

Access to digital banking services and household welfare among youth-led micro and small enterprise owners in Bungoma County, Kenya: The moderating role of education

Jervis Akona¹
Elvis Kiano²
Dedan Onganya³

¹jervico@gmail.com

²ekiano@yahoo.com

³onganyadedan@gmail.com

^{1,2,3}Moi University, Kenya

<https://doi.org/10.51867/ajernet.7.4.59>

ABSTRACT

Digital banking services have become an important component of financial inclusion, particularly for micro and small enterprise (MSE) owners who require accessible and convenient mechanisms for managing business and household transactions. Drawing on Human Capital Theory, Financial Intermediation Theory, and Solow Growth Theory, this study examined the association between access to digital banking services and household welfare among youth-led MSE owners in Bungoma County, Kenya, and assessed whether education moderates this relationship. Human Capital Theory provides the basis for understanding the role of education in enhancing individuals' knowledge, skills, and ability to effectively utilise financial services, while Financial Intermediation Theory explains how financial services facilitate the mobilisation and allocation of financial resources. Solow Growth Theory provides a broader perspective on how improvements in productive capabilities and technology can contribute to economic and welfare outcomes. However, access to digital banking services may not be associated with similar welfare outcomes across users because the ability to understand and effectively utilise digital banking products may vary with individual capabilities. A quantitative cross-sectional research design was employed using primary data from 400 youth-led MSE owners aged 18–35 years. Household welfare was operationalised as a binary outcome derived from a composite welfare index, while access to digital banking services was measured using indicators of accessibility, convenience, affordability, reliability, and usability. Probit regression was used to estimate the association between access to digital banking services and household welfare, with an interaction term between digital banking services and education introduced to test the moderating relationship. The baseline model produced a Pseudo R² of 0.218. Access to digital banking services was positively and statistically significantly associated with household welfare ($\beta = 0.384$, $p < 0.001$). In the moderated model, the digital banking services coefficient remained positive and statistically significant ($\beta = 0.309$, $p = 0.002$), while the digital banking services $\times$ education interaction was also positive and statistically significant ($\beta = 0.182$, $p = 0.011$). The Pseudo R² increased from 0.218 to 0.261 following inclusion of the interaction term. The average marginal effect of digital banking services was 0.152 ($p < 0.001$), indicating a positive association between higher access to digital banking services and the predicted probability of higher household welfare. The findings indicate that education conditions the relationship between access to digital banking services and household welfare. The study highlights the importance of complementing the expansion of digital banking services with financial capability and digital skills initiatives targeting young entrepreneurs.

Keywords: Digital Banking Services, Education, Financial Inclusion, Household Welfare, Kenya, Probit Regression, Youth-Led MSEs

I. INTRODUCTION

Micro and small enterprises (MSEs) play an important role in employment creation, income generation and livelihood support in developing economies. In Kenya, they provide opportunities for self-employment and income generation, particularly among young people who face limited opportunities in formal employment. Despite their importance, youth-led MSEs commonly operate with limited financial resources, unstable cash flows and low capacity to absorb business and household shocks. Since enterprise income is often closely linked to household consumption and financial security, constraints affecting enterprise operations may also have implications for household welfare.

Access to appropriate financial services can help individuals and enterprises manage income, make payments, save, obtain credit and respond to financial shocks. Financial inclusion has therefore become an important component of development policy and research (Lusardi & Mitchell, 2014). Within this broader financial inclusion framework, digital banking services have expanded the channels through which customers access bank-based financial services. These services include mobile banking, internet banking, USSD banking, electronic funds transfers, digital payments and other technology-enabled banking services. By reducing the need for physical branch visits, digital banking can lower transaction and geographical costs and facilitate faster access to financial information and transactions.

Digital banking services are particularly relevant to youth-led MSEs because these enterprises frequently undertake small-value and relatively frequent financial transactions. Entrepreneurs can use digital banking channels to receive customer payments, pay suppliers, transfer funds, monitor account balances, save and manage other business transactions (Demirgüç-Kunt et al., 2022). These capabilities may support financial management and liquidity management, which are important for enterprises whose income streams are often irregular. At the household level, improved management of enterprise finances may be associated with greater capacity to meet consumption needs, accumulate productive assets and withstand financial shocks.

However, access to digital banking services does not necessarily imply effective utilisation or similar outcomes among users. The benefits associated with digital banking may be constrained by transaction charges, unreliable network connectivity, limited digital skills, security concerns, inadequate consumer awareness and difficulties in understanding financial products and their associated costs. Digital banking may also expose users to financial obligations, including digital credit, where inadequate understanding of fees, repayment requirements and contractual conditions may create additional financial pressures. The welfare implications of digital banking may therefore vary according to the capacity of users to understand and utilise these services effectively. Education provides a potential explanation for such differences. Human Capital Theory considers education an investment that develops knowledge and skills that enhance productivity and economic decision-making (Becker, 1964; Schultz, 1971). In the context of digital banking, educational attainment may be associated with greater ability to interpret financial information, compare available products, understand transaction charges and repayment obligations, maintain financial records and recognise financial and digital risks. Consequently, education may condition the relationship between access to digital banking services and household welfare rather than merely having an independent association with welfare.

The Kenyan financial landscape provides an important context for examining this relationship. The country has experienced substantial expansion in technology-enabled financial services, accompanied by increased use of digital channels for payments and other financial transactions. Previous studies have documented relationships between digital financial services and transaction costs, risk sharing, financial inclusion, household resilience and long-term household outcomes (Jack & Suri, 2014; Mbiti & Weil, 2016; Suri & Jack, 2016; Demirgüç-Kunt et al., 2022). More recent evidence has also highlighted the importance of digital financial services in strengthening household resilience and financial access. However, much of the existing Kenyan literature has concentrated on mobile money, broad financial inclusion or general household and enterprise outcomes. Less empirical attention has been directed specifically towards bank-provided digital banking services and their relationship with household welfare among youth-led MSE owners.

A further gap concerns the role of education in this relationship. Existing research has established the importance of financial literacy and human capital in financial decision-making, but education is often examined as an explanatory characteristic rather than as a factor that may condition the relationship between access to financial services and welfare. This distinction is important because access to a digital banking platform does not necessarily guarantee the ability to select appropriate products, understand costs and risks, or use the available services effectively. Examining education as a moderator therefore provides an opportunity to assess whether the relationship between digital banking access and household welfare differs across levels of educational attainment. Against this background, this study examines the association between access to digital banking services and household welfare among youth-led MSE owners in Bungoma County, Kenya, and investigates the moderating role of education. The study contributes to the literature in three main respects. First, it focuses on digital banking services provided through banking institutions, thereby distinguishing bank-based digital services from broader digital financial services and mobile money. Second, it extends the analysis from enterprise-level outcomes to household welfare among youth-led MSE owners, whose business and household financial decisions are closely interconnected. Third, it examines education as a moderating variable, providing empirical evidence on whether educational attainment conditions the relationship between digital banking access and household welfare.

1.1 Statement of the Problem

Youth-led micro and small enterprises (MSEs) are important sources of employment, income and household livelihoods in Kenya, yet many young entrepreneurs operate under financial constraints and unstable cash flows that may affect both enterprise performance and household welfare. The rapid expansion of digital banking has created opportunities for MSE owners to conduct payments, transfers, savings, account monitoring and other financial transactions more conveniently and at lower transaction and geographical costs. Evidence from Kenya has linked digitally enabled financial services with reduced transaction costs, improved risk sharing, financial access, resilience and household economic outcomes (Jack & Suri, 2014; Mbiti & Weil, 2016; Suri & Jack, 2016; Demirgüç-Kunt et al., 2022; Yao et al., 2023). However, much of this evidence centres on mobile money or digital financial services broadly, leaving limited empirical evidence on whether access to bank-provided digital banking services is associated with household welfare among youth-led MSE owners. This gap is important because business and household finances are closely interconnected for many MSE owners, yet enterprise-level measures alone may not capture the broader welfare implications of financial-service access.

More importantly, access to digital banking does not necessarily translate into effective utilisation or similar welfare outcomes across users. Differences in educational attainment may influence entrepreneurs' ability to interpret financial information, understand charges and product conditions, navigate digital platforms and recognise financial and security risks. Although existing literature establishes the importance of education and financial literacy in financial decision-making and digital financial participation, limited empirical attention has examined education as a moderating factor in the relationship between access to bank-provided digital banking services and household welfare. Consequently, it remains unclear whether the welfare association of digital banking varies according to entrepreneurs' educational attainment. This study addresses this empirical gap by examining the association between access to digital banking services and household welfare among youth-led MSE owners in Bungoma County, Kenya, and by testing whether education significantly moderates this relationship.

1.2 Research Hypotheses

H₀₁: Access to digital banking services is positively and significantly associated with household welfare among youth-led micro and small enterprise owners in Bungoma County, Kenya.

H₀₂: Education significantly moderates the relationship between access to digital banking services and household welfare among youth-led micro and small enterprise owners in Bungoma County, Kenya.

II. LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Financial Intermediation Theory

Financial Intermediation Theory explains the role of financial institutions in facilitating the movement of financial resources between economic agents while reducing transaction and information costs. Financial intermediaries also facilitate payments, savings, liquidity management and risk management. The theory is relevant to digital banking because digital channels extend the traditional functions of banks beyond physical branches. Entrepreneurs can initiate payments, transfer funds, monitor accounts and access financial information remotely. For youth-led MSE owners, these functions may reduce transaction frictions and facilitate the management of business and household financial resources. Financial Intermediation Theory therefore provides a basis for expecting access to appropriate digital banking services to be associated with household welfare.

2.1.2 Solow Growth Perspective

The Solow growth model identifies capital accumulation, labour and technological progress as important determinants of productive capacity (Solow, 1956). Although the model was developed as a theory of aggregate economic growth, its emphasis on technological progress provides a complementary perspective for understanding the economic relevance of digital technologies. Digital banking represents an application of technological progress to financial intermediation. By facilitating faster and more convenient financial transactions, digital banking technologies may reduce operational frictions and support the financial activities of MSE owners. These functions may contribute to more efficient management of enterprise and household financial resources. The Solow perspective therefore complements Financial Intermediation Theory by emphasizing the role of technology in improving the efficiency of economic activities. However, it provides limited explanation for differences among individuals in their ability to use digital technologies. Human Capital Theory addresses this dimension.

2.1.3 Human Capital Theory

Human Capital Theory provides the principal theoretical basis for the proposed moderating role of education. Becker (1964) and Schultz (1971) conceptualize education as an investment that develops knowledge, skills and capabilities relevant to productivity and economic decision-making. Applied to digital banking, education may influence the ability of entrepreneurs to understand banking products, process financial information, evaluate costs and risks and use available digital services. Consequently, entrepreneurs with similar access to digital banking services may exhibit different welfare outcomes according to their educational attainment. Human Capital Theory therefore provides a theoretical basis for examining both the association between education and welfare and the possibility that education conditions the relationship between digital banking access and household welfare.

2.1.4 Theoretical Integration

The three perspectives provide complementary explanations for the proposed relationships. Financial Intermediation Theory explains how banking services can reduce transaction and information costs and facilitate financial resource allocation. The Solow perspective highlights the role of technological progress in improving the efficiency of financial and economic activities. Human Capital Theory explains differences in users' capacity to process information and utilize available financial technologies. Taken together, the theories suggest that access to digital

banking services may be associated with household welfare through improved transaction efficiency, financial resource management and liquidity management, while education may condition the extent to which entrepreneurs are able to utilize these services effectively.

2.2 Empirical Review

2.2.1 Digital Financial Services and Household Welfare in Kenya

Kenya provides an important context for examining the relationship between access to digital banking services and household welfare because of the rapid expansion of technology-enabled financial services. Commercial banks have increasingly adopted mobile banking, internet banking, USSD banking, electronic funds transfers and other digital channels, providing MSE owners with more convenient mechanisms for conducting business and household financial transactions. Access to these services may improve welfare by reducing transaction costs, facilitating payments and transfers, improving financial management and enabling households to respond more effectively to income and expenditure shocks. Empirical evidence from Kenya supports the welfare relevance of digitally enabled financial services. Jack and Suri (2014) found that mobile money reduced transaction costs associated with informal risk sharing and enhanced households' ability to smooth consumption following negative economic shocks. Mbiti and Weil (2016) documented changes in financial transaction behaviour and the use of formal financial services following the expansion of M-PESA, while Suri and Jack (2016) reported associations between mobile-money adoption and longer-term economic outcomes, including consumption and poverty reduction. More recently, Yao et al. (2023) found an association between mobile-money use and household resilience to economic shocks in Kenya. Although these studies provide evidence that digitally enabled financial services can contribute to improved household economic outcomes, most focus on mobile money rather than bank-provided digital banking services. The distinction is important because digital banking involves services delivered through banking institutions, including mobile banking, internet banking, USSD banking and electronic transfers, which may differ from mobile-money services in their institutional arrangements, product characteristics and range of financial functions.

Despite the growing evidence on digital financial services, limited empirical attention has been given to whether access to bank-provided digital banking services is associated with household welfare among youth-led MSE owners. This relationship is particularly relevant because business and household finances among MSE owners may be closely interconnected, with enterprise income contributing to household consumption and investment while household resources may also support business activities. Access to digital banking can facilitate receipt of customer payments, supplier payments, fund transfers, account monitoring and other financial activities, potentially improving the efficiency with which financial resources are managed. However, access alone may not generate similar welfare outcomes across users because the benefits derived from digital banking may depend on affordability, reliability, convenience and usability, as well as users' capacity to understand and effectively utilise the available services. This consideration is particularly important for the present study because education is proposed as a moderating factor that may condition the relationship between digital banking access and household welfare. The study therefore extends existing Kenyan evidence by focusing specifically on youth-led MSE owners in Bungoma County and by examining whether access to digital banking services is positively associated with household welfare.

2.2.2 Education, Financial Literacy and Financial Capability

Education and financial capability are important considerations in understanding how individuals translate access to financial services into economic outcomes. Lusardi and Mitchell (2014) demonstrate that financial knowledge influences decisions relating to saving, borrowing, investment and financial planning, while education can enhance individuals' ability to acquire, process and apply information. This distinction is important because formal educational attainment and financial literacy are related but conceptually different: education reflects the level of formal schooling, whereas financial literacy concerns the knowledge and skills required to make informed financial decisions. In digital financial environments, these capabilities may become particularly important because users are required to understand transaction costs, product conditions, security procedures, repayment obligations and other financial information. Consequently, two entrepreneurs with similar access to digital banking services may not derive similar benefits if their capacity to understand and effectively use those services differs. Education may therefore influence the extent to which access to digital banking is translated into improved financial management and, ultimately, household welfare.

Evidence from Kenya further highlights the relevance of financial capability and consumer protection to effective participation in digital finance. Musau et al. (2022) emphasize the role of financial literacy and consumer protection in supporting effective digital financial access among SMEs, suggesting that access to digital financial services involves not only availability but also the capacity to use such services appropriately. Although their study addresses the broader digital-finance environment rather than the specific relationship between bank-provided digital banking and household welfare, the findings provide a basis for considering education as a conditioning factor. From a Human Capital Theory perspective, education represents a productive capability that can enhance individuals' knowledge and skills, potentially enabling entrepreneurs to make more effective use of digital banking services.

However, limited empirical attention has been given to whether education changes the strength of the association between digital banking access and household welfare among youth-led MSE owners in Kenya. The present study addresses this gap by introducing an interaction between access to digital banking services and education to determine whether education significantly moderates their relationship with household welfare. Accordingly, the second hypothesis states that education significantly moderates the relationship between access to digital banking services and household welfare among youth-led micro and small enterprise owners in Bungoma County, Kenya.

2.2.3 Digital Divide and Technology Adoption

The digital divide literature highlights differences in individuals' ability to access and effectively use digital technologies due to variations in infrastructure, income, education, digital skills, device ownership, network coverage and access to service providers. In the context of digital banking, access to a platform does not necessarily imply effective utilisation of the services available through it. An entrepreneur may have access to mobile, internet or USSD banking but may derive limited benefits because of inadequate digital skills, affordability constraints, unreliable network connectivity, limited knowledge of available products or concerns about security. This distinction is important when examining the relationship between digital banking and household welfare because the welfare benefits associated with digital banking depend not only on whether a service is available but also on whether users can access and utilise it effectively. Thus, the digital divide perspective provides a useful framework for understanding variations in the extent to which youth-led MSE owners can convert digital banking access into productive financial and household outcomes.

The perspective also supports the multidimensional measurement of access to digital banking services adopted in the present study, incorporating accessibility, convenience, affordability, reliability and usability/security. These dimensions capture the extent to which digital banking services are practically accessible and usable rather than merely available to entrepreneurs. The digital divide perspective further provides a conceptual basis for examining education as a moderating factor. Individuals with higher levels of education may have greater capacity to process information, learn new technologies and understand financial terms and procedures, potentially enabling them to derive greater benefits from digital banking access. However, this relationship should be established empirically rather than assumed, since education may not eliminate other barriers such as affordability, network limitations or security concerns. The present study therefore examines whether education significantly changes the relationship between access to digital banking services and household welfare, thereby complementing the broader literature on digital access and technology adoption among MSE owners.

2.2.4 Youth Entrepreneurship and MSEs

Youth-led micro and small enterprises (MSEs) constitute an important source of employment, income generation and livelihood opportunities in Kenya. However, young entrepreneurs often operate within resource-constrained environments characterised by limited access to finance, markets, business skills, technology and other productive resources. Such constraints may affect enterprise performance and, where household livelihoods depend substantially on business income, may also have implications for household welfare. The relationship between an MSE and the owner's household is particularly relevant because business and household financial resources are often interconnected. Enterprise income may support household consumption, education, healthcare and investment, while household resources may be used to finance business operations. Consequently, financial services that facilitate business transactions, liquidity management and financial planning may generate benefits that extend beyond enterprise activities to the welfare of the entrepreneur's household.

Digital banking services can support youth-led MSE owners by facilitating customer and supplier payments, fund transfers, account monitoring, savings and other financial transactions. By reducing some transaction and information costs and improving the convenience of financial management, these services may enhance the ability of entrepreneurs to manage business and household resources. Nevertheless, the extent to which digital banking access is associated with household welfare may vary across entrepreneurs depending on their ability to use available services effectively. While existing research in Kenya has examined financial inclusion, mobile money and digital finance, comparatively limited attention has focused specifically on the association between bank-provided digital banking services and household welfare among youth-led MSE owners, particularly within rural county contexts. The present study addresses this gap by examining youth-led MSE owners in Bungoma County and by considering whether education conditions the relationship between access to digital banking services and household welfare.

2.2.5 Digital Finance, Resilience and the COVID-19 Period

The COVID-19 pandemic highlighted the importance of digital financial channels in maintaining economic and financial transactions during periods of restricted physical interaction. Restrictions on movement and face-to-face activities increased reliance on digital payments and remote financial services, drawing greater attention to the role of technology-enabled financial channels in supporting households and enterprises. The Global Findex 2021 documented substantial changes in the use of digital payments and financial services during the pandemic, while also highlighting

differences in financial access and financial resilience across population groups (Demirgüç-Kunt et al., 2022). For MSE owners, digital financial channels provided mechanisms for receiving and making payments and conducting other financial transactions when conventional face-to-face interactions were constrained. The pandemic therefore provides an important contextual background for understanding the growing relevance of digital financial services to financial management and resilience.

At the same time, the experience of the pandemic highlighted differences in individuals' ability to access and effectively use digital financial services. Factors such as education, digital skills, affordability, infrastructure and network reliability may influence the extent to which users benefit from available digital banking services. However, the present study does not specifically estimate the effect of COVID-19 on household welfare. Rather, it examines the association between access to digital banking services and household welfare among youth-led MSE owners during the 2018–2023 study period, while assessing whether education moderates this relationship. The COVID-19 experience therefore provides relevant contextual evidence for the importance of digital financial access and resilience, without being treated as a separate explanatory variable in the present study.

III. METHODOLOGY

3.1 Study Area

The study was conducted in Bungoma County, western Kenya. The county comprises rural, peri-urban and urban areas, with agriculture, trade and services forming important components of local economic activity. Micro and small enterprises (MSEs) provide employment and income-generating opportunities across these sectors. According to the Kenya National Bureau of Statistics (2019), Bungoma County had a population of 1,670,570. The county is administratively divided into nine sub-counties: Bumula, Bungoma Central, Bungoma East, Bungoma North, Bungoma South, Bungoma West, Cheptais, Kimilili and Mount Elgon. The diversity of economic activities and the presence of youth-owned enterprises made the county suitable for examining the relationship between digital banking services and household welfare.

3.2 Research Design

A quantitative cross-sectional research design was employed. Primary data were collected from youth-led MSE owners at one point in time using a structured questionnaire. The design enabled the study to estimate the statistical association between access to digital banking services and household welfare and to examine whether the association varied according to educational attainment. Given the cross-sectional nature of the data, the estimated relationships are interpreted as associations and not causal effects.

3.3 Study Population and Sample

The study population comprised youth-led MSE owners aged 18–35 years operating enterprises in Bungoma County. A youth-led MSE was defined as an enterprise owned or managed by an individual within the specified youth age category. The sample size was calculated using Cochran's (1977) formula for large populations as follows:

$$n_0 = \frac{Z^2 * p(1-p)}{(e)^2}$$

Where:

$Z = 1.96$ (standard normal variate at 95% confidence level)

$p = 0.5$ (assumed proportion of youth with banking participation)

$e = 0.05$ (desired level of precision).

$$n_0 = \frac{1.96^2 * 0.5(0.5)}{(0.05)^2} = 384$$

To allocate this sample proportionally across sub counties, the study applied Neyman's Allocation Formula (1934):

$$n_h = \frac{N_h}{N} \times n$$

Where:

n_h = Sample size for Sub County h

n = Total sample size 384 (determined by Cochran sample size formula)

N_h = Population size for sub-county h

N = Total population of Bungoma County

Based on this formula, the sample size for each sub-county was distributed as shown below: The population of the sub-counties was obtained from the 2019 national census.

Where

n_0 is the required sample size

Z is the standard normal value at the selected confidence level

p is the estimated population proportion and

e is the acceptable margin of error.

At a 95% confidence level, $p = 0.50$ and $e = 0.05$, the calculated minimum sample size was approximately 384 respondents. Cochran's (1977) formula yielded a minimum sample size of 384 respondents. However, to take care for non-response, questionnaires that would be incomplete, and data screening losses commonly associated with field surveys, the sample size was increased to 400 respondents. To further safeguard against non-response and ensure that the minimum required sample was achieved, 415 questionnaires were administered. Following data cleaning and screening, 400 fully completed and usable questionnaires were used for analysis, representing a response rate of 96.4%, which was considered adequate for statistical analysis and hypothesis testing

A stratified sampling procedure was used to obtain representation from the nine sub-counties. The sample was proportionately allocated across the strata, followed by simple random selection of eligible respondents. A total of 415 questionnaires were administered, of which 400 were completed and returned, giving a response rate of 96.4%. The final analysis was therefore based on 400 respondents.

3.4 Data Collection and Research Instrument

Primary data were collected using a structured questionnaire comprising mainly closed-ended questions. The instrument contained sections on respondent characteristics, access to digital banking services, educational attainment, household welfare and other financial and enterprise characteristics. Most construct items were measured on a five-point Likert scale. The questionnaire was reviewed by the research supervisors and relevant specialists to assess its clarity, relevance and coverage of the study constructs. A pilot study involving 40 respondents who were not included in the final sample was subsequently undertaken to assess the suitability of the instrument. Trained research assistants administered the questionnaires after respondents had been informed of the purpose of the study and the voluntary nature of participation. The main data-collection exercise was conducted over approximately two weeks following the required institutional and research approvals.

3.5 Measurement of Variables

3.5.1 Household Welfare

Household welfare was the dependent variable. It was measured using a composite index based on indicators relating to enterprise income, profitability, productive asset accumulation, financial security and the ability to withstand financial shocks. Responses to the individual welfare items were aggregated to generate a composite welfare measure. For Probit estimation, the composite welfare index was converted into a binary outcome representing lower and higher household-welfare categories. The resulting binary variable was coded as 1 for respondents classified in the higher household-welfare category and 0 otherwise.

3.5.2 Access to Digital Banking Services

Access to digital banking services was the principal explanatory variable. In this study, digital banking services refer to bank-provided financial services accessed through digital technologies rather than exclusively through physical bank branches. The construct included digital channels and activities such as mobile banking, internet banking, USSD banking, electronic funds transfers, digital payments and account-management services. Access was measured using indicators covering accessibility, convenience, affordability, reliability and usability/security. The items assessed ease of access and registration, affordability of transaction charges, security, availability of bank support, time and cost savings, ability to complete transactions digitally and reliability of the services. The responses were aggregated to form a digital banking services index, with higher scores indicating greater reported access to and usability of digital banking services.

3.5.3 Education

Education was specified as the moderating variable and was measured using respondents' formal educational attainment. The categories comprised no formal education, primary education, secondary education and tertiary education. Formal educational attainment was distinguished from financial literacy. Education captures the level of formal schooling completed, whereas financial literacy concerns knowledge and understanding of financial concepts and decisions. Accordingly, education was not used as a proxy for financial literacy.

3.5.4 Control Variables

Gender, household size and business age were included as control variables. Gender captured the respondent's reported sex, household size represented the number of household members, and business age captured the length of time the enterprise had been in operation. These variables were included to account for observable demographic and enterprise characteristics that may be associated with both financial-service access and household welfare.

3.5.5 Other Financial-Service Variables

Access to credit, savings and bancassurance were included as additional financial-service covariates. Their inclusion provided a means of estimating the relationship between digital banking services and household welfare while accounting for other financial services that may be associated with welfare outcomes.

3.6 Reliability and Data Quality

The internal consistency of multi-item constructs was assessed using Cronbach's alpha. A coefficient of 0.70 or higher was considered acceptable. The dataset was also examined for missing observations and potential outliers. No study variable had more than 5% missing observations, and no systematic pattern of missing data was identified; consequently, no imputation procedure was applied. Multivariate outliers were assessed using Mahalanobis distance. The identified observations were evaluated against the appropriate chi-square criterion based on the number of predictors in the relevant model.

3.7 Data Analysis

Data were coded and analysed using the Statistical Package for the Social Sciences (SPSS), Version 23. Descriptive statistics comprising frequencies, percentages, means and standard deviations were used to summarise respondent characteristics and the study variables. Pearson correlation coefficients were calculated to examine bivariate associations among the variables. Probit regression was employed because the dependent variable was specified as a binary household-welfare outcome. The analysis was undertaken in two stages. First, a baseline model estimated the association between access to digital banking services and household welfare while controlling for education, demographic characteristics and other financial-service covariates. Second, an interaction term between digital banking services and education was introduced to test the moderating relationship.

3.8 Baseline Probit Model

The baseline Probit model was specified as:

$$W_i^* = \beta_0 + \beta_1 DBS_i + \beta_2 EDU_i + \beta_3 GENDER_i + \beta_4 HSIZE_i + \beta_5 BAGE_i + \beta_6 CREDIT_i + \beta_7 SAVINGS_i + \beta_8 BCS_i + \varepsilon_i$$

Where:

W_i^* represents the latent household-welfare outcome for respondent i ; DBS represents access to digital banking services; EDU represents educational attainment; GENDER represents respondent gender; HSIZE represents household size; BAGE represents business age; CREDIT represents access to credit; SAVINGS represents savings; BCS represents bancassurance; β_0 is the constant; β_1 – β_8 are the estimated coefficients; and ε_i is the error term.

The observed binary welfare outcome was defined as:

$$W_i = 1 \text{ if } W_i^* > 0$$

$$W_i = 0 \text{ otherwise.}$$

The probability of a higher household-welfare outcome was therefore expressed as:

$$P(W_i = 1) = \Phi(X_i\beta)$$

where Φ denotes the cumulative distribution function of the standard normal distribution.

The coefficient β_1 represents the association between access to digital banking services and the latent propensity for higher household welfare, conditional on the other variables included in the model.

3.9 Moderation Model

To test the moderating role of education, an interaction between access to digital banking services and education was introduced into the Probit model:

$$W_i^* = \beta_0 + \beta_1 DBS_i + \beta_2 EDU_i + \beta_3 (DBS_i \times EDU_i) + \beta_4 GENDER_i + \beta_5 HSIZE_i + \beta_6 BAGE_i + \beta_7 CREDIT_i + \beta_8 SAVINGS_i + \beta_9 BCS_i + \varepsilon_i$$

Where:

$DBS_i \times EDU_i$ is the interaction term between access to digital banking services and educational attainment. The coefficient β_3 was used to test whether the association between access to digital banking services and household welfare varied according to educational attainment.

The moderation hypothesis was specified as: H_2 : Education significantly moderates the relationship between access to digital banking services and household welfare among youth-led micro and small enterprise owners in Bungoma County, Kenya. Because Probit is a nonlinear probability model, the interaction coefficient was interpreted as evidence of moderation on the latent index rather than directly as a percentage-point change in the probability of higher household welfare. Probability-scale interpretation requires evaluation of conditional marginal effects or predicted probabilities.

3.10 Diagnostic and Model-Fit Assessment

Multicollinearity was assessed using variance inflation factors (VIF) and tolerance statistics. This assessment was considered important because the correlation analysis revealed relatively high associations among some explanatory variables. Model specification was assessed using the specification diagnostics available from the estimated models. Model fit was evaluated using the Probit Pseudo R^2 and relevant model-fit statistics. Changes in model fit between the baseline and interaction specifications were also examined. The Breusch-Pagan/Cook-Weisberg test was used where applicable to assess heteroskedasticity. The reported test was not statistically significant ($p = .292$), providing no statistical evidence of heteroskedasticity under that diagnostic. Normality of the explanatory variables was not imposed as a requirement for Probit estimation.

3.11 Ethical Considerations

Ethical principles were observed throughout the study. Participation was voluntary, and respondents were informed about the purpose of the research and the intended use of the information collected. Respondent confidentiality and privacy were maintained throughout the data-collection and analysis processes. The study was conducted after obtaining the relevant institutional and research approvals.

IV. FINDINGS & DISCUSSION

4.1 Respondent Characteristics

The study analysed data from 400 youth-led MSE owners aged 18–35 years in Bungoma County. Males constituted 63.75% ($n = 255$) of the respondents, while females accounted for 36.25% ($n = 145$). Respondents aged 18–25 years represented 33.0% of the sample, those aged 26–30 years 37.0%, and those aged 31–35 years 30.0%, with a mean age of 27.8 years ($SD = 5.73$). Most respondents (77.0%) had operated their businesses for less than five years, indicating that the sample was predominantly composed of relatively young enterprises. Educational attainment varied across the respondents: 16.25% had no formal education, 30.25% had primary education, 30.75% had secondary education, and 22.75% had tertiary education. More than half of the respondents (56.5%) reported household sizes of more than five members. Overall, the sample reflects young MSE owners with variation in educational attainment, household size and business experience.

Table 1
Respondent Characteristics

Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Male	255	63.75
	Female	145	36.25
Age (years)	18–25	132	33.00
	26–30	148	37.00
	31–35	120	30.00
Education level	No formal education	65	16.25
	Primary education	121	30.25
	Secondary education	123	30.75
	Tertiary education	91	22.75
Business age	Less than 5 years	308	77.00
	5 years and above	92	23.00
Household size	5 or fewer members	174	43.50
	More than 5 members	226	56.50

Note: Mean age = 27.8 years; $SD = 5.73$. Percentages are based on $N = 400$.

4.2 Descriptive Statistics and Correlations

Digital banking services were assessed using indicators of accessibility, registration, affordability, security, institutional support, convenience, transaction capability and reliability. The item means ranged from 3.12 to 3.30 on a five-point scale. The highest mean was recorded for the statement that digital banking services save time and reduce costs ($M = 3.30$, $SD = 1.36$), followed by ease of access and registration ($M = 3.27$ for each). Affordability of transaction charges recorded the lowest mean ($M = 3.12$, $SD = 1.40$). The results suggest moderate perceptions of access to and usability of digital banking services, with transaction affordability emerging as a relatively weaker dimension.

The composite digital banking services index recorded a mean of 3.61 ($SD = 0.98$), while household welfare had a mean of 3.57 ($SD = 0.97$). The mean scores for access to credit, savings, bancassurance and education were 3.52 ($SD = 0.91$), 3.49 ($SD = 1.03$), 3.38 ($SD = 0.99$) and 3.56 ($SD = 0.95$), respectively. The household-welfare indicators, covering enterprise income, profitability, productive asset accumulation, financial security and the ability to withstand financial shocks, recorded means ranging from 3.32 to 3.35.

Table 2
Descriptive Statistics of Composite Study Variables

Variable	N	Mean	SD
Access to credit	400	3.52	0.91
Savings	400	3.49	1.03
Digital banking services	400	3.61	0.98
Bancassurance	400	3.38	0.99
Education	400	3.56	0.95
Household welfare	400	3.57	0.97

Pearson correlation analysis indicated positive and statistically significant associations between household welfare and education ($r = .784$), access to credit ($r = .742$), digital banking services ($r = .731$), savings ($r = .698$) and bancassurance ($r = .663$), all at $p < .01$. The explanatory variables were also positively correlated with one another. Relatively high correlations were observed between access to credit and savings ($r = .754$), education and digital banking services ($r = .747$), and education and access to credit ($r = .736$). These associations warranted further assessment of multicollinearity using regression diagnostics. The correlations represent bivariate relationships and do not establish causal relationships.

Table 3
Pearson Correlations among Study Variables

Variable	Welfare	Credit	Savings	DBS	Bancassurance	Education
Household welfare	1.000					
Access to credit	.742**	1.000				
Savings	.698**	.754**	1.000			
Digital banking services	.731**	.709**	.728**	1.000		
Bancassurance	.663**	.681**	.694**	.712**	1.000	
Education	.784**	.736**	.719**	.747**	.703**	1.000

Note: ** $p < .01$. Source: Authors' survey data, 2026.

4.3 Baseline Probit Regression Results

A baseline Probit model was estimated to examine whether access to digital banking services was associated with the probability of being classified in the higher household-welfare category. Gender, household size and business age were included as control variables, while access to credit, savings and bancassurance were included as additional financial-service covariates.

Table 4
Baseline Probit Regression Results

Variable	β	SE	z	p-value
Access to credit	0.412	0.098	4.21	<.001
Savings	0.356	0.091	3.91	<.001
Digital banking services	0.384	0.095	4.04	<.001
Bancassurance	0.298	0.087	3.42	.001
Education	0.267	0.079	3.38	.001
Constant	-1.214	0.312	-3.89	<.001
Pseudo R ²	0.218			

The results show that access to digital banking services was positively and statistically significantly associated with household welfare ($\beta = 0.384$, $p < .001$). Thus, higher levels of access to digital banking services were associated with a higher probability of belonging to the higher household-welfare category, holding the other variables in the model constant. Access to credit also showed a positive and statistically significant association with household welfare ($\beta = 0.412$, $p < .001$). Savings ($\beta = 0.356$, $p < .001$) and bancassurance ($\beta = 0.298$, $p = .001$) were similarly positively associated with household welfare. Education was also positively associated with household welfare ($\beta = 0.267$, $p = .001$). The baseline model produced a Pseudo R² of 0.218. This indicates explanatory improvement over the intercept-only specification. The Pseudo R² is reported as a model-fit measure appropriate to the Probit framework and should not be interpreted in the same manner as the conventional R² in ordinary least-squares regression. The positive and statistically significant coefficient for digital banking services provides empirical support for H₁.

4.4 Moderating Role of Education

To examine whether education conditions the relationship between digital banking services and household welfare, interaction terms between education and the financial-service variables were introduced while retaining the controls and other covariates.

Table 5
Probit Regression Results with Interaction Terms

Variable	β	SE	z	p-value
Access to credit	0.331	0.102	3.25	.001
Savings	0.284	0.096	2.96	.003
Digital banking services	0.309	0.098	3.15	.002
Bancassurance	0.241	0.091	2.65	.008
Education	0.214	0.083	2.58	.010
Credit $\times$ Education	0.176	0.069	2.55	.011
Savings $\times$ Education	0.149	0.064	2.33	.020
Digital banking services $\times$ Education	0.182	0.071	2.56	.011
Bancassurance $\times$ Education	0.137	0.062	2.21	.027
Constant	-1.306	0.341	-3.83	.001
Pseudo R ²	0.261			

Note: Gender, household size and business age were included in the model as control variables but are not displayed in this abbreviated table. Source: Authors' analysis of survey data, 2026.

The interaction between digital banking services and education was positive and statistically significant ($\beta = 0.182$, $p = .011$). This indicates that the relationship between access to digital banking services and household welfare varies with educational attainment. The positive interaction is consistent with the proposition that education may influence the ability of entrepreneurs to understand and utilise digital banking services. Entrepreneurs with different levels of educational attainment may differ in their capacity to interpret financial information, understand charges and product conditions, manage digital transactions and recognise financial risks.

Because the Probit model is nonlinear, however, the interaction coefficient should not be interpreted directly as a percentage-point change in the probability of higher household welfare. The coefficient establishes a statistically significant interaction on the latent Probit scale. A probability-scale interpretation would require conditional marginal effects or predicted probabilities evaluated at specified levels of education and digital banking access. The interaction terms for credit $\times$ education ($\beta = 0.176$, $p = .011$), savings $\times$ education ($\beta = 0.149$, $p = .020$) and bancassurance $\times$ education ($\beta = 0.137$, $p = .027$) were also statistically significant. These findings suggest that education may condition the relationship between several financial-service variables and household welfare. However, these interactions are supplementary to the principal relationship examined in this study, which is digital banking services $\times$ education.

The Pseudo R² increased from 0.218 in the baseline model to 0.261 in the interaction model. This represents an increase of 0.043 in the reported Pseudo R². The increase indicates greater explanatory performance of the interaction specification; however, it should not be described as statistically significant without a formal model-comparison test. The positive and statistically significant digital banking services $\times$ education interaction provides empirical support for H₂.

4.5 Average Marginal Effects

To facilitate interpretation of the baseline Probit estimates, average marginal effects (AMEs) were estimated.

Table 6
Average Marginal Effects from the Baseline Probit Model

Variable	AME	SE	z	p-value
Access to credit	0.164	0.038	4.32	<.001
Savings	0.141	0.036	3.92	<.001
Digital banking services	0.152	0.037	4.10	<.001
Bancassurance	0.118	0.034	3.47	<.001
Education	0.106	0.031	3.41	<.001

The average marginal effect of digital banking services was 0.152 ($p < .001$). Holding the other variables constant and averaging over the observed sample, a one-unit increase in the digital banking services index was associated with an approximately 15.2 percentage-point increase in the predicted probability of being in the higher household-

welfare category. The corresponding marginal effects for access to credit, savings, bancassurance and education were 0.164, 0.141, 0.118 and 0.106, respectively, and were statistically significant at $p < .001$. The AMEs provide probability-scale interpretations of the baseline Probit estimates and are therefore more readily interpretable than the latent-scale coefficients. It is important to distinguish these estimates from the moderation results. The AME of 0.152 represents the average marginal effect of digital banking services in the baseline model. It does not show how the effect varies across education levels. Such an interpretation would require conditional marginal effects or predicted probabilities from the interaction model.

4.6 Discussion

The results provide evidence of a positive and statistically significant association between access to digital banking services and household welfare among youth-led MSE owners in Bungoma County. The baseline Probit coefficient for digital banking services was positive and statistically significant, while its average marginal effect indicated a substantial association on the probability scale. This finding is consistent with the financial intermediation perspective, which suggests that financial services can reduce transaction costs and facilitate payments, transfers and financial resource management. Digital banking extends these functions by allowing entrepreneurs to conduct banking transactions remotely. The descriptive results provide additional context, as respondents recorded relatively favourable ratings for the ability of digital banking services to save time and reduce transaction costs.

The finding is also broadly consistent with evidence from Kenya on digitally enabled financial services. Jack and Suri (2014) reported that mobile money facilitated risk sharing and consumption smoothing, while Mbiti and Weil (2016) documented its significance for financial transactions and formal financial-service use. Suri and Jack (2016) similarly linked mobile money to household economic outcomes, and Yao et al. (2023) reported an association between mobile-money use and household resilience. The present study extends this literature by examining bank-provided digital banking services rather than treating mobile money and digital banking as equivalent services. The positive associations observed for credit, savings and bancassurance are also consistent with the broader financial-intermediation argument. Credit can provide liquidity for enterprise activities, savings can provide financial buffers and facilitate financial planning, while insurance-related services can support management of selected financial risks. Nevertheless, these results represent statistical associations and should not be interpreted as causal effects given the cross-sectional research design.

Education was positively associated with household welfare and significantly moderated the relationship between digital banking services and welfare. The moderation result is consistent with Human Capital Theory, which suggests that education develops knowledge and skills relevant to information processing and economic decision-making (Becker, 1964; Schultz, 1971). In the context of digital banking, educational attainment may be associated with the ability to understand financial information, interpret product terms and charges, navigate digital platforms and recognise financial risks. The moderation finding also provides empirical support for the digital-divide perspective. Effective digital inclusion involves more than the availability of technology; users must also be able to engage with digital services effectively. The significant digital banking services $\times$ education interaction therefore suggests that educational attainment is relevant to the strength of the relationship between bank-provided digital banking services and household welfare.

The additional significant interactions involving credit, savings and bancassurance indicate that education may also condition relationships between other financial services and household welfare. These findings are supplementary and do not alter the primary focus of the study on digital banking services. Overall, the baseline results support H_1 , while the statistically significant digital banking services $\times$ education interaction supports H_2 . The findings should, however, be interpreted within the limits of the cross-sectional design. They demonstrate statistically significant associations rather than establishing that digital banking services or education cause changes in household welfare.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

This study examined the relationship between access to digital banking services and household welfare among youth-led micro and small enterprise owners in Bungoma County, Kenya, with particular attention to the moderating role of education. The findings demonstrate a positive and statistically significant association between access to digital banking services and household welfare. The average marginal effect further indicates that higher levels of digital banking access are associated with a higher predicted probability of being in the higher household-welfare category. The study also establishes a positive and statistically significant interaction between digital banking services and education, indicating that the relationship between digital banking access and household welfare varies with educational attainment. These findings provide empirical support for the study's two hypotheses and suggest that the welfare relevance of digital banking depends not only on access to financial technology but also on users' capacity to understand and effectively utilise available services.

The study contributes to the digital-finance and MSE literature by examining bank-provided digital banking services in relation to household welfare and by treating education as a moderating factor rather than solely as a direct predictor. The findings underscore the importance of viewing digital financial inclusion as involving both access and effective utilisation. For youth-led MSE owners, digital banking may provide important mechanisms for managing business and household financial transactions, but the extent to which these services are associated with welfare may differ according to individual capabilities. The findings should, however, be interpreted within the scope of the study, as the cross-sectional design establishes statistical associations and does not permit definitive causal conclusions.

5.2 Recommendations

The findings suggest that financial institutions should strengthen the affordability, accessibility, reliability and usability of digital banking services targeting youth-led MSE owners. Particular attention should be given to transaction affordability, which emerged as a relatively weaker dimension of digital banking access in the study. Banks and other financial-service providers should enhance transparency in the communication of transaction charges and product conditions, consider cost-sensitive products for small-value MSE transactions, and strengthen customer support for digital banking users. Improving the reliability and security of digital channels would further support sustained and effective utilisation of these services.

Given the significant moderating role of education, digital financial inclusion initiatives should be complemented by programmes that strengthen financial and digital capabilities. Financial institutions, government agencies and organisations supporting youth entrepreneurship should incorporate practical training on digital banking, transaction costs, account management, electronic payments, digital security, saving, borrowing and financial planning into MSE development programmes. Such programmes should be differentiated to accommodate entrepreneurs with varying levels of educational attainment. This approach would address not only the availability of digital financial services but also the capabilities required to use them effectively. Future research should consider longitudinal or panel designs to examine changes over time and provide stronger evidence on the direction of the relationship between digital banking access, education and household welfare.

Declaration of Interest

The authors declare that they do not have any known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Funding Declaration

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

REFERENCES

- Becker, G. S. (1964). *Human capital: A theoretical and empirical analysis, with special reference to education*. University of Chicago Press.
- Demirgüç-Kunt, A., Klapper, L., Singer, D., & Ansar, S. (2022). *The Global Findex Database 2021: Financial inclusion, digital payments, and resilience in the age of COVID-19*. World Bank. <https://doi.org/10.1596/978-1-4648-1897-4>
- Hanushek, E. A., & Woessmann, L. (2020). Education, knowledge capital, and economic growth. In S. Bradley & C. Green (Eds.), *The economics of education* (2nd ed., pp. 171–182). Academic Press. <https://doi.org/10.1016/B978-0-12-815391-8.00014-8>
- Jack, W., & Suri, T. (2014). Risk sharing and transactions costs: Evidence from Kenya's mobile money revolution. *American Economic Review*, 104(1), 183–223. <https://doi.org/10.1257/aer.104.1.183>
- Kenya National Bureau of Statistics. (2019). *2019 Kenya population and housing census: Volume I—Population by county and sub-county*.
- Lusardi, A., & Mitchell, O. S. (2014). The economic importance of financial literacy: Theory and evidence. *Journal of Economic Literature*, 52(1), 5–44. <https://doi.org/10.1257/jel.52.1.5>
- Mbiti, I., & Weil, D. N. (2016). Mobile banking: The impact of M-Pesa in Kenya. In S. Edwards, S. Johnson, & D. N. Weil (Eds.), *African successes, volume III: Modernization and development* (pp. 247–294). University of Chicago Press. <https://doi.org/10.7208/9780226315867-009>
- Musau, S. M., Muathe, S., & Mwangi, L. W. (2022). Financial literacy and consumer protection: A road map to digital financial access by SMEs in Kenya. *The Journal of Entrepreneurial Finance*, 24(2), 103–127. <https://doi.org/10.57229/2373-1761.1412>
- Schultz, T. W. (1971). *Investment in human capital*. Free Press.



- Solow, R. M. (1956). A contribution to the theory of economic growth. *The Quarterly Journal of Economics*, 70(1), 65–94. <https://doi.org/10.2307/1884513>
- Suri, T., & Jack, W. (2016). The long-run poverty and gender impacts of mobile money. *Science*, 354(6317), 1288–1292. <https://doi.org/10.1126/science.aah5309>
- Yao, B., Shanoyan, A., Schwab, B., & Amanor-Boadu, V. (2023). The role of mobile money in household resilience: Evidence from Kenya. *World Development*, 165, Article 106198. <https://doi.org/10.1016/j.worlddev.2023.106198>