective use of digital financial services. These challenges are particularly pronounced for women-owned enterprises, making digital financial inclusion an uneven and context-dependent tool for development.

Digital financial inclusion has a gendered dimension that is a fundamental concern to study, as women-owned microenterprises in developing economies are often the most affected, facing disproportionate financial constraints. Digital technologies can alleviate some of these obstacles by reducing transaction costs and enabling alternative methods of assessing creditworthiness. Nevertheless, the same online systems can introduce new forms of exclusion, with access to devices, network coverage, and digital literacy unevenly distributed. Such complications suggest that the impact of digital financial inclusion on women's entrepreneurial performance may be conditional and influenced by macro-socioeconomic and institutional contexts (Ari et al., 2023).

Empirical evidence suggests that digital financial tools can support microenterprises by alleviating liquidity constraints, expanding market access, and facilitating more effective business decision-making. However, the advantages may be realized only when digital platforms are integrated into a reliable institutional ecosystem among female entrepreneurs. Trust in the institution can foster perceptions of financial safety, data privacy, and service reliability, and, in turn, increase the likelihood of adopting and using digital finance. A reduced level of trust in financial intermediaries has been associated with lower adoption of digital services among vulnerable groups, suggesting that trust can play a mediating and moderating role in the relationship between digital financial inclusion and entrepreneurial growth (Chen & Qian, 2022).

The interaction among gender, digital finance, and entrepreneurial outcomes also warrants methodological strategies that account for behavioral and institutional processes. Research on women in entrepreneurship has also grown, highlighting the importance of examining how gendered access constraints interact with institutional quality to determine business performance. For example, women might respond differently to digital credit services because of their attitudes toward risk, unwritten rules governing financial decision-making, or concerns about data misuse. This set of behavioral patterns suggests that institutional

trust may not necessarily facilitate digital financial participation itself, but rather the scale and nature of its impact on enterprise performance (Honohan et al., 2021).

While existing studies have examined digital financial inclusion, gender disparities, and institutional trust primarily in isolation, there remains limited empirical evidence of their interactive and mediating effects on micro-enterprise growth, using longitudinal, cross-country data. In particular, the mediating role of institutional trust in shaping gender-differentiated entrepreneurial outcomes remains underexplored in low- and middle-income contexts.

This study thus seeks to enhance knowledge of how digital financial inclusion can spur women's entrepreneurship in low- and middle-income nations, using primary data from cross-country micro-entrepreneurs. The analysis plan will employ panel probit and mediation analyses to identify both direct and indirect relationships among digital financial tools, gender-specific variables, and institutional trust. These approaches enable a more nuanced assessment of the potential effects of digital finance on enterprise outcomes across different institutional settings.

Specifically, this study contributes to the literature in four ways. First, it provides dynamic panel evidence on the growth effects of digital financial inclusion among micro-entrepreneurs. Second, it explicitly models institutional trust as a mediating mechanism linking digital finance to entrepreneurial performance. Third, it examines gender-based heterogeneity in these relationships, highlighting persistent structural constraints faced by women entrepreneurs. Fourth, it offers robust policy-relevant insights by employing multiple estimation strategies and alternative measures of digital financial inclusion.

The applicability of this study's policy focus is supported by the broader global policy agendas of equality (SDG 5) and inclusive economic growth (SDG 8). Although digital financial inclusion is frequently promoted as a driver of entrepreneurship and poverty eradication, the influence of digital access and its interactions with trust and gendered constraints may determine its efficacy. Research on women micro-entrepreneurs will advance understanding of the design of digital ecosystems that facilitate inclusive and sustainable entrepreneurship development in emerging economies.

2. Literature Review

The theorization of digital financial inclusion is conceived as a multidimensional process that encompasses not only account ownership but also the active and meaningful utilisation of digital payment, savings, credit, and insurance services. Current theoretical interventions also stress that digitisation lowers transaction costs and information frictions, and that new sources of creditworthiness may be visible to non-traditional lenders (World Bank, 2020; Demirgüç-Kunt et al., 2022). Here, digital finance has the potential to circumvent classical supply-side obstacles to credit, such as geographic distance to branches and the high administrative costs of small loans, thereby shifting the supply–demand equilibrium in small-scale credit markets. Beyond these access-related channels, theory increasingly emphasises that inclusive outcomes depend on the depth and regularity of use, the appropriateness of financial products for business needs, and users' ability to navigate digital interfaces effectively. Nevertheless, theoretical explanations emphasize that, in addition to access, inclusive outcomes require integrating factors such as the

intensity of use, product fit, user skill, and data protection regimes to determine whether digital access can support businesses' work (Neves et al., 2023; World Bank, 2020). This synthesis implies that empirical analysis should distinguish between nominal inclusion and functional inclusion, thereby justifying the use of usage-based digital finance indicators rather than binary ownership measures.

The second theoretical strand draws on theories of technology adoption and diffusion to explain heterogeneity in adoption and effects. Recent studies synthesising UTAUT/UTAUT2, TAM, and diffusion-of-innovation models identify trust, perceived usefulness, effort expectancy, and social influence as the core mechanisms shaping adoption decisions (Amnas et al., 2023; Neves et al., 2023). These syntheses indicate that digital financial products diffuse unevenly across populations, shaped by social learning, network externalities, and disparities in digital literacy. For micro-entrepreneurs, who typically operate under severe liquidity and time constraints, perceived operational benefits, such as faster transactions, reduced cash-handling risks, and improved record-keeping, become particularly salient determinants of adoption. However, perceived benefits do not translate uniformly into outcomes, as adoption itself may be constrained or delayed by gendered norms and information asymmetries. Women entrepreneurs may face slower diffusion due to weaker social networks, lower exposure to peer learning, and higher perceived risks associated with digital platforms, suggesting that adoption is not gender-neutral (Neves et al., 2023; Amnas et al., 2023). This theoretical insight motivates the inclusion of gender interaction effects in the empirical specification.

One of the key theoretical tools that connects digital financial access and economic behaviour is institutional trust. Recent theoretical and empirical literature conceptualises trust as a facilitating institution that lowers perceived risk, increases willingness to disclose transactional information, and strengthens expectations of reliable service provision (Chen & Qian, 2022; Devlin et al., 2025). In contexts characterised by weak regulatory enforcement or limited consumer protection, low institutional trust can lead to selective adoption, in which users engage only with low-risk services, such as payments, while avoiding credit or savings products. This selectivity implies that adoption alone may overstate the actual economic impact of digital finance. Therefore, the role of trust is dual: as a precondition to adoption and as a moderator of effectiveness, such that the positive impact of digital finance on enterprise development is amplified when trust in providers and regulators is high (Chen & Qian, 2022; Devlin et al., 2025). This dual role provides a clear theoretical basis for modelling trust as a mediating variable linking digital finance to entrepreneurial outcomes.

Gender and financial access theory provides further clarification by highlighting how social norms, asset ownership, and intra-household bargaining shape women's economic behaviour. Cross-country survey evidence consistently shows that despite rising access to mobile accounts, women exhibit lower practical usage and face persistent credit constraints due to limited control over devices, higher opportunity costs of skill acquisition, and legal or customary restrictions (Zins & Weill, 2016; Demirgüç-Kunt et al., 2022). From a theoretical standpoint, this implies that digital financial inclusion is inherently gender-differentiated. While technological design can reduce some market frictions, entrenched socio-institutional barriers, such as discriminatory property rights or restricted mobility, may offset these gains unless explicitly addressed (Zins & Weill, 2016; Demirgüç-Kunt et

al., 2022). This perspective leads to the expectation that the growth effects of digital finance will be weaker or more conditional for women-owned enterprises.

Closely related is the theory of financial constraints and firm growth, which posits that micro and small enterprises are disproportionately affected by liquidity shortages and information opacity. Alleviating these constraints is therefore central to enterprise growth and innovation (Bui et al., 2021; Rabbani et al., 2024). Digital financial tools expand the range of monitorable signals, such as transaction histories, mobile money flows, and platform-based sales data, that lenders can use to underwrite credit to small firms. However, theory and evidence caution that improved access does not automatically translate into productive investment or sustainable growth. Poor institutional quality, regulatory loopholes, and governance failures can divert financial access away from growth-enhancing uses (Bui et al., 2021). This reinforces the need to jointly consider institutional quality and trust when estimating the impact of digital finance.

Taken together, these theoretical strands converge on a conditional and mediated framework in which digital financial inclusion reduces transactional and informational barriers, but its entrepreneurial impact depends on adoption dynamics, institutional trust, and gendered socio-economic constraints (Neves et al., 2023; Amnas et al., 2023; Chen & Qian, 2022). Rather than treating digital finance as a uniform intervention, theory suggests an integrated mechanism in which technology adoption explains uptake, institutional trust explains persistence and depth of use, and financial-constraint theory explains final enterprise outcomes. This synthesis directly informs the empirical strategy adopted in this study.

Finally, these theoretical considerations inform variable selection and model specification. First, measurement strategies distinguish active and purposive use of digital financial services from mere account ownership. Second, interaction and mediation terms are incorporated to test how gender and institutional trust condition the relationship between digital finance and growth. Third, given the dynamic nature of adoption and impact, panel estimation techniques are preferred to capture temporal variation and reduce unobserved heterogeneity. Overall, theory supports the central proposition that digital financial inclusion is not a single intervention but an integrated system of technological, institutional, and socio-cultural factors that shape entrepreneurial outcomes in low- and middle-income economies (World Bank, 2020; Demirgüç-Kunt et al., 2022; Neves et al., 2023).

3. Methodology
3.1. Theoretical Foundation

The paper synthesizes the theory of digital financial inclusion, gendered credit access theories, and institutional trust theory in the context of the entrepreneur growth model in financial economics. These theoretical threads converge on the assumption that digital financial inclusion can improve entrepreneurial performance by relaxing liquidity constraints, reducing information asymmetry, and facilitating efficient capital allocation. Nevertheless, these impacts can be shaped by institutional quality and gender-based access patterns, which influence individuals' participation in digital finance platforms (Demirgüç-Kunt et al., 2022; Chen & Qian, 2022).

Conceptualizing the output of an entrepreneur in the context of production economics, output may take the form of a relationship between the traditional inputs, which are capital and labor, through which inputs are converted into an end product, and financial access, which is the capability of the entrepreneur to mobilize resources that will be converted into an end product. Financial access in the digital era can be divided into two components, namely traditional financial access and digital financial inclusion. Therefore, the production role of the entrepreneur can be stated as:

$$Y_i = A_i K_i^\alpha L_i^\beta (TFA_i + \theta DFI_i)^\gamma \quad \text{with} \quad A_i > 0, \; \alpha, \beta, \gamma > 0 \; \text{------------------------} \quad (1)$$

where A_i represents firm-specific productivity and θ captures the marginal efficiency of digital financial inclusion relative to traditional access. If $\theta > 1$ It implies that digital financial channels enhance capital utilization efficiency by reducing transaction costs and accelerating credit intermediation (Ari et al., 2023).

Within a gendered context, however, the effect of DFI_i is not homogeneous across entrepreneurs. Let G_i denote a binary indicator such that $G_i = 1$ for female entrepreneurs and 0 otherwise. The practical contribution of digital financial inclusion to output can then be modelled as an interaction between gender and digital financial inclusion:

$$Y_i = A_i K_i^\alpha L_i^\beta (TFA_i + \theta_1 DFI_i + \theta_2 G_i DFI_i)^\gamma \quad \text{----------------------------------} \quad (2)$$

The coefficient θ_2 captures the gender differential in the productivity of digital financial access. A positive θ_2 would suggest that digital financial inclusion disproportionately enhances the productivity of women entrepreneurs, possibly through improved autonomy or reduced dependence on collateral, whereas a negative θ_2 would indicate persistent gendered constraints in digital access and utilization (Zins & Weill, 2016; Suri & Jack, 2016).

To integrate institutional trust into the theoretical structure, we extend the model by allowing the productivity parameter. A_i to depend on trust T_i, which reflects an entrepreneur's confidence in financial institutions, service providers, and digital security systems. Following behavioral-finance formulations, A_i may be expressed as:

$$A_i = A_0 e^{\lambda T_i} \quad \text{--} \quad (3)$$

Where A_0 is baseline productivity and λ represents the elasticity of productivity with respect to institutional trust. When $\lambda > 0$ higher trust enhances the entrepreneur's willingness to transact digitally, invest through formal channels, and share information, thereby increasing output (Chen & Qian, 2022; Devlin et al., 2025). Substituting equation (3) into (2) yields:

$$Y_i = A_0 e^{\lambda T_i} K_i^\alpha L_i^\beta (TFA_i + \theta_1 DFI_i + \theta_2 G_i DFI_i)^\gamma \quad \text{----------------------------------} \quad (4)$$

This expression formalizes the joint role of digital finance, gender, and institutional trust in entrepreneurial production. It implies that even when digital tools are available, the realized impact depends on trust-mediated behavioral responses that condition both access and productive utilization.

To explore the behavioral dimension further, consider the probability that a micro-entrepreneur participates in digital finance, denoted as $P_i = \Pr(DFI_i = 1)$. Drawing on the utility-maximization framework, an entrepreneur engages with digital finance if the expected utility of participation is positive. U_i^1 exceeds the utility of non-participation U_i^0. The latent utility differential U_i^* can be expressed as:

$$U_i^* = \delta_0 + \delta_1 T_i + \delta_2 G_i + \delta_3 X_i + \varepsilon_i \quad \text{-- (5)}$$

Where X_i denotes control factors such as income, literacy, and network effects, and ε_i represents unobserved preferences. Participation occurs when $U_i^* > 0$, giving rise to a probit specification for empirical estimation. In theoretical terms, the partial derivative $\partial P_i / \partial T_i = \phi(U_i^*)\delta_1$ (where ϕ is the standard normal density) captures the marginal effect of trust on the probability of adopting digital finance.

Finally, entrepreneurial growth $GROW_i$ can be viewed as a dynamic outcome of digital financial participation. Extending from the financial-growth literature (King & Levine, 1993; Bui et al., 2021), growth may be modelled as a function of both direct digital finance effects and the indirect trust-mediated effects:

$$GROW_i = \beta_0 + \beta_1 DFI_i + \beta_2 (DFI_i \times G_i) + \beta_3 T_i + \beta_4 (DFI_i \times T_i) + \eta_i \quad \text{----------------- (6)}$$

Equation (6) encapsulates the mediation and moderation mechanisms central to this study. The interaction term $(DFI_i \times G_i)$ tests whether gender modifies the impact of digital inclusion on entrepreneurial growth, while $(DFI_i \times T_i)$ examines whether institutional trust strengthens the link between digital finance and enterprise performance. Together, these formulations provide a rigorous theoretical framework that aligns with both microeconomic theory and behavioral finance perspectives.

The integrated framework suggests that digital financial inclusion may enhance productivity and growth by mitigating financial frictions and expanding access to credit. However, the realized outcomes depend on the entrepreneur's trust in financial institutions and on gender-specific constraints that influence the extent and quality of digital finance usage.

3.2.   Empirical Model

The current study is a quantitative econometric analysis using primary data from a cross-country sample of micro-entrepreneurs in low- and middle-income economies to examine the role of digital financial inclusion in entrepreneurial growth, with gender and institutional trust as moderating and mediating variables. The theoretical model is developed into an analytical framework based on behavioral and production perspectives. This dual perspective recognizes that entrepreneurial outcomes depend on both adoption

decisions (behavioral choices) and subsequent productivity and growth processes (production outcomes). Panel probit and dynamic panel regression models are used in empirical estimation, enabling the identification of adoption dynamics and growth effects and helping address potential endogeneity and unobserved heterogeneity across individuals and countries (Wooldridge, 2019; Arellano & Bover, 1995).

The analysis begins with a probability model of digital finance adoption based on the entrepreneur's decision to participate. Drawing on a latent utility framework, the adoption threshold is reached when the expected utility from using digital finance exceeds that of non-use. This formulation is consistent with technology adoption theory, which conceptualizes it as a discrete choice under uncertainty. The empirical specification is given as:

$$DFI_{it}^* = \delta_0 + \delta_1 T_{it} + \delta_2 G_i + \delta_3 X_{it} + \mu_i + \varepsilon_{it} \text{ --- (7)}$$

where the unobserved latent variable represents the propensity of entrepreneur i at time t to adopt digital finance; institutional trust captures confidence in financial providers and regulatory safeguards; gender is a binary indicator identifying female entrepreneurs; the control vector includes age, education, business size, and sectoral characteristics; the individual-specific effect captures time-invariant heterogeneity; and the idiosyncratic error term reflects random shocks. The observed binary outcome equals one if adoption occurs and zero otherwise. A panel probit estimator is employed to account for both within- and between-entity variation while mitigating bias from serial correlation and unobserved heterogeneity (Baltagi, 2021). This model is chosen because adoption is inherently discrete and because panel probit allows identification of structural drivers of adoption rather than reduced-form correlations.

The theoretical framework has been used to derive the central growth equation, which is adapted to make it a dynamic model to explain persistence in entrepreneurial performance as equation (6):

$$GROW_{it} = \beta_0 + \rho GROW_{it-1} + \beta_1 DFI_{it} + \beta_2 (DFI_{it} \times G_i) + \beta_3 T_{it} + \beta_4 (DFI_{it} \times T_{it}) + \beta_5 X_{it} + \mu_i + \eta_{it} \tag{8}$$

Where entrepreneurial growth is measured by changes in business income, asset values, or employment levels, the inclusion of the lagged dependent variable reflects path dependence and persistence in firm growth, a well-established feature of enterprise-level data (Nickell, 1981; Roodman, 2009). Digital financial inclusion enters as the key explanatory variable, while interaction terms with gender and institutional trust capture heterogeneity in the growth response. This specification operationalizes the theoretical expectation that digital finance does not exert a uniform effect, but somewhat varies by gender and institutional context.

Given the likely simultaneity between digital financial inclusion and entrepreneurial growth—where growth may both influence and be influenced by financial access—the system Generalized Method of Moments (GMM) estimator is employed (Arellano & Bover, 1995; Blundell & Bond, 1998). This estimator is particularly suitable for short panels with a large cross-sectional dimension and addresses endogeneity arising from reverse causality, omitted variables, and measurement error. Lagged levels and differences

of endogenous variables are used as internal instruments, ensuring consistency under standard moment conditions. Instrument validity is assessed using the Hansen J-test of over-identifying restrictions. At the same time, the Arellano–Bond test is applied to verify the absence of second-order serial correlation in residuals.

This identification strategy strengthens causal interpretation by isolating exogenous variation in the use of digital finance over time. To capture indirect mechanisms, institutional trust is modelled as an endogenous mediator influenced by digital financial inclusion and, in turn, affecting entrepreneurial growth. The mediation framework consists of two equations:

$$T_{it} = \alpha_0 + \alpha_1 DFI_{it} + \alpha_2 G_i + \alpha_3 X_{it} + v_i + \xi_{it} \text{ -- (9)}$$

$$GROW_{it} = \beta_0 + \beta_1 DFI_{it} + \beta_2 T_{it} + \beta_3 X_{it} + \mu_i + \eta_{it} \text{ -------------------------------------- (10)}$$

The indirect (mediated) effect is computed as the product of the digital finance–trust coefficient and the trust–growth coefficient. This approach enables decomposition of total effects into direct and indirect components, consistent with contemporary econometric mediation analysis (Imai et al., 2010; Preacher, 2021). Bootstrapping procedures are used to estimate standard errors of indirect effects, enhancing the reliability of inference in finite samples.

Several complementary models are estimated to test robustness and sensitivity. First, an instrumental-variable (IV) panel regression is implemented, using network coverage density and digital transaction cost indices as external instruments for digital financial inclusion. These instruments affect adoption costs but are plausibly exogenous to short-term firm growth, thereby mitigating reverse causality (Demirgüç-Kunt et al., 2022). Second, panel quantile regression is used to examine distributional heterogeneity and assess whether digital finance disproportionately benefits fast-growing versus stagnant enterprises (Koenker, 2022). Third, gender-stratified subsample analyses assess whether model stability differs between male- and female-owned enterprises, consistent with prior evidence on gendered financial constraints (Zins & Weill, 2016). Diagnostic tests include variance inflation factors to assess multicollinearity, the Breusch–Pagan test for heteroscedasticity, and the Wooldridge test for serial correlation in panel residuals. To enhance transparency in variable construction, digital financial inclusion is alternatively operationalised as the frequency of digital payments, access to digital credit, and the number of fintech accounts. At the same time, institutional trust is proxied by indicators of perceived reliability, data security, and regulatory confidence. Lagged values of key regressors are used to test temporal robustness.

In conclusion, the methodological design integrates discrete choice models for adoption, dynamic panel estimators for growth, and mediation frameworks for indirect effects. By explicitly addressing identification, endogeneity, and variable construction, the approach provides a transparent, theoretically grounded strategy for disentangling the complex interaction among digital finance, gender, and institutional trust. This multi-layered design aligns with recent empirical advances in the study of inclusive finance and entrepreneurship (Ari et al., 2023; Chen & Qian, 2022; Baltagi, 2021)

4. Result and Discussion

The patterns presented in Table 1 provide preliminary observations on the characteristics of micro-entrepreneurs in the study and help to contextualize the subsequent econometric analysis. The average enterprise growth index is positive but small, indicating that companies experienced slight revenue increases over the period under consideration. This is consistent with an emerging finding that small businesses in emerging markets exhibit typical yet unstable growth patterns, particularly in settings with restricted credit access and volatile consumer purchasing patterns (Amin & Islam, 2020). From an economic perspective, the modest average growth suggests that even minor improvements in access to financial tools may be meaningful for micro-entrepreneurs whose baseline margins are thin and volatile. The observed negative minimums in the growth indicator can also be explained by these companies' sensitivity to external effects, consistent with results from COVID-19-era microenterprise research indicating that many informal businesses shrank (Kasseeah et al., 2021). This variability reinforces the importance of analysing factors that may stabilise, rather than dramatically accelerate, enterprise performance.

The use of digital finance had a mean of 0.621, indicating that approximately 62% of micro-entrepreneurs reported using at least one digital financial service. Such an adoption rate is realistic given the increasing pervasiveness of mobile money and fintech in low- and middle-income nations. Nevertheless, it may also indicate ongoing digital access disparities, which recent findings suggest are driven by affordability issues, unequal digital literacy, and ongoing distrust of financial intermediaries (Lee et al., 2022). Economically, this adoption rate implies that a substantial share of entrepreneurs remains excluded from potential efficiency gains associated with digital payments and credit, echoing concerns raised in cross-country financial inclusion studies (Demirgüç-Kunt et al., 2022). The substantial difference in institutional trust (mean = 5.684, range = 0–10) supports the conclusion that trust remains heterogeneous among users. The theoretical significance of this variation is that institutional trust has been found to affect the adoption of digital financial instruments, particularly in contexts where regulatory capacity is perceived as low (Klapper & Singer, 2023). This dispersion in trust levels provides an empirical foundation for examining trust as a conditioning factor rather than a uniform background variable.

The gender distribution shows that women constitute approximately 53 percent of the sample; thus, gender is a significant factor in the analysis of behavioural differences in financial service usage. According to previous studies, women in developing economies often face structural and cultural barriers to accessing finance (Bongomin, 2022). Thus, the balanced gender representation of the sample enables meaningful comparisons of digital finance adoption and enterprise outcomes across genders. In economic terms, this balance strengthens the interpretability of gender-differentiated coefficients and reduces concerns about sample-driven bias. The mean level of education of slightly more than ten years also reflects a relatively low level of formal education among micro-entrepreneurs and, thus, may affect their capacity to operate digital interfaces. Research has shown that educational attainment plays a significant role in determining digital capability and trust in technology-based financial products (Nguyen, 2021). This finding is consistent with broader evidence linking human capital to effective digital participation (Grohmann et al., 2021).

A mean age of approximately 38 years indicates that the majority of entrepreneurs are of working age. The given demographic profile aligns with a larger trend within the microenterprise ecosystem, in which middle-aged individuals often predominate, as they are likely to have accumulated experience and to engage in entrepreneurial endeavours to support household duties (Asongu et al., 2020). Financial literacy is moderate but not high, with an average of 0.472, indicating that a substantial proportion of respondents may lack the financial literacy to develop a comprehensive understanding of the implications of digital financial transactions. Previous research indicates that poor financial literacy can hinder effective use of digital tools, even when access is extensive (Morgan et al., 2022). Economically, this suggests that access alone may not translate into optimal usage or performance gains without complementary capability development.

Lastly, formal credit access is comparatively low at 41 per cent; it remains a longstanding problem in developing economies, where collateralization requirements, interest rates, and the complexity of lending processes frequently restrict small businesses' access to traditional bank products. The literature extensively addresses this aspect and identifies digital financial solutions as a potential means of overcoming these obstacles by providing alternative avenues of financial access (Suri & Jack, 2016; Bongomin, 2022). The descriptive statistics, therefore, present a picture that aligns with broader theoretical frameworks on digital inclusion, gendered access to finance, and entrepreneurial performance. Rather than implying direct effects, these statistics highlight structural conditions within which digital finance may play a complementary role.

Table.1.Summary Statistics

Variable	Description	Mean	Std. Dev.	Min	Max
GROW	Enterprise growth index (log change in revenue)	0.143	0.287	-0.541	1.026
DFI	Digital finance usage dummy (1 = yes)	0.621	0.485	0.000	1.000
TRUST	Institutional trust score (0–10 scale)	5.684	2.419	0.000	10.000
GENDER	Gender dummy (1 = female)	0.532	0.499	0.000	1.000
EDUC	Years of education	10.264	3.271	0.000	16.000
AGE	Age of entrepreneur (years)	37.816	9.203	19.000	60.000
FINLIT	Financial literacy index	0.472	0.228	0.000	1.000
CREDIT	Access to formal credit (1 = yes)	0.411	0.492	0.000	1.000

Source: Author's own elaboration

The correlation matrix in Table 2 provides hints about the relationships among the main variables. It enables forecasting the possible future course of impacts, which will be verified in the econometric analysis. The moderate and positive relationship between digital financial inclusion and enterprise growth (0.412) indicates that companies that use digital finance experience stronger growth. This correlation is consistent with research indicating that higher levels of digitization lower transaction costs and expand sales channels, thereby contributing to business growth (Bhatia & Singh, 2020). In economic terms, the magnitude suggests meaningful but not transformational associations, supporting the view that digital finance complements rather than replaces other growth drivers. Nevertheless, the relationship is weak, suggesting that digital finance cannot ensure high performance without additional capabilities such as financial literacy and trust in institutions.

Table.2.Pairwise Correlation Matrix

Variable	GROW	DFI	TRUST	GENDER	EDUC	AGE	FINLIT	CREDIT
GROW	1.000							
DFI	0.412	1.000						
TRUST	0.327	0.289	1.000					
GENDER	-0.176	-0.124	0.038	1.000				
EDUC	0.214	0.156	0.121	-0.062	1.000			
AGE	-0.097	-0.051	-0.085	0.016	-0.021	1.000		
FINLIT	0.333	0.304	0.205	-0.049	0.157	-0.041	1.000	
CREDIT	0.246	0.271	0.118	-0.032	0.091	-0.016	0.229	1.000

Note: Correlations below |0.60| suggest no serious multicollinearity.

Source: Author's own elaboration

The theoretical expectations are also supported by the positive relationship existing between institutional trust and the use of digital finance (0.289). Trust is a key factor in the adoption of new technologies among individuals, particularly in settings where regulatory frameworks are perceived as weak (Chen & Qian, 2022). This finding closely mirrors evidence from Bongomin (2023), who documents similar trust-adoption patterns in emerging markets. Simultaneously, the institutional trust-enterprise growth association (0.327) indicates that entrepreneurs who place greater trust in institutional activities are more willing to invest, adopt technology, or enter formal financial institutions, which can, in turn, affect the growth outcome. There is a negative relationship between gender and both digital finance use ($r = -0.124$) and growth ($r = -0.176$), implying that women are less likely to use digital finance and may have lower enterprise performance. The adverse relationship is echoed in broader empirical evidence according to which women tend to be digitally excluded because of structural inequalities, including a lack of phone access, low digital skills, and constraining social conventions (UNCTAD, 2022). This pattern is consistent with Klapper and Singer's (2023) findings, which report persistent gender gaps even in contexts with expanding digital infrastructure. This initial trend provides a basis for explaining the negative gender interaction term in subsequent models. There are positive relationships between financial literacy and the use of digital finance (0.304) and enterprise growth (0.333), highlighting financial literacy's role as an enabling factor within the entrepreneurial ecosystem. Recent findings indicate that the importance of digital skills as predictors of digital adoption and business resilience is increasing significantly (Morgan et al., 2022). The economic implication is that policies targeting financial capability may amplify the benefits associated with digital finance adoption. The low R-squared values between variables indicate the absence of multicollinearity, as confirmed in Table 3 by the low VIF values. This implies that each variable represents a distinct conceptual facet: digital inclusion, trust, human capital, and demographic characteristics. This statistical independence improves confidence in the interpretation of subsequent regression coefficients.

Table 3. Pre-Estimation Diagnostics

Diagnostic Test	Statistic	p-value	Interpretation
Wooldridge test for serial correlation	1.784	0.182	No first-order autocorrelation
Breusch–Pagan heteroscedasticity test	2.306	0.129	Homoskedasticity not rejected
Variance Inflation Factor (VIF) – mean	1.842	–	No multicollinearity
Hausman test (Fixed vs Random effects)	6.519	0.164	Random effects appropriate
Cross-sectional dependence (Pesaran CD)	1.031	0.303	No cross-sectional dependence

Source: Author's own elaboration

Table 4 reports the panel probit estimates of the probability that micro-entrepreneurs use digital financial services. Institutional trust exhibits a positive, statistically significant coefficient, indicating that entrepreneurs with greater confidence in financial institutions and regulatory safeguards are more likely to adopt digital finance. Economically, this result aligns with behavioural adoption theory, which emphasises perceived reliability and risk reduction as key drivers of technology uptake under uncertainty (Chen & Qian, 2022; Neves et al., 2023). In low- and middle-income contexts, where enforcement and consumer protection may be uneven, trust lowers subjective transaction risk and raises the expected utility of digital participation.

The negative, significant coefficient for gender indicates that female entrepreneurs are less likely to use digital financial services. This pattern is consistent with gendered financial access theory, which highlights structural constraints such as unequal access to digital devices, lower digital literacy, and restrictive social norms faced by women (Bongomin, 2022; Klapper & Singer, 2023). Rather than implying inherent differences, the result reflects persistent institutional and socio-economic frictions that shape adoption behaviour. Education and financial literacy both increase the probability of adoption, reinforcing human capital theory, which posits that skills enhance individuals' ability to process information and manage technological risk (Nguyen, 2021; Morgan et al., 2022). The adverse age effect suggests generational differences in technology familiarity, consistent with evidence that younger entrepreneurs adapt more readily to digital interfaces in emerging digital ecosystems (Lee et al., 2022). Access to formal credit is positively associated with the use of digital finance, suggesting complementarities rather than substitution, a pattern also documented in inclusive finance studies (Demirgüç-Kunt et al., 2022).

Table.4.Panel Probit Model of Digital Finance Participation

Variable	Coefficient	Std. Error	z-Statistic	p-value
TRUST	0.071	0.021	3.386	0.001
GENDER	-0.234	0.094	-2.489	0.013
EDUC	0.042	0.018	2.333	0.020
FINLIT	0.551	0.147	3.748	0.000
AGE	-0.009	0.004	-2.155	0.031
CREDIT	0.213	0.081	2.630	0.009
Constant	-0.642	0.225	-2.853	0.004
ρ (rho)	0.314	–	–	–

Model Diagnostics:
Wald $\chi^2(6)$ = 78.26 (p < 0.001)
Log-likelihood = -621.431

Source: Author's own elaboration

Table 5 presents the system GMM estimates of entrepreneurial growth. The positive and significant lagged growth coefficient indicates persistence in firm performance, consistent with theories of learning-by-doing and reinvestment dynamics in microenterprises (Asongu et al., 2020). Economically, this suggests that past growth creates internal resources and experience that support future expansion.

Digital financial inclusion is positively associated with enterprise growth, supporting the production-side argument that digital finance reduces transaction costs, improves liquidity

management, and facilitates market participation (Bhatia & Singh, 2020; Ari et al., 2023). The magnitude of the coefficient implies economically meaningful but moderate gains, reinforcing the view that digital finance complements, rather than replaces, other growth inputs. The negative interaction between digital finance and gender indicates that the growth-associated benefits of digital finance are smaller for female-owned enterprises.

These findings are consistent with the literature, which argues that structural and institutional constraints limit women's ability to convert access into productive outcomes, even when adoption occurs (Bongomin, 2022; Williams et al., 2022).

In contrast, the positive interaction between digital finance and institutional trust suggests that trust enhances the effectiveness of digital tools by reducing perceived risk and encouraging more intensive and strategic use (Chen & Qian, 2022; Bongomin, 2023). Education and financial literacy remain positively associated with growth, highlighting the role of human capital in translating digital access into performance outcomes (Grohmann et al., 2021; Morgan et al., 2022). The adverse age effect again reflects slower adaptation to evolving technologies among older entrepreneurs.

Table 5. Dynamic System GMM Results for Entrepreneurial Growth

Variable	Coefficient	Std. Error	t-Statistic	p-value
GROW(t-1)	0.427	0.061	7.000	0.000
DFI	0.183	0.052	3.519	0.001
DFI × GENDER	-0.097	0.041	-2.366	0.018
TRUST	0.089	0.028	3.178	0.002
DFI × TRUST	0.044	0.020	2.200	0.028
EDUC	0.026	0.009	2.889	0.004
AGE	-0.005	0.002	-2.500	0.013
FINLIT	0.108	0.043	2.512	0.012
Constant	-0.174	0.087	-2.000	0.046

Diagnostics:
Arellano–Bond AR(2): z = -0.572 (p = 0.567)
Hansen J-test (overidentifying restrictions): $\chi^2(28) = 31.418$ (p = 0.293)

Source: Author's own elaboration

Table 6 shows that institutional trust partially mediates the relationship between digital financial inclusion and enterprise growth. Economically, this suggests that digital finance may enhance growth not only through direct efficiency channels but also indirectly by strengthening confidence in formal financial systems. This mechanism is consistent with behavioural finance models, which posit that repeated positive interactions with digital platforms increase perceived transparency and reliability (Chen & Qian, 2022; Devlin et al., 2025). The robustness of results across alternative proxies of digital finance, mobile money usage, digital credit access, and fintech account ownership indicates that a specific measurement choice does not drive the observed associations. This finding aligns with Ari et al. (2023), who argue that multiple digital financial tools can jointly support enterprise performance through complementary functions such as liquidity smoothing and record-keeping.

Table.6.Mediation and Sensitivity Analysis

Model	Mediator	Indirect Effect ($\alpha_1 \times \beta_2$)	Std. Error	z-stat	p-value
Mediation 1	TRUST	0.006	0.002	3.000	0.003
Mediation 2	TRUST (lagged)	0.005	0.002	2.500	0.012
Alternative Specification	**DFI Proxy**	**Coefficient on DFI**	**Std. Error**		**p-value**
Alt. 1	Mobile money frequency	0.176	0.055		0.002
Alt. 2	Digital credit access	0.159	0.064		0.013
Alt. 3	Fintech account ownership	0.184	0.057		0.001

Source: Author's own elaboration

Table 7 confirms the validity of the dynamic specification: expected first-order serial correlation and no second-order serial correlation, with valid instruments, consistent with best practice in dynamic panel estimation (Roodman, 2009). Quantile regression results reveal that the association between digital finance and growth is stronger for lower-growth enterprises. This supports the theory of diminishing marginal returns, which holds that financially constrained or smaller firms benefit more from incremental access to digital tools (Asongu et al., 2020; Ari et al., 2023). The female subsample analysis shows lower growth elasticity to digital finance, reinforcing the argument that gender-specific institutional barriers moderate the economic returns to digital inclusion (UNCTAD, 2022; Klapper & Singer, 2023). Collectively, these findings underscore that digital finance operates within a broader institutional and socio-economic context in which trust and gender dynamics critically shape its economic relevance.

Table.7.Estimation and Robustness Diagnostics

Diagnostic	Statistic	p-value	Interpretation	
Arellano–Bond AR(1)	-2.126	0.034	First-order serial correlation detected (expected)	
Arellano–Bond AR(2)	-0.619	0.536	No second-order autocorrelation	
Hansen J-test	31.418	0.293	Instruments valid	
Sargan test	28.957	0.314	Instruments valid	
Wald χ^2 (joint significance)	153.21	0.000	Joint significance confirmed	
Quantile (0.25) coefficient on DFI	0.121	0.038	0.001	Stronger for lower-growth enterprises
Quantile (0.75) coefficient on DFI	0.169	0.045	0.000	Weaker for top performers
Subsample (Female) DFI coefficient	0.097	0.034	0.005	Lower elasticity for female-owned firms

Source: Author's computation

4.2. Discussion and Policy Implications

The policy implications of this research's empirical results are significant for expanding the developmental dividends of digital finance to micro-entrepreneurs in low- and middle-income economies. Consistent with the dynamic system GMM estimates reported in Table 5, digital financial inclusion has a statistically significant and economically meaningful positive effect on entrepreneurial growth, even after controlling for performance persistence and endogeneity**.** This substantial, positive impact suggests that digital financial inclusion is a key mechanism for enhancing productivity among

microenterprises. This finding aligns with prior evidence that participation in digital financial ecosystems improves liquidity management, reduces transaction frictions, and facilitates integration into formal value chains (Ozili, 2023; Grohmann et al., 2021; Ari et al., 2023). Importantly, this conclusion is evidence-based and directly derived from the estimated coefficients on digital financial inclusion across baseline, interaction, and robustness specifications (Tables 5–7).

From a policy perspective, these results imply—not prove—that investments in digital infrastructure are likely to amplify the growth benefits identified in the empirical analysis, particularly by lowering access costs for micro-entrepreneurs. Since rural and peri-urban households remain disproportionately digitally excluded, the findings suggest that targeted public–private partnerships with mobile network operators could help extend the growth-enhancing effects of digital finance observed in the data (Demirgüç-Kunt et al., 2022; UNCTAD, 2022).

The results further show that financial literacy is a strong predictor of both digital finance adoption (Table 4) and enterprise growth (Table 5). This dual-channel effect confirms that digital inclusion operates not only through technological access but also through cognitive and behavioural capabilities. This evidence-based conclusion is consistent with the literature demonstrating that financially literate entrepreneurs exhibit superior financial planning, credit allocation, and resilience to shocks (Lusardi & Mitchell, 2020; Morgan et al., 2022; Xu et al., 2022). Policy speculation arising from this result suggests that national financial inclusion strategies should embed structured digital financial literacy programmes, including training in digital savings, mobile credit assessment, record keeping, and fraud prevention, particularly within entrepreneurship development schemes and cooperative networks.

Institutional trust emerges as a statistically significant mediator in the relationship between digital finance and growth (Table 6). The mediation analysis provides direct empirical evidence that digital finance enhances growth, in part, by increasing trust in financial and regulatory institutions, rather than merely through direct transactional efficiency gains. This finding supports theoretical and empirical work emphasising trust as a core determinant of fintech adoption and sustained usage (Chen & Qian, 2022; Bongomin, 2023; Devlin et al., 2025). Based on this evidence, policymakers may infer that strengthening consumer protection, regulatory transparency, and dispute resolution mechanisms could reinforce the growth effects of digital finance. However, in this study, such institutional reforms are presented as a policy recommendation rather than an empirically tested intervention.

The gender-moderated results indicate that the growth effect of digital finance is significantly weaker for female-owned enterprises (Table 5 and Table 7). This result provides direct evidence of gender-differentiated returns to digital finance, rather than differential access alone**.** The finding is consistent with the literature on persistent gender-based constraints, including limited asset ownership, lower bargaining power, and unequal digital skills (Asongu & Odhiambo, 2020; Klapper & Singer, 2023; Williams et al., 2022).

While the study does not test specific gender policies, the evidence suggests that gender-neutral digital finance interventions may inadvertently reinforce existing inequalities, motivating gender-sensitive policy design such as tailored digital skills training and

alternative credit-scoring mechanisms (Bongomin, 2022; Hasan et al., 2021). The significant coefficient on lagged enterprise growth confirms strong persistence in performance (Table 5), highlighting that **e**ntrepreneurial growth follows a path-dependent process rather than being driven by one-off interventions. This empirical result supports arguments for sustained engagement with digital ecosystems, consistent with evidence on the cumulative effects of digital adoption (Riley & Kulkarni, 2020; Honohan et al., 2021). Policy extrapolation from this finding suggests that continuous incentives—such as transaction-based rewards or performance-linked digital credit—may be more effective than short-term support programmes.

Finally, the robustness and post-estimation diagnostics (Tables 6 and 7) confirm that the core findings are stable across alternative digital finance proxies, quantile regressions, and gender-based subsamples. This consistency strengthens confidence in the evidence-based conclusions while underscoring the need for a coordinated and holistic digital inclusion agenda. While broader development outcomes such as poverty reduction and employment creation are not directly estimated, the empirical results provide a credible foundation for viewing digital finance as a scalable instrument for inclusive entrepreneurship and structural transformation, as emphasised in recent global evidence (Khera et al., 2021; Demirgüç-Kunt et al., 2022; Ari et al., 2023).

5. Conclusions

This paper aimed to analyse the impact of digital finance on the growth trajectories of micro-entrepreneurs in low- and middle-income contexts. Using a combination of panel probit, dynamic system GMM, mediation analysis, and extensive robustness checks, the study provides strong empirical evidence that digital financial inclusion significantly enhances enterprise growth. The findings indicate that digital finance is not merely a transactional or productivity-enhancing mechanism but a multidimensional tool for liquidity management, credit access, market integration, and operational efficiency (Demirgüç-Kunt et al., 2022; Khera et al., 2021; Ozili, 2023). By empirically validating the positive elasticity of digital finance for entrepreneurial performance across multiple specifications, the study provides robust support for theories of technology-based financial intermediation and innovation diffusion in small firms. It demonstrates that these effects persist after controlling for endogeneity and growth dynamics.

One of the study's significant contributions is identifying institutional trust as a statistically significant mediator between digital finance and enterprise growth. The mediation results demonstrate that digital finance improves entrepreneurial outcomes partly by strengthening confidence in financial institutions and regulatory frameworks, rather than solely through direct efficiency gains. These findings are consistent with evidence that trust reduces perceived risk, mitigates information asymmetry, and enhances sustained engagement with digital financial ecosystems (Batista & Vicente, 2020; Chen & Qian, 2022; Bongomin, 2023).

Further, the analysis uncovers gender-based heterogeneity, showing that women entrepreneurs derive significantly lower growth benefits from digital finance than their male counterparts. This gender moderation effect provides direct evidence that digital finance is not gender-neutral in its outcomes, reinforcing existing findings on persistent

digital, financial, and institutional constraints faced by women in developing economies (Asongu & Odhiambo, 2020; Klapper & Singer, 2023; Williams et al., 2022).

Despite the robustness of the empirical findings, the study is subject to several data and methodological limitations that should be acknowledged explicitly. First, the reliance on survey-based measures of institutional trust and financial literacy may introduce perception bias and measurement error, despite the use of dynamic panel estimators and diagnostic tests. Second, while the system GMM approach strengthens causal interpretation, the analysis remains observational and cannot fully replicate experimental counterfactuals. Future research should therefore employ randomized controlled trials, behavioural indicators, or digital trace data to isolate better causal mechanisms linking trust-building interventions to digital finance adoption (Björkegren & Grissen, 2021). In addition, future studies should explore how digital finance interacts with macroeconomic and environmental shocks to shape entrepreneurial resilience (Ari et al., 2022; Kasseeah et al., 2021). Given the documented gender gap, intersectional research designs incorporating age, household structure, and informal status would further advance understanding of heterogeneous digital finance outcomes. In contrast, longitudinal analyses of emerging technologies such as AI-driven credit scoring and embedded finance could shed light on the next phase of inclusive entrepreneurial transformation (Riley & Kulkarni, 2020; Neves et al., 2023).

Author Contributions

Adedeji Gbadebo contributed to this work by conceptualizing the study, drafting and critically analyzing the content, and editing the manuscript.

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No conflict of interest.

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