



Sustainability of Microfinance Banks in the Digital Age in Selected Sub-Saharan African Countries

**Kehinde Adekunle Adetiloye^{*1}, Ayobola Aminat Kaka-Lawal²,
Ganiyu Olalekan Taslim³, Tolulope Femi Adesina⁴**

Abstract

The digital transformation of microfinance banks (MFBs) in sub-Saharan Africa (SSA) is increasingly critical due to rising competition and the need for adaptation. This study examines the sustainability of MFBs in selected SSA countries within the context of digitalisation. Using data from 2017–2022 from the Microfinance Information Exchange, the International Monetary Fund, and the World Bank, the study analyses 115 MFBs across 21 SSA countries using a fixed-effects regression model. Findings show that digital technologies significantly enhance MFB performance and sustainability, with digitalisation investments, mobile banking, and internet banking positively influencing financial self-sufficiency and return on assets. Bank size and age are also identified as key drivers of sustainable performance. In contrast, inflation, leverage, and average loan size negatively affect sustainability, while GDP growth exerts a modest positive effect. The study recommends that policymakers promote digitalisation to improve efficiency, productivity, customer outreach, and loan management in microfinance banks.

Keywords

Sustainability, Microfinance Banks, Digitalisation, Sub-Saharan Africa, Poverty Reduction, Performance

I. Introduction

Over the past three decades, sustainable economic activities have become central to growth and development, particularly in developing countries. Sustainability is now seen as

* Corresponding author

¹ Covenant University, Km. 10 Idiroko Road, Canaan Land, Ota, Ogun State, Nigeria.
E-mail: kehinde.adetiloye@covenantuniversity.edu.ng.

² Covenant University, Km. 10 Idiroko Road, Canaan Land, Ota, Ogun State, Nigeria.
E-mail: aminat.kaka-lawalpgs@stu.cu.edu.ng.

³ Covenant University, Km. 10 Idiroko Road, Canaan Land, Ota, Ogun State, Nigeria.
E-mail: taslim.ganiyupgs@stu.cu.edu.ng.

⁴ Covenant University, Km. 10 Idiroko Road, Canaan Land, Ota, Ogun State, Nigeria.
E-mail: tolulopefemi.adesina@covenantuniversity.edu.ng.

critical for long-term economic stability (Abdulai and Tewari, 2017; Jamwal, Patra and Shukla, 2021). Since the launch of the United Nations' 2015 Sustainable Development Goals (SDGs), policymakers have prioritised poverty reduction and financial inclusion. Goal 1 focuses on poverty eradication, while Goals 8 and 9 promote financial access and inclusive growth. Despite global efforts, poverty remains widespread, with Africa carrying a significant share. Nearly 460 million Africans live below the \$1.90 daily poverty threshold, and in 2020 alone, 89 million more were classified as extremely poor (World Bank, 2022). Microfinance, introduced in the late 1980s, has long been viewed as a tool for poverty reduction (Chmelikova and Redlichova, 2020). Yet, in highly populated African countries such as Nigeria, Kenya, and Ethiopia, millions remain financially excluded. Although microfinance institutions (MFIs) have expanded their services, they continue to struggle with high operating costs, regulatory restrictions, and the urgent need for digitalisation. Microfinance supports low-income groups, informal workers, and those at the "Base of the Pyramid", offering micro-savings, loans, insurance, pensions, and transfers (Kasenge, 2011; Jamwal et al., 2021). Digitalisation is increasingly seen as key to improving sustainability by lowering costs and expanding outreach. However, "microfinance" in practice often refers specifically to the formal services provided by recognised MFIs.

The achievement of the SDGs, particularly in sub-Saharan Africa (SSA), depends in part on strengthening the sustainability of microfinance banks (MFBs). These institutions are vital in bridging financial gaps and supporting underserved communities (Chikalipah, 2017). Over time, the sector has evolved to include microcredit, micro-savings, insurance, franchising, and consignment models (Van Kirk, 2010). In the digital era, the adoption of mobile money, online platforms, and other technologies has become crucial.

However, the transition to digital services introduces new challenges. Many African MFBs face funding shortages, weak infrastructure, and limited regulatory support in this area. Cybersecurity risks, fraud, and operational disruptions further threaten progress. Additionally, some stakeholders resist full digital transformation, preferring to maintain MFBs as small-scale banks. The persistent digital divide in SSA – marked by gaps in internet access, device availability, and literacy – further restricts adoption. Regulatory inconsistencies across countries also complicate licensing, prudential oversight, and consumer protection. While effective governance and risk management are essential, overly restrictive policies risk constrain growth.

Overcoming these barriers requires consensus among regulators, policymakers, and shareholders on the importance of digitalisation for financial inclusion. Without it, the MFBs' ability to drive poverty reduction and economic development remains constrained.

Research Questions and Hypotheses Development

This study examines the sustainability of microfinance banks (MFBs) in the digital era by addressing three research questions: (i) To what extent does digitalisation enhance MFB sustainability in sub-Saharan Africa (SSA)? (ii) How does technology adoption influence financial inclusion and access? (iii) What role does bank size play in determining MFB performance?

Despite extensive literature on microfinance, financial inclusion, and sustainability, important gaps remain in SSA. While prior studies emphasise poverty reduction and access to finance, the implications of digital transformation for the sustainability of MFBs are insufficiently explored. Although sustainability has gained prominence in financial systems (Abdulai and Tewari, 2017; Jamwal, Patra and Shukla, 2021), empirical evidence on the link between digitalisation and MFB sustainability and performance in SSA remains limited. Existing studies highlight microfinance's role in extending financial services to underserved populations (Kasenge, 2011; Jamwal et al., 2021; Robinson, 2001; Hartarska, 2004; Dokulilova et al., 2009), while sustainability is commonly assessed using indicators such as operational and financial self-sufficiency, portfolio quality, and capital adequacy (Navajas et al., 2000; Dunford, 2000; Ledgerwood, and White 2006). However, these studies largely overlook digital transformation. Emerging evidence shows that digital finance – particularly mobile money platforms such as M-PESA – enhances financial inclusion (Kinyua and Kihui, 2020), and fintech developments have expanded financial services across SSA (Elkady et al., 2021; Olorunleke and Adewumi, 2021). Digital platforms also improve credit assessment and customer engagement (Ndiaye et al., 2020). Nonetheless, adoption is constrained by infrastructural deficits, low digital literacy, and regulatory barriers (Gyamfi and Sarpong, 2020). Consequently, the effect of digitalisation on MFB sustainability remains empirically underexplored, forming the basis for Hypothesis H01.

A second gap is on the relationship between technology adoption and MFB performance. While technological innovation is associated with improved efficiency and service delivery, its impact on microfinance performance – particularly return on assets (ROA) and institutional sustainability – remains insufficiently examined. Earlier studies focus on financial inclusion and poverty alleviation (Robinson, 2001; Hartarska, 2004; Dokulilova et al., 2009; Navajas et al., 2000; Dunford, 2000), with limited attention to operational implications of technology adoption. Recent evidence suggests that digital technologies reduce costs and enhance service delivery (Kinyua and Kihui, 2020; Ndiaye et al., 2020), while fintech innovations such as digital payments and automated lending improve financial intermediation (Elkady et al., 2021; Olorunleke and Adewumi, 2021). However, infrastructural and regulatory constraints persist (Gyamfi and Sarpong, 2020), and empirical studies largely focus on commercial banks rather than MFBs. This gap motivates Hypothesis H02.

A third gap relates to the role of institutional size in shaping MFB performance and sustainability. Although firm size is widely recognised as a determinant of organisational performance, its implications within microfinance remain inconclusive. Early microfinance models prioritised outreach through group-based lending (Robinson, 2001; Hartarska, 2004), whereas subsequent institutional evolution led to larger, regulated entities with diversified operations (Ledgerwood and White, 2006). Larger institutions may benefit from economies of scale and stronger capital structures (Navajas et al., 2000; Dunford, 2000), but increased commercialisation may undermine social objectives (Brau and Woller, 2004; Woller, 2002). Empirical evidence for SSA remains limited, providing the basis for Hypothesis H03.

Accordingly, the study hypothesises in null form as follows:

H₀₁: Digitalisation has no significant impact on MFB sustainability in SSA.

H₀₂: Technology adoption does not significantly improve MFB performance, measured by return on assets and sustainability.

H₀₃: Bank size, proxied by the logarithm of total assets, has no significant effect on MFB performance and sustainability.

II. Literature Review

Among the theories underpinning this study are Institutional theory, Financial systems theory, Empowerment theory, and Welfarism theory. These theories offer valuable perspectives on how microfinance firms should provide vulnerable segments of the population with financial services and improve citizens' well-being (Bhatt and Tang, 2001; Brau and Woller, 2004; Woller and Woodworth, 2001). However, the institutionalist theory stands out among them for this study.

Empirical research on the sustainability of microfinance institutions (MFIs), particularly in sub-Saharan Africa (SSA), remains limited due to the scarcity of industry data. Additionally, most existing studies focus primarily on performance, outreach, and the impact of microfinance on poverty reduction (Van Rooyen et al., 2012). Through keyword searches of “Microfinance banks”, “digitalisation”, “sustainability” and “SSA”, the paper reviewed extant empirical literature, specifically examining studies on sustainability and the role of technology in the microfinance sector with emphasis on SSA countries. This is presented in Table 1.

Table 1: Summary of Recent Empirical Studies

Author	Objective	Methodology	Key Findings	Research Gap
Pattnaik and Hassan (2025)	Mapped microfinance research to the Sustainable Development Goals and identified dominant thematic trends.	Scientometric and bibliometric review of 1,004 articles (2014–2023) using Scopus, SciVal, and BERTopic analysis.	Research focuses on poverty reduction, economic empowerment, gender inclusion, and inequality reduction.	The study is descriptive rather than causal and does not provide direct empirical evidence on how microfinance affects development outcomes.
Osuma, Nzimande, and Simon-Ilogho (2025)	Investigated the nexus between microfinance, financial inclusion, poverty reduction, and sustainable development in Sub-Saharan Africa.	Panel study of 10 SSA countries, 2000–2023; threshold-based empirical analysis.	ATM access and mobile banking significantly reduced poverty and supported economic growth, with their effects becoming stronger over time.	The study does not examine MFI dynamics, cross-country heterogeneity, or the roles of regulation, governance, and macroeconomic conditions.

Author	Objective	Methodology	Key Findings	Research Gap
Ali et al. (2021)	Examined the impact of digital financial inclusion on economic growth and environmental sustainability in developing countries.	Panel data analysis using GMM to evaluate financial inclusion indicators and macroeconomic variables.	Digital financial inclusion promotes economic growth but may increase environmental pressures.	This is a very important study that neither tested nor specifically examined the sustainability of microfinance banks in Sub-Saharan Africa.
Elhadj and Elouaourti (2021)	Investigated factors influencing the adoption of digital financial services in Islamic banking.	Survey research using the Technology Acceptance Model (TAM) and PLS-SEM analysis.	Perceived usefulness, trust, and ease of use significantly influence adoption of digital financial services.	Focused on customer adoption rather than institutional sustainability of financial institutions.
Berhanu et al. (2021)	Assessed the impact of microfinance participation on poverty reduction and rural livelihoods.	Household survey data using propensity score matching and regression analysis.	Microfinance significantly improves household income and livelihood outcomes.	The study focused on social outcomes rather than financial sustainability of microfinance institutions.
Siwale and Godfroid (2021)	Examined the tension between financial sustainability and social mission in microfinance institutions.	Qualitative case study using interviews with microfinance managers and institutional records.	Institutional pressures often lead to mission drift, in which financial sustainability is prioritised over poverty-reduction goals.	The study lacked quantitative evidence and did not analyse the effects of digital transformation on sustainability.
Gidigbi (2021)	Investigated the role of microfinance banks in promoting financial inclusion in Nigeria.	Secondary data analysis using regression techniques.	Microfinance banks contribute significantly to financial inclusion but face operational challenges.	Did not examine digitalisation and technological innovation as drivers of microfinance sustainability.
Tasos et al. (2020)	Analysed the role of FinTech in improving financial inclusion and financial service delivery.	Empirical and conceptual analysis of fintech adoption across financial institutions.	FinTech enhances access to financial services but introduces regulatory and cybersecurity challenges.	Did not specifically analyse microfinance banks or sustainability outcomes.
Dorffleitner et al. (2019)	Examined the effects of digital transformation on the efficiency of microfinance institutions globally.	Cross-country dataset and quantitative econometric models.	Digital technology improves operational efficiency and outreach of microfinance institutions.	The study did not focus specifically on Sub-Saharan African microfinance banks.

Author	Objective	Methodology	Key Findings	Research Gap
Chmelíková, Krauss, and Dvoulitý (2019)	Examined whether social capital influences the performance of European microfinance institutions.	Unbalanced panel of 302 European MFIs, 2008–2015; fixed-effects regression.	Social capital improved repayment performance, profitability, and outreach, with a weaker positive effect on efficiency.	The study is limited to Europe and pre-digital transformation period, with little attention to sustainability outcomes, fintech, or developing-country contexts.

Source: Summary of recent studies compiled from various journals

III. Methodology

This study focuses on all registered microfinance banks (MFBs) operating in selected sub-Saharan African (SSA) countries. Given the research scope, a purposeful sampling technique was used to select 115 MFBs based on their size, coverage, and level of digitalisation. The selection was also guided by data availability for the study period. The MFBs are from 21 SSA countries: Benin, Burundi, Cameroon, Democratic Republic of Congo, Ethiopia, Gambia, Ghana, Guinea, Kenya, Madagascar, Malawi, Mali, Mozambique, Nigeria, Rwanda, Senegal, South Africa, Tanzania, Togo, Uganda, and Zambia. This wide coverage ensures that the findings can be generalised across the region.

The study utilised time-series data from 2017 to 2022, drawn from multiple sources, especially World Bank (2024) and International Monetary Fund (2024). Financial sustainability is the key metric for evaluating the financial viability and resilience of MFBs. Two primary indicators of sustainability measure Financial Self-Sufficiency (FSS), which reflects an MFB's ability to cover operational expenses and loan loss provisions with operational income. This metric considers credit risk and loan portfolio quality. ROA is a profitability and efficiency measure calculated as net income divided by total assets (D'Espallier et al., 2017). The main independent variable is digital technology adoption, measured by annual investments in digital solutions. Number of mobile banking users, customers using digital payment systems. Other key variables influencing performance and sustainability include:

- * Firm Age (MFBAge): Older MFBs tend to take fewer risks and leverage managerial experience. Measured in years since establishment, with an age-squared term to capture non-linear effects.
- * Firm Size: Measured by total assets, representing financial strength, outreach, and overall success (Hermes, 2018).
- * Customer Deposits (MFBDebt): Reflects micro-savings mobilisation, a crucial funding source.
- * Credit Risk (Portfolio at Risk – PaR): Represents loans overdue by 30+ days, indicating portfolio quality. Higher values suggest lower repayment rates. Control variables of inflation and Real Growth are included to ensure that the estimated relationship is not spurious and to isolate the true effect of the variable of interest.

- * Two control variables, *inflation* and *Real GDP*, were included to isolate the true effect of the main independent variables on the dependent variable. Variables, sources, formula and *a priori* are presented in Table 2.

Unbalanced panel data was used to evaluate the factors influencing the sustainability of microfinance institutions in a digital age. The capacity of the panel data approach to account for changes in the data and to handle related issues not addressed by static cross-sectional and ordinary regression analysis guided the choice (Wooldridge, 2006). Furthermore, panel data analysis offers greater degrees of freedom and leverages large sample sizes, i.e., large N and small T (Hsiao et al., 2014). The model used in this study is adapted from the empirical work of Abdulai and Tewari (2017) and is specified in both its functional and econometric form.

The model contemporaneously tests the performance (ROA) and sustainability (FSS) of MFBs. The equation estimating the variables is stated in the form specified below:

$$\begin{aligned} MfBPerf_{i,t} = & \alpha_0 + \beta_1 DigAdopT_{i,t} + \beta_2 MfBSize + \beta_3 ALS_{i,t} + \beta_4 DEP_{i,t} \\ & + \beta_5 PaR_{i,t} + \beta_6 Lev_{i,t} + \beta_7 PR_{i,t} + \beta_8 LA_{i,t} + \beta_9 MfBAge_{i,t} \\ & + \beta_{10} Infl_{i,t} + \beta_{11} RGDPg_{i,t} + \beta_{12} Opex_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (1)$$

where *MfBPerf* is the dependent variable, which measures and proxies Microfinance Bank sustainability as financial self-sufficiency (FSS), and the performance proxy (ROA) at time t and time i . The explanatory variable influencing sustainability is the digital adoption proxy, comprising investment in digitalisation (INVDig), mobile banking (MBK), and internet banking (*INTB*). In SSA, while banks' ATMs are fading, Point of Sale (PoS) and mobile banking seem more flexible and popular. The variables are transformed via logarithms to improve the model's performance.

Given the study's sample size, advanced estimators such as GMM and 2SLS are unsuitable. The Breusch-Pagan LM test first confirmed the presence of panel effects, ruling out pooled OLS. Subsequently, the Hausman specification test was applied to choose between fixed- and random-effects models. The result ($p = 0.03436 < 0.05$) rejects the null hypothesis of no systematic difference, indicating that the fixed-effects model is more appropriate. This choice is further justified by the need to control for time-invariant unobserved heterogeneity inherent in panel data (Ciftci et al., 2019). *A priori*, digital transformation is expected to enhance the sustainability and performance of microfinance banks in sub-Saharan Africa, as outlined in Table 2.

Table 2: Description of variables

Variable	Notation	Measure	Data source	A priori
Dependent variables				
Financial Self-Sufficiency	FSS	Total Revenue from economic activities divided by financial costs + Loan Loss Provision + Operating Expenses	Ayayi and Sene (2010); Bhanot and Bapat (2015)	+
Return on Assets	ROA	Net Income after taxes divided by Total assets (%)	Bhanot and Bapat (2015); Veenapani (2017);	+
Explanatory variables				
Digital Technology Investment	INVDA	Total investment amount in digital technology in the last five years	Gupta and Gupta (2014)	+
Digital Adoption – Mobile Banking	MBK	Proportion of customers using mobile banking	Deb (2017); Xu, Fu and Liu (2019)	+
Digital Adoption – Internet Banking	INTB	Proportion of customers using Internet banking service	Fabian and Xianzhi (2013)	+
MFB Size	MFBsize	Natural log of total assets of the bank	Mahapatra and Dutta (2016) Makan and Kabra (2021)	+/-
Average Loan Size	ALS	Average gross loan divided by the total number of active borrowers	Meutia et al. (2020);	+/-
Deposits	DEP	Total deposits mobilised divided by Gross Loan Portfolio	Fabian and Xianzhi (2013)	+
Portfolio at Risk	PaR	Outstanding loans > 30 days divided by adjusted gross loan portfolio (%)	Mahapatra and Dutta (2016); Abdulai and Tewari, (2017); Deb (2017)	–
Leverage	LEV	Debt to Equity ratio	Githaiga (2021)	–
Portfolio Return	PR	Interest and fees on loans divided by gross loan portfolio	Veenapani (2017); Xu, Fu and Liu (2019)	-/+
Loan to Asset	LA	Gross Loan Portfolio divided by Average Total Assets	Fabian and Xianzhi (2013)	+
Age	MFBage	Number of years since MFB has been in operations	Githaiga (2021)	+
Operating Expenses	Opex	Operating expense to assets ratio	Githaiga (2021)	+/-
Control variables				
Inflation	INFL	Consumer price index annual (%),	Makan and Kabra (2021)	–
Real GDP growth	RGDPG	Annual growth rate of GDP (%)	Mahapatra and Dutta (2016) Makan and Kabra (2021)	+

Source: Compiled from various journals

IV. Data Analysis and Discussion of Results

Table 3 presents the descriptive statistics of the study's variables. The ROA averaged -1.58 per cent, with the lowest-performing MFBs returning -21.44% , while the highest was 10.05% , and a standard deviation of 4.2% indicates somewhat high volatility in returns. FSS shows higher volatility, with a mean of 51.51 , a maximum of 41.58 , and an SD of 60.44 . The result shows that MFBs in SSA were, on average, 8 years old. INVDig averaged 41.08 , with a maximum of 62.22 and an SD of 14.44 , indicating increasing investment. The average loan size is lower for MFBs in SSA (US \$563.45) than for the rest of the world (US \$808.00). Generally, MFBs have acceptable portfolio quality; the credit risk exposure captured by PaR averaged 8% , which is higher than most central banks' permitted amount of 5% . The portfolio return of MFBs in SSA is 25 per cent, whereas, on average, MFIs in the rest of the world charge interest rates of 30.6% and pay to acquire loanable funds, highlighting that loan funding is costlier. Inflation and RGDP growth in SSA averaged 9% and 4% , respectively.

Table 3: Descriptive summary statistics

Variable	Obs.	Mean	Std dev.	Min	Max
FSS	575	51.5114	60.4456	-98.0675	41.5118
ROA	575	-1.5362	4.2104	-21.4413	10.0562
INVDig	575	41.0863	14.4412	1.2803	62.2194
MBK	575	42.0575	29.5911	2.0757	73.0284
INTB	575	9.0569	13.8025	0.0843	42.9432
MFBsize	575	46.0329	122.4110	0.1973	2809.0000
ALS	575	563.45	1,041.85	14.0375	11471.0540
DEP	575	21.0541	68.0848	4272.0000	1,650.0000
PaR	575	0.0826	0.9217	0.0003	0.1300
LEV	575	4.5743	9.1382	0.0738	372.8921
PR	575	25.3815	22.2015	0.0650	122.5362
LA	575	4.8520	1.0633	0.3631	17.3211
MFBAge	575	8.2016	5.5195	11.0000	32.0000
INFL	575	0.0911	0.0836	-0.1108	0.4484
RGDPG	575	0.0495	0.0186	-0.0389	0.3273
Opex	575	0.6431	28.9513	0.0000	89.8660

Source: Own processing 2024

The correlation matrix table could not be displayed; however, multicollinearity was assessed using variance inflation factors (VIF) for the explanatory variables, with the results presented in Table 4. As noted by Baltagi (2008) and Hsiao (2014), multicollinearity becomes a concern when the correlation coefficient exceeds 0.70 . In this study, the highest observed coefficient was 0.334 between LA and LEV. Overall, the correlation analysis

suggests that multicollinearity is not an issue, as all bivariate correlations are below 0.70. Additionally, the VIF values ranged between 1.011 and 1.164, further supporting the correlation matrix findings and confirming that multicollinearity is not a concern in this study.

Table 4: Variance Inflation Factor

Variable	VIF	1/VIF
INVDig	1.011	0.987
MBK	1.155	0.865
INTB	1.073	0.931
MFBSIZE	1.164	0.859
ALS	1.053	0.950
DEP	1.108	0.902
PaR	1.146	0.876
LEV	1.103	0.904
PR	1.110	0.900
LA	1.047	0.955
MFBAge	1.073	0.932
INFL	1.033	0.968
RGDPG	1.153	0.869
Opex	1.136	0.914
Mean VIF	1.097	

Source: Own processing 2024

Table 5: Results of the Hausman fixed effect and random effect test

Test Type	Technique	F-Value	Probability
Model selection	Hausman Test	0.373380	0.03436

Source: Own processing, 2024

Model 1 highlights the effect of digitalisation on MFBs' sustainability, while Model 2 demonstrates that technology adoption enhances ROA, the proxy for performance. Table 6 reveals a positive and significant relationship between digital transformation investment and financial self-sufficiency (FSS) at the 5% significance level. Mobile banking also positively influences sustainability, whereas internet banking shows a positive but statistically insignificant impact, likely due to low internet penetration and high associated costs. Additionally, MFBs' size, measured by the natural logarithm of total assets, significantly improves both FSS and ROA.

Deposits have a strong positive effect on FSS and ROA at the 5% level, while portfolio at risk (PaR) negatively impacts financial sustainability. The loan-to-asset ratio significantly enhances both FSS and ROA, with a 1% increase leading to a 0.0610% and 0.04296% rise, respectively. Similarly, MFBs' age correlates positively with FSS and ROA, with each

additional year increasing FSS and ROA by 0.42%. However, inflation negatively affects sustainability and performance, as a unit increase results in a 0.08617% decline in FSS and a 0.0632% decline in ROA.

Table 6: Regression Analysis

Variable	Model 1 (FSS)		Model 2 (ROA)	
	Coefficient	P-Value	Coefficient	P-Value
Δ INVD	0.06463	0.03016**	0.04482	0.0000***
Δ MB	0.04221	0.00023***	0.12191	0.0463**
Δ INTB	0.02007	0.07101*	0.03012	0.09121*
Δ MFBSize	0.03163	0.04211	0.11383	0.0002***
Δ ALS	-0.06032	0.07110	-0.07330	0.1118*
Δ DEP	0.19340	0.00001***	0.12115	0.0300**
Δ PaR	-0.11094	0.04290**	-0.08400	0.01580**
Δ LEV	-0.05620	0.01010	-0.00837	0.04933**
Δ PR	0.02110	0.00000***	0.06033	0.00543***
Δ LA	0.06105	0.04882	0.04296	0.00300***
Δ MFBAge	0.01666	0.03633	0.009813	0.01154***
Δ INFL	-0.089617	0.00010***	-0.06942	0.0000***
Δ RGDPG	0.03930	0.00383***	0.04226	0.00542***
Δ Opex	-0.08433	0.04116**	-0.04326	0.02001**
Constant	12.39949	6.43033	2.17934	20.32037
Observations		575		575
R ²		0.6303		0.7409
Adj. R ²		0.4740		0.6215
F-Statistic		21.5537		19.3340
Probability (F-Stat)		0.0000		0.0000
Durbin Watson		1.9302		1.8530

Source: Own processing Data 2024 Note: ***, **, and * denote statistical significance at the 0.01, 0.05 and 0.10 levels, respectively

Interest rates on microcredit significantly boost FSS and ROA, with a 1% rise leading to increases of 0.02110% and 0.06033%, respectively. While higher lending rates enhance financial sustainability, careful risk management is necessary to mitigate default risks and reduce patronage. Real GDP growth positively influences FSS and ROA at the 5% and 10% significance levels, with a 1% increase in GDP growth raising FSS by 0.11930% and ROA by 0.09546%. Investment in digitalisation (INVD) has a stronger effect on ROA than FSS. Conversely, leverage, measured by the debt-to-equity ratio, negatively impacts both FSS and ROA at the 5% and 10% levels. Table 7 shows that the model explains 63% of FSS and 74.1% of ROA variation ($R^2 = 63.03\%$ and 74.09% , respectively). The DW statistics

(1.9302 for FSS and 1.8530 for ROA) indicate no autocorrelation issues, confirming the model's reliability.

To assess the robustness of the results in Table 7, the study used outreach (OUTR) and ROA as critical indicators to evaluate the performance and sustainability of Microfinance Banks (MFBs) across SSA. On the other hand, the study used ROE to gain insight into how efficiently a typical MFB manages the shareholder funds.

Table 7: Robustness Analysis

Variable	Model 1 (OUTR)		Model 2 (ROE)	
	Coefficient	p-Value	Coefficient	p-Value
Δ INVD	0.06381	0.05011**	0.03011	0.0020***
Δ MB	0.03262	0.0000***		
Δ INTB			0.0107	0.05011**
Δ MFBsize	0.06832	0.0093***	0.08943	0.0000***
Δ ALS	-0.05729	0.08032*	-0.00224	0.0000***
Δ DEP	0.14837**	0.0000***	0.09037	0.0000***
Δ PaR	-0.09462	0.0108***	-0.10737	0.0103***
Δ LEV	-0.07821	0.0010***	-0.0623	0.0228**
Δ PR	0.02002	0.00000***	0.02748	0.05012**
Δ LA	0.06428	0.05199**	0.07322	0.0000***
Δ MFBAge	0.04837	0.02010**	0.09313	0.0642*
Δ INFL	-0.09723	0.0000***	-0.0562	0.17362*
Δ RGDPG	0.09082	0.0001***	0.03111	0.0015***
Δ Opex	-0.07299	0.03928**	-0.09084	0.2610*
Constant	19.00453	4.74948	2.6836	5.07621
Observations	575		575	
R ²	0.7031		0.6302	
Adj. R ²	0.6473		0.5403	
F-statistic	28.0246		16.3829	
Prob. (F-Stat)	0.0000		0.0000	
Durbin-Watson	1.7001		2.0083	

Source: Own processing, 2024

The results are consistent with the initial findings reported in Table 6. Specifically, the coefficient for the technological adoption proxy, as an investment in technology, remains positive and statistically significant at the 0.05 level and beyond, suggesting that technological adoption is an important factor influencing the performance and sustainability of MFBs in sub-Saharan Africa. This is partly because technology can help the bank reach more customers with its products and services. At the granular level, mobile and internet banking positively influence the performance of MFBs in SSA. As established

in Table 7, a significant positive influence of bank size on MFB’s performance is observable. The negative and significant coefficients for leverage and inflation further confirm the explanatory power of excessive debt use and a high inflation rate in affecting the performance of MFBs’ activities. The two variables are considered a threat to sustainability, especially when they are not adequately managed alongside other important variables. The results show that a bank’s age and real GDP growth are associated with better bank performance.

The study carried out three diagnostic tests, the heteroskedasticity, serial correlation and normality tests, to enhance the reliability of the results obtained for the fixed effects model. The study used the Breusch-Pagan-Godfrey test for heteroskedasticity. Table 8 shows that the *p*-value is 0.36272, greater than 0.05. This result suggests that the residuals are normally distributed and have equal variance, indicating homoscedasticity.

Table 8: Heteroskedasticity Test – Breusch-Pagan-Godfrey

Null hypothesis: Homoskedasticity			
F-statistic	0.65362	Prob. F(6.6)	0.36272
Observation *R-squared	4.95474	Prob. Chi-Squared (6)	0.63730
Scaled explained SS	1.26429	Prob. Chi-Squared (6)	0.91102

Source: Own processing 2024

Empirical results indicate that the COVID-19 pandemic did not represent a structural break in the model. The introduction of pandemic-specific dummy and interaction variables yielded statistically insignificant results, suggesting the shock was transitory rather than a permanent shift in structural parameters. Consistent sub-sample results and robustness checks verify that the model’s fundamental relationships and fit remained stable through the pandemic. Total lockdown days ranged from 30 to 62 in 2020 across SSA countries (Johns Hopkins University, 2023).

Test of Hypotheses

H₀₁: The digitalisation of financial services does not significantly impact the financial sustainability of microfinance banks (MFBs) in SSA.

Estimates reported in Table 6 indicate that digitalisation has a positive, statistically significant effect on MFB sustainability indicators. The coefficients are significant at the 5% level and above, indicating strong empirical support. Accordingly, the empirical evidence permits rejection of the null hypothesis, thereby lending support to the hypothesised relationship that digitalisation enhances the financial sustainability of MFBs in SSA.

H₀₂: The adoption of digital technology does not improve performance (ROA) in ensuring MFB sustainability in SSA.

Results in Table 6 (supported by Table 7) indicate that digital technology adoption has a positive, statistically significant impact on return on assets (ROA). This suggests that technology adoption improves operational efficiency and profitability, thereby strengthening

sustainability. The study fails to find support for the null hypothesis, leading to the acceptance of the alternative hypothesis.

H₀₃: MFB size (log of total assets) does not significantly affect performance and sustainability in SSA.

Findings in Table 7 indicate that MFB size has a positive and statistically significant effect on performance and sustainability metrics. Larger institutions benefit from scale advantages that enhance outreach and financial outcomes. Hence, the null hypothesis is not supported, confirming that size is a significant determinant of MFB performance and sustainability in SSA.

Regression results indicate that investment in digitalisation – specifically mobile and internet banking – positively impacts both the FSS and performance (ROA) of Microfinance Banks (MFBs) in sub-Saharan Africa, with ROA showing higher significance. The components of digitalisation indicate that Mobile banking significantly enhances outreach and service delivery while reducing costs, whereas internet banking shows a similar but statistically weaker relationship. The more pronounced impact of digital investment on ROA suggests that technological adoption directly drives profitability through increased transaction volumes and operational efficiency. These findings align with Ray et al. (2018) and Tasos et al. (2020), who emphasise the role of digital tools in advancing financial inclusion. They are also consistent with Dorfleitner et al. (2019), who found that digitalisation improves the efficiency of microfinance banks by reducing operational costs. By strengthening financial self-sufficiency, digitalisation enhances the long-term viability of MFBs, particularly in extending services to underserved rural populations. However, as Osuma et al. (2025) noted, certain operational and outreach thresholds must be achieved before MFBs can generate meaningful poverty-reduction outcomes. This would enable them to sustain as institutions. Thus, efforts must be made to achieve these thresholds in all SSA countries.

Sustainability is further bolstered by revenue growth from loan interest and large asset sizes, which provide economies of scale (Hartarska et al., 2013). However, challenges remain: Portfolio at Risk (PaR) negatively affects sustainability, as noted by Ayayi and Sene (2010) and Tehulu (2013). Additionally, inflation and leverage create fiscal pressure on both FSS and ROA. These results underscore the need for policymakers and central banks to incentivise digital adoption and provide regulatory support to mitigate economic volatility and ensure the sector's resilience. Additionally, Real GDP growth significantly improves microfinance bank performance by increasing credit demand and strengthening repayment capacity, whereas inflation undermines performance by eroding real incomes, elevating credit risk, and creating macroeconomic instability. These conditions ensure the sustainability of MFBs as institutions (Woller and Woodworth, 2001).

V. Conclusion

This study examined the sustainability of microfinance banks (MFBs) in the digital era across selected sub-Saharan African (SSA) countries. Using panel data from 115 MFBs in 21 SSA countries (2017–2022), a fixed-effects model – supported by the Hausman test – was applied. Digital technology investment, mobile banking, and internet banking served as key explanatory variables, while ROA and FSS proxied for performance and sustainability, respectively.

Findings show that digital adoption significantly improves MFB performance and sustainability. Investment in digital technology enhances both FSS and ROA, while mobile and internet banking strengthen operational outcomes. Poor portfolio quality (PaR) undermines sustainability. Bank size positively affects performance, though less strongly than in commercial banks, reflecting structural and regulatory rigidities and constraints. Overall, the results highlight digitalisation, sound risk management, institutional characteristics, and macroeconomic stability as key drivers of MFB sustainability in SSA, with important implications for policymakers, regulators, and practitioners.

The integration of technology plays a vital role in enhancing the performance and profitability of Microfinance Banks (MFBs), especially in sub-Saharan Africa. By adopting technological solutions, MFBs can improve access to financial services more efficiently, thereby boosting their performance and contributing to poverty alleviation in the region. Furthermore, digitalisation fosters the growth of the financial sector in these economies. This study highlights the need for MFBs to adopt innovative strategies to expand their customer base while reassessing business operations to improve efficiency, reduce operational costs through technology, and ensure long-term sustainability. The findings underscore that technology adoption positively impacts MFBs' ROA and their outreach efforts. Based on the foregoing, the study recommends that microfinance banks in sub-Saharan Africa continue to deepen access to financial services to strengthen financial inclusion and broaden participation in the formal financial system. They need to accelerate the adoption of technological innovations to expand customer outreach, mobilise more deposits, and lower operating costs. Second, MFBs should diversify their loan portfolios and extend their market reach through innovative service delivery channels such as mobile banking and remote financial services. Thirdly, given the dual challenges of low interest returns due to competition with commercial banks and the persistent risk of loan default, MFBs must pursue creative, sustainable strategies to retain existing customers and attract new ones. Fourthly, at the macroeconomic level, central banks across sub-Saharan Africa should maintain inflation at manageable levels and allow MFBs reasonable leverage so as to support real sector growth and enhance the institutional sustainability of microfinance banks. Finally, policymakers and other relevant stakeholders should design supportive initiatives to reduce operational costs and lending risks, thereby improving returns on investment and making the sector more attractive to additional investment.

A major limitation is the study's inability to cover the full list of SSA countries due to data constraints. Future research could focus on assessing the adoption of digital financial products in rural areas, with particular attention to literacy rates and income levels in these regions.

References

- Abdulai, A., & Tewari, D. D. (2017). Trade-off between outreach and sustainability of microfinance institutions: Evidence from sub-Saharan Africa. *Enterprise Development and Microfinance*, 28(3), 162–181. <https://doi.org/10.3362/1755-1986.16-00014>.
- Ali, H., Gueyié, J., & Okou, C. (2021). Assessing the impact of information and communication technologies on microfinance institutions in Niger. *Journal of Small Business & Entrepreneurship*, 33(1), 71–91. <https://doi.org/10.1080/08276331.2019.1648753>.
- Baltagi, B. H. (2008). *Econometric analysis of panel data* (4th ed.). John Wiley & Sons.
- Berhanu, A., Amare, A., Gurmessa, B., Bekele, Y., & Chalchisa, T. (2021). Does microcredit use help farmers win the battle against food insecurity? *Agriculture & Food Security*, 10(1), 31. <https://doi.org/10.1186/s40066-021-00323-8>.
- Bhatt, N., & Tang, S.-Y. (2001). Delivering microfinance in developing countries: Controversies and policy perspectives. *Policy Studies Journal*, 29(2), 319–333. <https://doi.org/10.1111/j.1541-0072.2001.tb02095.x>.
- Brau, J. C., & Woller, G. M. (2004). Microfinance: A comprehensive review. *Journal of Entrepreneurial Finance*, 9(1), 1–26. <https://digitalcommons.pepperdine.edu/jef/vol9/iss1/2>.
- Chikalipah, S. (2017). Financial sustainability of microfinance institutions in sub-Saharan Africa. *Enterprise Development and Microfinance*, 28(3), 182–199. <https://doi.org/10.3362/1755-1986.16-0002>.
- Chmelíková, G., Krauss, A., & Dvouletý, O. (2019). Performance of microfinance institutions in Europe – Does social capital matter? *Socio-Economic Planning Sciences*, 68, Article 100670. <https://doi.org/10.1016/j.seps.2018.11.007>.
- Chmelíková, G., & Redlichová, R. (2020). Is there a link between financial exclusion and over-indebtedness? Evidence from Czech peripheral municipalities. *Journal of Rural Studies*, 78, 457–466. <https://doi.org/10.1016/j.jrurstud.2020.07.010>.
- Ciftci, I., Tatoglu, E., Wood, G., Demirbag, M., & Zaim, S. (2019). Corporate governance and firm performance. *International Business Review*, 28(1), 90–103. <https://doi.org/10.1016/j.ibusrev.2018.08.004>.
- Deb, J. (2017). Assessing sustainability of microfinance institutions in India. *International Journal of Banking, Risk & Insurance*, 5(1), 1–9.
- D’Espallier, B., Jann, G., Marek, H., & Roy, M. (2017). From NGOs to banks. *World Development*, 89, 19–33. <https://doi.org/10.1016/j.worlddev.2016.08.003>.
- Dokulilova, L., Janda, K., & Zetek, P. (2009). Sustainability of microfinance institutions. *European Financial and Accounting Journal*, 4(2), 7–33. <https://doi.org/10.18267/j.efaj.94>.
- Dorfleitner, G., Nguyen, Q. A., & Röhe, M. (2019). Microfinance institutions and the provision of mobile financial services: First empirical evidence. *Finance Research Letters*, 31, 357–362. <https://doi.org/10.1016/j.frl.2018.12.002>.

- Dunford, C. (2000). The holy grail of microfinance. *Small Enterprise Development*, 11, 40–44.
- Elhadj, N., & Elouaouri, H. (2021). Mobile banking and financial inclusion. *Journal of African Business*, 22(2), 123–140. <https://doi.org/10.1080/15228916.2020.1790924>.
- Elkady, M., Ismail, N., & Abdelrahman, S. (2021). Fintech solutions and digital wallets. *Egyptian Journal of Business and Economics*, 12(2), 255–272.
- Fabian, E., & Xianzhi, K. (2013). Microfinance and poverty alleviation. *International Journal of Economics and Finance Studies*, 5(1), 27–35.
- Gidigbi, M. O. (2021). Specialised banks' credit provision in Nigeria. *African Journal of Economic Review*, 9(2), 151–171.
- Githaiga, P. N. (2022). Revenue diversification and financial sustainability of MFIs. *Asian Journal of Accounting Research*, 7(1), 31–43. <https://doi.org/10.1108/AJAR-11-2020-0122>.
- Gupta, N. K., & Gupta, H. (2014). Determinants of capital structure. *ELK Asia Pacific Journal of Finance*, 5(1), 1–12.
- Gyamfi, K., & Sarpong, D. (2020). Digital finance in Ghana. *Journal of Financial Innovation*, 6(2), 103–118. <https://doi.org/10.1186/s40854-020-00199-1>.
- Hartarska, V. (2004). Governance and performance of MFIs. *World Development*, 30(10), 1627–1643. <https://doi.org/10.1016/j.worlddev.2002.05.007>.
- Hartarska, V., Shen, X., & Mersland, R. (2013). Scale economies in MFIs. *Journal of Banking & Finance*, 37(1), 118–131. <https://doi.org/10.1016/j.jbankfin.2012.08.004>.
- Hsiao, C. (2014). *Analysis of panel data*. Cambridge University Press. <https://doi.org/10.1017/CBO9781139839327>.
- International Monetary Fund. (2024). *IMF database*. <https://data.imf.org/en/datasets/IMF>.
- Jamwal, U., Patra, S. K., & Shukla, V. (2021). Sustainable banking practices. *Journal of Banking Regulation*, 22(3), 239–255. <https://doi.org/10.1057/s41261-020-00128-9>.
- Johns Hopkins University. (2023). *Coronavirus Resource Centre*. <https://coronavirus.jhu.edu>.
- Kinyua, J., & Kihui, E. (2020). Mobile money and financial inclusion. *African Development Review*, 32(3), 348–360. <https://doi.org/10.1111/1467-8268.12434>.
- Ledgerwood, J., & White, V. (2006). *Transforming microfinance institutions: Providing full financial services to the poor*. World Bank. <https://doi.org/10.1596/978-0-8213-6615-8>.
- Mahapatra, M. S., & Dutta, S. (2016). Determinants of sustainability of microfinance sector in India. *Journal of Rural Development*, 35(3), 507–522.

- Makan, L. T., & Kabra, K. C. (2021). Carbon emission and financial performance. *Indonesian Journal of Sustainability Accounting and Management*, 5(1), 23–32. <https://doi.org/10.28992/IJSAM.V5I1.292>.
- Meutia, I., Kartasari, S. F., Yaacob, Z., & Arunachalam, M. M. (2020). Sustainable finance mapping. *Indonesian Journal of Sustainability Accounting*, 4(1), 13–27. <https://doi.org/10.28992/ijssam.v4i1.110>.
- Navajas, S., Schreiner, M., Meyer, R. L., González-Vega, C., & Rodríguez-Meza, J. (2000). Microcredit and poverty. *World Development*, 28(2), 333–346. [https://doi.org/10.1016/S0305-750X\(99\)00121-7](https://doi.org/10.1016/S0305-750X(99)00121-7).
- Ndiaye, D., Faye, J., & Sy, A. (2020). Technology and sustainability of microfinance banks. *Journal of Financial Regulation and Compliance*, 28(2), 190–205. <https://doi.org/10.1108/JFRC-02-2019-0026>.
- Olorunleke, G., & Adewumi, M. (2021). Fintech innovations and microfinance transformation. *Journal of Financial Services Marketing*, 26(3), 309–320. <https://doi.org/10.1057/s41264-021-00106-9>.
- Osuma, G., Nzimande, N., & Simon-Ilogho, B. (2025). Examining microfinance and financial inclusion nexus in poverty alleviation and sustainable development in Sub-Saharan Africa. *Journal of Cleaner Production*, 520, Article 146135. <https://doi.org/10.1016/j.jclepro.2025.146135>.
- Pattnaik, D., & Hassan, M. K. (2025). Mapping microfinance research to sustainable development goals: Insights from Scientometrics and BERTopic analysis. *Journal of Economic Surveys*, 39(4), 1630–1676. <https://doi.org/10.1111/joes.12669>.
- Robinson, M. S. (2001). *The microfinance revolution*. World Bank. <https://doi.org/10.1596/0-8213-4524-9>.
- Ray, S., Paul, S., & Miglani, S. (2018). *Innovation, efficiency and inclusion: Integration of digital technologies in the Indian microfinance sector* (ICRIER Working Paper No. 366). Indian Council for Research on International Economic Relations.
- Tasos, S., Amjad, M. I., Awan, M. S., & Waqas, M. (2020). Poverty alleviation and microfinance. *Economies*, 8(63). <https://doi.org/10.3390/economies8030063>.
- Tehulu, T. (2013). Determinants of financial sustainability. *European Journal of Business and Management*, 5(17), 152–158.
- Van Kirk, G. (2010). Micro-consignment model. *Innovations*, 5(1), 101–127. <https://doi.org/10.1162/itgg.2010.5.1.101>.
- Van Rooyen, C., Stewart, R., & De Wet, T. (2012). Impact of microfinance in SSA. *World Development*, 40(11), 2249–2262. <https://doi.org/10.1016/j.worlddev.2012.03.012>.
- Woller, G., & Woodworth, W. (2001). Microcredit policy. *Policy Studies Journal*, 29, 267–282.

Wooldridge, J. M. (2006). *Introductory econometrics: A modern approach* (3rd ed.). Thomson/South-Western.

World Bank. (2024). *MIX Market: Microfinance information exchange audited financial records of microfinance banks*. *World Development Indicators*. <https://databank.worldbank.org/source/mix-market>.

World Bank. (2022). Poverty and shared prosperity 2022: Correcting course. World Bank. <https://doi.org/10.1596/978-1-4648-1893-6>.

Xu, W., Fu, H., & Liu, H. (2019). Sustainability of MFIs. *Sustainability*, 11(21). <https://doi.org/10.3390/su11215947>.