



Financial Inclusion in a Changing Business Environment: Extent and Determinants among Smallholder Farmers in Songwe Region, Tanzania

Japhet Ngailonga Hasunga, Adam B. S. Mwakalobo & Alex Reuben Kira

University of Dodoma, Tanzania

Article History

Received: 20.06.2026

Revised: 04.10.2026

Accepted: 16.10.2026

Published: 18.10.2026

Keywords

Composite index

Determinants

Farmers

Financial inclusion

How to cite:

Hasunga, J. N., Mwakalobo, A. B. S., & Kira, A. R. (2026). Financial Inclusion in a Changing Business Environment: Extent and Determinants among Smallholder Farmers in Songwe Region, Tanzania. *Research Journal of Business and Finance*, 5(2), 175-187.

Abstract

This study addresses the measurement gap in financial inclusion (FI) research among smallholder farmers by constructing a Composite Financial Inclusion Index (CFII) and examining its determinants in Songwe Region, Tanzania. It tests whether socio-economic characteristics, assets and technology, land tenure, and district are associated with inclusion. Cross-sectional survey data were collected from 420 smallholder farming households in nine wards of four districts (Mbozi, Ileje, Momba, Songwe), with fixed quotas in purposively chosen wards. A two-stage Principal Component Analysis was used to construct the CFII across access, usage, quality, and digital dimensions (38 indicators; Kaiser-Meyer-Olkin .85-.94), and a fractional logit model, checked against ordinary least squares and Tobit estimates and fitted with Huber-White robust standard errors, was used to identify its determinants. The first component explained 89.3% of the variance in the four sub-indices. Financial inclusion was predominantly low (65.5% of farmers), with substantial district disparities (mean CFII: Songwe 0.64, Ileje 0.14). Education and asset wealth were the strongest determinants: secondary education or more was associated with a 0.23-point higher CFII and the highest asset tercile with a 0.20-point higher CFII. Ileje farmers scored 0.21 points below Mbozi farmers, and land ownership was positively associated (0.07). A gender gap of 0.06 points remained after controls but was sensitive to specification. Telephone ownership and farm income band were not significant. The cross-sectional design limits causal inference, particularly for land ownership, and the nine purposively chosen wards limit generalisation; panel data or an instrumental-variable approach would strengthen future work. The findings support geographically targeted infrastructure investment in underserved districts (Ileje, where the access and digital sub-indices were lowest), led by the Bank of Tanzania and mobile network operators, adult education for farmers without secondary schooling, and gender-responsive financial inclusion programming. A validated index of access, usage, quality and digital dimensions shows low and uneven inclusion among the surveyed farmers. Education, asset wealth and living in Ileje

Copyright © 2026





matter most, so policy should pair local service provision with education and gender-responsive design.

Introduction

Poverty remains a defining challenge for smallholder farmers across the developing world, Tanzania included. Globally, more than 475 million smallholder farmers supply over 70% of food security needs and 20% of GDP in their respective economies, yet a large share of them remains trapped in extreme poverty (Demirgüç-Kunt et al., 2018; Fan & Rue, 2020). In Tanzania, rural extreme poverty stands at 31.3%, well above the urban rate of 19.2% (NBS, 2020), and smallholder farmers who contribute over 95% of the country's food security and employ 63.6% of Tanzanians (URT, 2021) are disproportionately affected.

Financial inclusion (FI) has been positioned by governments and development agencies as a key lever against this poverty, on the logic that access to savings, credit, insurance, and digital financial services allows households to smooth consumption, absorb shocks, and invest in productive activity (Adegbite & Machethe, 2020; Demirgüç-Kunt et al., 2018, 2019). Tanzania has pursued this route deliberately: financial sector reforms since 1991 have produced over 61 banks, nearly 60,000 bank agents, 36 insurance companies, and five mobile money providers (Mpogole et al., 2020; BOT, 2018). In 2023, 76% of Tanzanian adults were formally financially included, up from 65% in 2017, and about 72% used mobile money (Financial Sector Deepening Trust Tanzania [FSDT], 2023). Yet despite this expansion, poverty among smallholder farmers persists a puzzle this study helps explain.

National averages can hide regional gaps. Songwe Region is among Tanzania's leading food and cash crop producers, yet its farmers are unevenly served. In the survey reported here, 67.2% of farmers ($n = 415$) reported using mobile money for financial transactions, close to the national figure of about 72% of adults, and 32.2% ($n = 419$) held a bank account. The averages hide large differences between districts: in Ileje only 25.8% used mobile money and 10.1% held a bank account, against 75.0% and 40.5% in Mbozi. These figures describe the sampled farmers only and are not strictly comparable with national estimates for adults, but they show that the gaps lie within the region, between districts, which is why a district-level measure of inclusion is needed.

The phrase “changing business environment” in the title refers to a shift in how financial services reach rural households. Delivery has moved from bank branches towards agents, mobile money and other digital channels, and formal inclusion rose from 65% to 76% between 2017 and 2023 (FSDT, 2023). In such an environment, holding an account no longer shows that a farmer is well served: services must also be within reach, regularly used, of acceptable quality and available digitally. These four aspects (access, usage, quality, and digital access) define the index built in this study.

A central reason for this puzzle is measurement. Most prior studies on financial inclusion among smallholder farmers rely on narrow indicators drawn from either the supply-side or the demand side alone, rarely both (Abiona & Koppensteiner, 2022; Mbowe et al., 2020; Mhella, 2020; Sanka & Nkijijiwa, 2021; Stephen et al., 2022). This partial conceptualisation produces inconclusive and sometimes misleading results, and by extension, policy recommendations that do not match the real drivers of exclusion. Approaches to building composite financial inclusion indices have varied distance-based methods (Sarma, 2008; Yorulmaz, 2018), axiomatic approaches (Chakravarty & Pal, 2010), and two-stage Principal Component Analysis (Cámara & Tuesta, 2014) but several composite indices developed for African contexts (Adegbite, 2021; Kalu & Obera, 2021; Koomson et al., 2020) have consistently left out indicators such as insurance and digital financial services, limiting comprehensiveness. Existing measures also fall short in two further ways. Studies that model a single outcome, such as binary access to agricultural credit (Sanka & Nkijijiwa, 2021), show whether a farmer



holds one product but not whether services are within reach, used regularly, of acceptable quality or available digitally. Indices built for cross-country comparison (Amidžić et al., 2014; Cámara & Tuesta, 2014; Sarma, 2008; Yorulmaz, 2018) rely on national data and cannot show where, within a region, farm households are excluded. The consequence is targeting that rests on partial evidence: investment may go to the wrong places or groups while quality and digital barriers remain unaddressed.

Theoretical Review

Two theoretical perspectives inform this study. Vulnerable Group Theory (Ozili, 2020) holds that financial inclusion interventions should specifically target vulnerable populations the poor, women, and smallholder farmers who face structural barriers such as inadequate documentation. The Sustainable Livelihoods Framework (Chambers & Conway, 1992; Department for International Development [DFID], 1999) situates financial capital alongside natural, physical, human, and social capital as resources households draw on to withstand shocks. In the framework, infrastructure belongs to physical capital, and the institutions, policies and service providers that shape access belong to “transforming structures and processes” (DFID, 1999). Location is therefore part of the framework: districts differ in the infrastructure and service providers available to farmers, and district is included in the empirical model as a proxy for these conditions. Together the two perspectives lead to the expectation that inclusion is lower among women and among less educated and poorer farmers, and that it differs between districts.

Empirical Review

Empirically, in Tanzania specifically, Malm and Toyama (2021) found that many smallholder farmers still rely on friends and family, or informal savings, because formal banking products do not match their needs. On determinants, Sanka and Nkiliwi (2021), studying rice farmers in Shinyanga, used a binary logit model of access to agricultural credit and found gender, household size, income, cooperative membership, and land size positively associated with access to agricultural credit; and Stephen et al. (2022), studying Rungwe District in Mbeya, found financial literacy and risk-management capability significant predictors of sustained inclusion. Neither study combines access, usage, quality and digital dimensions in one index: the first treats inclusion as a yes/no outcome for a single product. Despite this body of work, no study has combined access, usage, quality, and digital dimensions into a single validated composite index specifically for smallholder farmers in a Tanzanian region, nor examined its determinants using micro-level primary data. This study fills that gap using primary data from 420 smallholder farming households across the four districts of Songwe Region Mbozi, Ileje, Momba, and Songwe constructing a Composite Financial Inclusion Index (CFII) and examining its determinants.

The study has two objectives: (i) to measure the extent of financial inclusion among smallholder farmers in Songwe Region with a composite index of access, usage, quality and digital dimensions; and (ii) to examine the determinants of that index. Three groups of determinants are considered: socio-economic characteristics (gender, age, education, marital status, household size, years of farming and farm income), assets and technology (asset wealth and telephone ownership), and land tenure. District is included to capture differences in local infrastructure and institutions.

Method

Research design

This study adopted a cross-sectional survey design and a quantitative research approach (Kothari, 2004). The design suits the objectives because both ask how much inclusion exists at one point in time and which characteristics go with it, and because a single visit to each farmer allowed 420 households to be reached at reasonable cost. A quantitative approach allows inclusion to be measured on a



common scale and compared across districts and groups. Its limitation is that associations cannot be read as causal effects. Data were collected from smallholder farmers in Songwe Region, among Tanzania's leading food and cash crop producing regions, contributing about 10% of the national food basket while still recording extreme poverty incidence of 20.2%.

Data and sampling

The data are primary and quantitative. They were collected between 27 May and 4 June 2025 with a structured questionnaire administered on KoboCollect. The financial inclusion questions were yes/no items, while age, years of farming, household size and farm income were recorded in bands, not as exact values.

The target population comprised smallholder farmers registered in the Ministry of Agriculture's 2024 subsidy database across the region's four districts ($n = 251,290$: Mbozi 146,384, Ileje 48,850, Momba 47,224 and Songwe 8,832). A sample of 420 farmers was drawn using a multi-stage sampling procedure and random sample selection: nine wards were chosen purposively and each contributed a fixed quota of 30 or 60 farmers, yielding 210 respondents from Mbozi (Igamba, Ihanda, Kilimampimbi and Ukwile wards), 90 from Momba (Ndalambo and Nkangamo), 90 from Ileje (Chitete and Mbebe), and 30 from Songwe (Mwambani). Sample size was informed by Yamane's formula at a 95% confidence level and 5% margin of error. The quotas were not strictly proportional to registered farmers: Mbozi holds 58.3% of registered farmers but contributed 50.0% of the sample, Ileje 19.4% and 21.4%, Momba 18.8% and 21.4%, and Songwe 3.5% and 7.1%. No weights were applied.

A subsidy database can bias a sample towards farmers who are better connected to government systems. Only 89 of the 420 respondents (21.2%) reported being registered in it (80 of them in Mbozi), and 331 (78.8%) reported that they were not, so the sample is not confined to registered farmers. Registered farmers did score higher (mean CFII 0.51, against 0.27 for the others; Mann-Whitney $p < .001$), and the effect of registration on the estimates is examined in the Results. The findings describe the surveyed farmers and are not representative of all smallholders in the region.

Conceptual framework

Figure 1 shows the constructs under study. Financial inclusion is measured by the CFII, which combines four dimensions: access, usage, quality and digital access. Four groups of determinants are examined: socio-economic characteristics, assets and technology, land tenure, and location (district). Arrows show associations examined in cross-sectional data, not established causal effects.

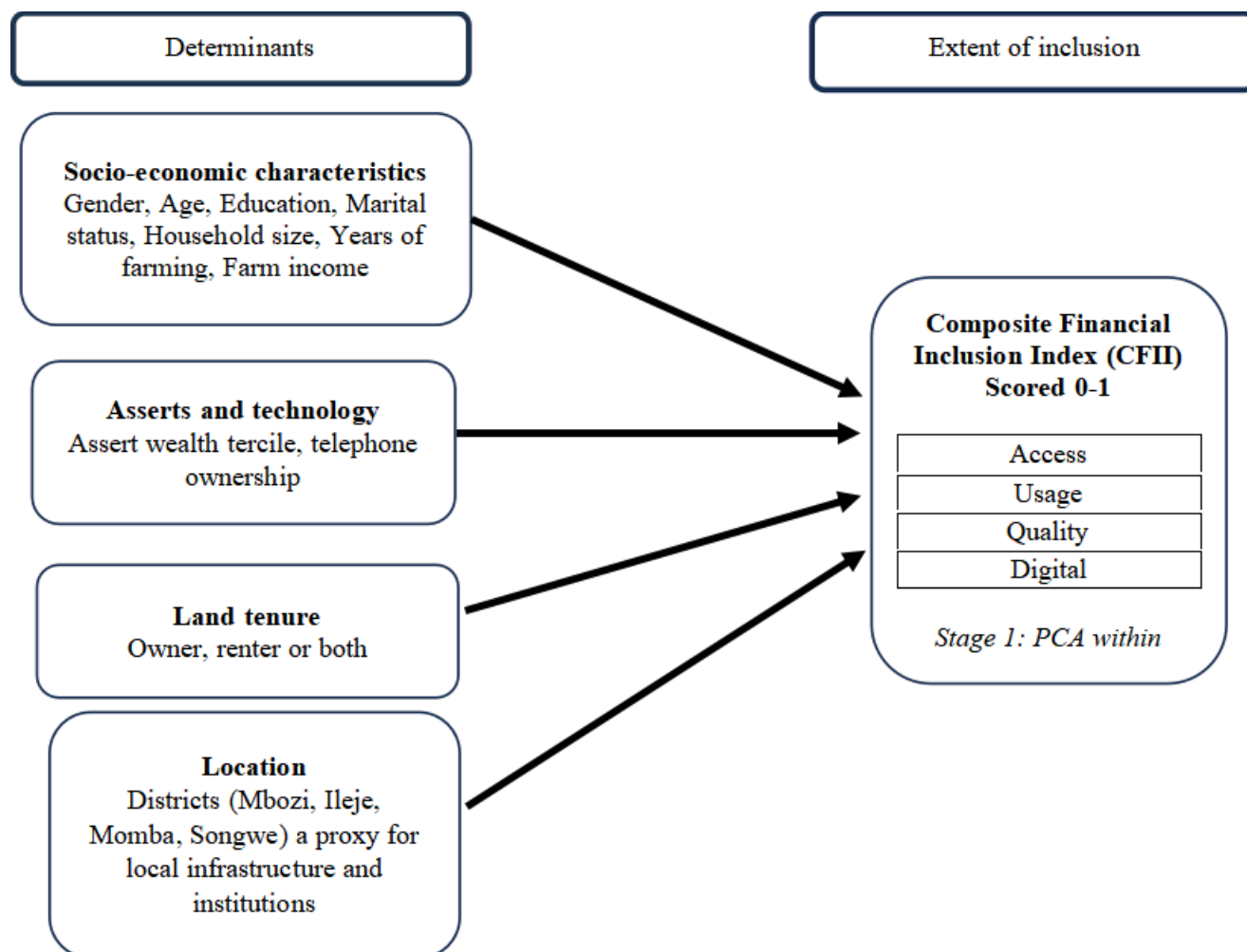


Figure 1: Determinants of Financial Inclusion

Note. Arrows show associations examined, not established causal effects.

Measuring financial inclusion

Financial inclusion was operationalised across four dimensions access, usage, quality, and digital/infrastructure drawing on indicators adapted from FinScope, Bank of Tanzania, and Tanzania Communications Regulatory Authority sources. The CFII combines 38 distinct yes/no indicators. Access (8 indicators) covers, for example, being able to save, deposit and receive payments through a bank, having a bank or other access point within 5 kilometres, and access to mobile money and insurance. Usage (10) covers holding bank and mobile money accounts, having secured a loan, and using banks, mobile money and ATMs. Quality (12) covers trust, clear information on fees and rights, loan terms that suit needs, and respectful, equal and varied service. Digital (9) covers use of digital financial tools, digital payments and loans, internet and SIM-based banking, and the security of fintech services. One indicator, receiving digital payments, enters both the usage and digital dimensions.



The Composite Financial Inclusion Index (CFII) was constructed using a two-stage Principal Component Analysis: PCA was first applied within each dimension to derive dimension-specific sub-indices, then a second-stage PCA combined the four sub-indices into the final CFII. Indicators were coded 1 (yes) or 0 (no) and standardised, so that PCA was run on correlation matrices. In stage one, the score of each dimension is the first principal component, that is, a weighted sum of the standardised indicators with the first eigenvector as weights, rescaled to 0–1 as (score – minimum)/(maximum – minimum). In stage two, PCA was run on the four rescaled sub-indices, and the CFII is the first component, a weighted sum of the standardised sub-indices with eigenvector weights of 0.500 (access), 0.508 (usage), 0.484 (quality) and 0.508 (digital), rescaled to 0–1 in the same way. The weights are close to equal, so no dimension dominates the index. Sampling adequacy was assessed with the Kaiser–Meyer–Olkin (KMO) measure (Kaiser, 1974) and Bartlett's (1954) test of sphericity, and internal consistency with the Kuder–Richardson formula 20 (KR-20; Kuder & Richardson, 1937). CFII scores were rescaled to a 0–1 range and respondents classified into Low (CFII < 0.33), Moderate (0.33–0.67), and High (CFII ≥ 0.67) categories. These cut-offs divide the scale into three nearly equal intervals. They are a descriptive convention, not a threshold taken from the literature, and the analysis of determinants does not depend on them because the CFII is modelled as a continuous variable.

Estimation

Determinants of CFII were examined with a fractional logit model (Papke & Wooldridge, 1996), a generalised linear model with a binomial family and logit link that respects the 0–1 range of the index. The choice follows from the data: the CFII is bounded, 49 of 418 farmers (11.7%) scored exactly 0 because they answered “no” to all 38 indicators, and 24 (5.7%) scored exactly 1. Ordinary least squares (OLS) fitted to the same data produced 33 fitted values below zero (minimum –0.27). Coefficients are reported as log-odds and as average marginal effects (AMEs), the average change in the CFII, in index points, for a one-unit change in a variable, which can be compared directly with OLS coefficients. A two-limit Tobit model (Tobin, 1958) and OLS were estimated as checks. The explanatory variables were gender, education, age, farm income band, land ownership, farming experience, marital status, household size, asset wealth (terciles of an index of 35 asset indicators), telephone ownership, and district fixed effects. Age, farming experience, household size and income are recorded in bands and were entered as bands or dummy variables; age and education were entered as dummy variables. Heteroscedasticity-robust standard errors were applied because the Breusch–Pagan (1979) test, run on the OLS residuals, rejected constant error variance (Breusch–Pagan/Cook–Weisberg $\chi^2(1) = 39.6$, $p < .001$; test on all regressors: LM = 70.1, $df = 19$, $p < .001$), and Huber–White standard errors (White, 1980) were used throughout. Multicollinearity was checked with variance inflation factors, the largest being 2.7.

Results

Construction and validation of the CFII

Table 1: Principal Component Analysis of the Composite Financial Inclusion Index

Panel A. Stage 1: dimension sub-indices							
Dimension	Indicators	KMO	Bartlett χ^2 (df)	Eigenvalue	Variance (%)	KR-20	Loadings (range)
Access	8	.884	3,140.6 (28)	5.124	64.0	.909	0.44–0.94
Usage	10	.936	4,114.9 (45)	6.845	68.4	.944	0.50–0.93
Quality	12	.936	5,039.2 (66)	8.156	68.0	.956	0.69–0.89
Digital	9	.881	2,646.3 (36)	5.304	58.9	.907	0.64–0.86



Panel B. Stage 2: CFII from the four sub-indices

Sub-index	PC1 loading	Communality	Weight
Access	0.944	0.891	0.500
Usage	0.960	0.922	0.508
Quality	0.914	0.835	0.484
Digital	0.960	0.922	0.508

KMO = 0.85; Bartlett $\chi^2(6) = 2,029.1$; eigenvalue = 3.571; variance explained = 89.3%

Note. PCA = principal component analysis; PC1 = first principal component; KMO = Kaiser–Meyer–Olkin measure of sampling adequacy; KR-20 = Kuder–Richardson formula 20. Bartlett's test of sphericity was significant in every analysis (all $p < .001$). Loadings are those of the individual indicators (Panel A) and of the four sub-indices (Panel B). The weight is the element of the first eigenvector. In Panel B the CFII is PC1, which had an eigenvalue of 3.571 and explained 89.3% of the variance. $n = 420$.

Table 1 shows that the indicators within each dimension are strongly related (KMO 0.88–0.94) and consistent (KR-20 0.91–0.96), and that the first component explains 58.9% to 68.4% of the variance in each dimension. For access, quality and digital services a second component also had an eigenvalue slightly above 1 (1.11, 1.06 and 1.33); the first component was kept as the single score of each dimension. All four sub-indices loaded strongly and positively onto the CFII, with usage and digital carrying the highest loading (0.96) and quality the lowest (0.91), and the first component explains 89.3% of their variance, so the four dimensions can be summarised in one index. The mean CFII for the full sample was 0.32 ($SD = 0.34$) and the median 0.16, a positively skewed distribution (skewness = 0.91).

Level of financial inclusion

Table 2: Level of Financial Inclusion Overall and by District, Gender and Education

Group	<i>n</i>	<i>M</i>	<i>SD</i>	Low, <i>n</i> (%)	Moderate, <i>n</i> (%)	High, <i>n</i> (%)
All farmers	420	0.32	0.34	275 (65.5)	53 (12.6)	92 (21.9)
<i>District</i>						
Mbozi	210	0.35	0.35	134 (63.8)	25 (11.9)	51 (24.3)
Ileje	90	0.14	0.22	80 (88.9)	3 (3.3)	7 (7.8)
Momba	90	0.34	0.34	58 (64.4)	10 (11.1)	22 (24.4)
Songwe	30	0.64	0.27	3 (10.0)	15 (50.0)	12 (40.0)
<i>Gender</i>						
Male	202	0.41	0.37	108 (53.5)	29 (14.4)	65 (32.2)
Female	218	0.24	0.29	167 (76.6)	24 (11.0)	27 (12.4)
<i>Education</i>						
No formal education	117	0.16	0.21	100 (85.5)	11 (9.4)	6 (5.1)
Primary	165	0.22	0.29	132 (80.0)	13 (7.9)	20 (12.1)
Secondary	93	0.48	0.32	37 (39.8)	23 (24.7)	33 (35.5)
Tertiary	45	0.77	0.31	6 (13.3)	6 (13.3)	33 (73.3)

Note. *M* and *SD* refer to the CFII (0–1). Low < 0.33; moderate 0.33 to < 0.67; high ≥ 0.67 . Percentages are of the group. District differences: $F(3, 416) = 20.56$, $p < .001$, $\eta^2 = 0.129$; Kruskal–Wallis $H(3) = 71.2$, $p < .001$. Gender difference: Welch $t(383) = 5.16$, $p < .001$, $\eta^2 = 0.061$. Education differences: Kruskal–Wallis $H(3) = 125.5$, $p < .001$, $\eta^2 = 0.335$. Tertiary = certificate, diploma or degree. Median CFII = 0.16; 26.2% of farmers scored below 0.05 and 10.2% above 0.95. Songwe: 93.3% men, 70.0% with secondary education or more. Mbozi–Momba difference: Mann–Whitney $p = 0.93$; all other district pairs $p < .001$.

Table 2 shows that inclusion is low and unevenly spread. The mean CFII was 0.32 ($SD = 0.34$) and the median 0.16. The median lies far below the middle of the scale because scores are polarised: 26.2% of farmers scored below 0.05 and 10.2% above 0.95. Overall, 65.5% of farmers ($n = 275$) were in the low group, 12.6% ($n = 53$) in the moderate group and 21.9% ($n = 92$) in the high group.



Districts differed widely. Ileje had the lowest mean (0.14), with 88.9% of its farmers in the low group and 7.8% in the high group. Songwe had the highest (0.64), with 10.0% low and 40.0% high, but this rests on 30 farmers from one ward, 93.3% of them men and 70.0% with secondary education or more. Mbozi (0.35) and Momba (0.34) were similar (Mann-Whitney $p = 0.93$), and both differed from Ileje and Songwe (all $p < .001$). District explained 12.9% of the variance in the CFII, less than education (33.5%). Men scored higher than women (0.41 against 0.24), and 76.6% of women were in the low group against 53.5% of men. Education showed the sharpest gradient: the mean was 0.16 for farmers with no formal education (85.5% low) and 0.77 for tertiary-educated farmers (13.3% low).

Determinants of financial inclusion

Table 3: Fractional Logit Estimates of the Determinants of the Financial Inclusion Index

Variable	<i>b</i>	Robust SE	<i>p</i>	AME	95% CI for AME
Female (ref. male)	-0.40	0.16	.015	-0.06	[-0.11, -0.01]
Age 16-24 (ref. 35-44)	-0.77	0.31	.014	-0.12	[-0.22, -0.02]
Age 25-34	-0.06	0.19	.732	-0.01	[-0.07, 0.05]
Age 45-54	0.03	0.21	.892	0.00	[-0.06, 0.07]
Age 55-60	-0.62	0.40	.122	-0.10	[-0.22, 0.02]
Age over 60	-1.19	0.50	.018	-0.19	[-0.34, -0.03]
Primary education (ref. none)	0.35	0.23	.119	0.06	[-0.01, 0.13]
Secondary education or higher	1.47	0.22	< .001	0.23	[0.17, 0.29]
Married (ref. single)	0.10	0.15	.494	0.02	[-0.03, 0.06]
Owns land (ref. renter or both)	0.48	0.17	.005	0.07	[0.02, 0.13]
Years of farming (band, 1-5)	-0.07	0.08	.432	-0.01	[-0.04, 0.02]
Household size (band, 1-4)	0.12	0.12	.282	0.02	[-0.02, 0.06]
Farm income above TZS 2 million	-0.28	0.20	.162	-0.04	[-0.10, 0.02]
Middle asset tercile (ref. lowest)	0.43	0.18	.016	0.07	[0.01, 0.12]
Highest asset tercile	1.30	0.17	< .001	0.20	[0.15, 0.25]
Owns a telephone	0.37	0.23	.106	0.06	[-0.01, 0.13]
Ileje (ref. Mbozi)	-1.36	0.26	< .001	-0.21	[-0.29, -0.14]
Momba	-0.25	0.21	.230	-0.04	[-0.10, 0.02]
Songwe	0.18	0.27	.514	0.03	[-0.06, 0.11]

Note. Dependent variable: CFII (0-1); $n = 418$. *b* = fractional logit coefficient (log-odds) with Huber-White robust standard errors; AME = average marginal effect in index points; CI = confidence interval. Reference groups are shown in parentheses. Squared correlation between fitted and observed CFII = 0.516. For comparison, OLS gave $R^2 = 0.498$ (adjusted $R^2 = 0.474$), $F(19, 398) = 25.8$, $p < .001$.

Table 3 shows that education, asset wealth and district had the strongest associations. Farmers with secondary education or more scored 0.23 index points higher than those with no formal education (95% CI [0.17, 0.29]), whereas primary education alone made no significant difference (AME = 0.06, $p = .121$). Farmers in the highest asset tercile scored 0.20 points higher than those in the lowest (95% CI [0.15, 0.25]) and those in the middle tercile 0.07 points higher ($p = .017$). Compared with Mbozi, farmers in Ileje scored 0.21 points lower (95% CI [-0.29, -0.14]), while Momba (AME = -0.04, $p = .231$) and Songwe (AME = 0.03, $p = .513$) did not differ significantly from Mbozi. Owning land was associated with a 0.07-point higher CFII ($p = .004$). Women scored 0.06 points lower than men ($p = .015$); the unadjusted gap was 0.17. Compared with farmers aged 35-44, those aged 16-24 scored 0.12 points lower ($p = .014$) and those over 60 scored 0.19 points lower ($p = .016$); the other age bands did not differ significantly.

The weaker and negative findings matter for interpretation. Marital status (AME = 0.02, $p = .495$), years of farming (-0.01, $p = .432$), household size (0.02, $p = .282$) and telephone ownership (0.06, $p = .110$) were not significantly associated with the CFII. Reported farm income above TZS 2 million had a negative sign (-0.04, $p = .162$); this suggests that income, recorded in only three bands, adds little



once asset wealth is controlled, and it runs against the expectation that richer farmers are more included. These variables are coarse (bands and yes/no), so non-significance should not be read as proof of no relationship. Dropping each group of variables from the OLS model lowers R^2 by 0.095 (education), 0.066 (asset wealth), 0.046 (district), 0.025 (age) and 0.007 (gender), so district adds less explanatory power than education or wealth.

Robustness checks

OLS and fractional logit agreed in sign and in significance at the 5% level for all 19 coefficients (largest difference between an OLS coefficient and an AME: 0.06 points), and a fractional probit gave the same verdict for all 19. The Tobit model agreed in sign for all 19 and in significance for 17 (primary education and telephone ownership became significant, $p = 0.035$ and 0.047). Using only complete cases to build the index ($n = 366$) gave the same sign for all 19 coefficients and the same verdict for 17 (age 16–24 and the middle asset tercile differed), and using the share of indicators achieved ($n = 414$) gave the same verdict for all 19. Ward-clustered standard errors (nine clusters, too few for reliable inference) changed the verdict only for telephone ownership. Adding subsidy-registration status to the model gave an AME of 0.12 for registered farmers (95% CI [0.06, 0.19], $p < .001$). It left the estimates for secondary education (0.20) and the highest asset tercile (0.20) close to those in Table 3, but reduced the Ileje coefficient to -0.14 ($p < .001$), the land coefficient to 0.06 ($p = .032$) and the gender gap to -0.04 ($p = .090$). Because 80 of the 89 registered farmers live in Mbozi, part of the district difference overlaps with registration, and the gender gap is not robust to this control.

Discussion

These findings paint a clear picture for Songwe's smallholder farmers: financial inclusion here is not simply a matter of account ownership or mobile money uptake at the surface level; it runs deeper, tangled up with education, asset wealth, gender, and where a farmer happens to live. Inclusion is low and polarised: two thirds of farmers are in the low group, Nationally, 76% of adults were formally included in 2023 (FSDT, 2023), whereas 32.2% of the surveyed farmers held a bank account; the comparison is indicative, but it suggests that farmers lag the national average.

Location matters, but mainly because of one district. Ileje's lag is not simply a matter of poorer or less educated farmers: the district effect (-0.21 points) survives controlling for education, asset wealth, age, gender and other characteristics. It was visible in all four sub-indices (Ileje against Mbozi: access 0.11 against 0.32, usage 0.11 against 0.32, quality 0.22 against 0.41, digital 0.13 against 0.35), and only 6.7% of Ileje farmers reported a bank or other access point within 5 kilometres and 26.7% reported access to mobile money, against 81.1% and 88.9% in Momba. This points to service availability such as mobile network coverage, road access and financial service points, in line with Allen et al. (2016), who linked account ownership to proximity to financial intermediaries, and with Asuming et al. (2019), who found the presence of financial institutions among the significant predictors of inclusion in 31 sub-Saharan African countries. The submitted comparison of district and individual effects should nevertheless be read carefully: district explained less of the variation than education or wealth (Table 3 and Section 4.3), Momba did not differ from Mbozi, and Songwe's high raw score disappeared once education and wealth were controlled. The Ileje coefficient also fell from 0.21 to 0.14 when subsidy-registration was added, so part of the Ileje gap reflects the low share of registered farmers there (1 of 90).

At the same time, the individual-level story matters too, and education and asset wealth stand out. This agrees with Zins and Weill (2016), who found education and income to have the strongest influence on inclusion across 37 African countries, and with Lotto (2018), who identified gender, education, age and income as the main determinants in Tanzania and linked education to the ability to afford accounts and offer guarantees. Only secondary education or more was associated with higher



scores here; primary education alone was not, which suggests that inclusion depends on the literacy and numeracy needed for documents, loan terms and digital interfaces. Contrary to Zins and Weill (2016) and Lotto (2018), reported farm income was not associated with inclusion. Income was recorded in three bands, which may mask differences, and asset wealth may be a better proxy for long-run resources among farmers whose cash income varies from season to season.

The residual gender gap is smaller than the raw gap and weaker as evidence. Women scored 0.06 points lower than men after controls, against an unadjusted gap of 0.17, so about two thirds of the raw gap is accounted for by education, asset wealth, age and district. Women also scored lower on all four sub-indices (for example usage 0.20 against 0.38 for men). This is consistent with Aterido et al. (2013), who found that the gender gap in access to finance in sub-Saharan Africa largely disappears once individual characteristics are controlled, and with Mndolwa and Alhassan (2020), who attributed gender gaps in Tanzania to women being poorer, less educated and more dependent. Unlike Aterido et al. (2013), a small gap remained here, but it was not robust: it fell to 0.04 ($p = .090$) when subsidy-registration was controlled. Whether the remaining gap reflects intra-household decision-making, social norms about women handling money or distrust of formal institutions cannot be tested with these data, which contain no measures of norms or decision-making.

The positive land ownership association and the null telephone result both need careful reading. Land tenure may raise inclusion by giving farmers collateral and a fixed address for lenders, but the direction may also be reversed: farmers who already save and borrow may be better placed to buy or rent land, and the survey records current tenure, not when land was acquired. The same applies to telephones. A farmer who already uses mobile money has a reason to own a phone, so reverse causality could inflate the association, while the shared use of phones within households could attenuate it; the null result should not be read as showing that phones do not matter for inclusion. Cross-sectional data cannot separate these directions, which would need panel data or an instrument.

Limitations

A limitation worth acknowledging: the associations reported here are not causal; they remain associations and the causal direction, particularly for variables like land ownership and telephone ownership, cannot be fully disentangled from reverse causality without panel data or an instrumental variables approach. Only 21.2% of respondents were registered in the subsidy database that served as the planning frame, and registration was concentrated in Mbozi. Age, income, farming experience and household size are bands, which limits the detail of the estimates. The 38 indicators describe general financial services; agriculture-specific products such as crop insurance and seasonal input loans are not separated, and supply-side conditions such as distance to agents and network coverage were not measured directly.

Conclusion

This study set out to measure the extent of financial inclusion among smallholder farmers in Songwe Region and identify what drives it. Using a Composite Financial Inclusion Index that combines access, usage, quality and digital dimensions and passed standard validity checks (KMO .85–.94; the first component explaining 59%–68% of the variance within dimensions and 89% across them), it shows that financial inclusion remains low and unevenly distributed: about two thirds of the surveyed farmers are in the low group and about one in five is highly included. Education and asset wealth explain more of the variation than district, and the district effect is concentrated in Ileje. Education, asset wealth and land ownership are the strongest correlates at the individual-level, and women score lower than men on every dimension, although the residual gap after controls is small and sensitive to specification. These conclusions describe the surveyed farmers and are not representative of all smallholders in the region.



Three recommendations follow, each tied to the districts and dimensions where the evidence points and to the institution responsible.

Firstly, service availability in Ileje needs priority. Ileje lags on all four sub-indices, and the access gap is the clearest (only 6.7% report a bank or other access point within 5 kilometres). The Bank of Tanzania, through its financial inclusion framework and regulation of agent banking, and mobile network operators, with the Tanzania Communications Regulatory Authority, should extend agents and network coverage in Ileje. Because the sample came from a planning frame linked to a government subsidy database, and registered farmers scored markedly higher, the Ministry of Agriculture could also use its extension services to reach unregistered farmers, who are the least included.

Secondly, financial inclusion programming should be paired with adult education and financial literacy initiatives for farmers without secondary education, whose mean CFII was 0.16 (no formal education) and 0.22 (primary) against 0.48 (secondary) and 0.77 (tertiary). This could be delivered through the National Financial Education Framework that Mndolwa and Alhassan (2020) recommended be implemented, and through agricultural extension.

Lastly, gender-responsive design, not just gender-targeted income support, is needed, because women score lower than men on access, usage, quality and digital services alike. Providers, under Bank of Tanzania oversight, should test product features and delivery channels with women farmers. Programme planners should treat all three recommendations as hypotheses to test, since the data are cross-sectional and drawn from nine wards.

References

- Abiona, O., & Koppensteiner, M. F. (2022). Financial inclusion, shocks, and poverty: Evidence from the expansion of mobile money in Tanzania. *Journal of Human Resources*, 57(2), 435–464. <https://doi.org/10.3368/jhr.57.2.1018-9796R1>
- Adegbite, O. O. (2021). *Financial inclusion of rural smallholder farmers in Nigeria: Measurement issues, impact on livelihood and implications for policy interventions* [Doctoral thesis, University of Pretoria]. <http://hdl.handle.net/2263/78182>
- Adegbite, O. O., & Machethe, C. L. (2020). Bridging the financial inclusion gender gap in smallholder agriculture in Nigeria: An untapped potential for sustainable development. *World Development*, 127, 104755. <https://doi.org/10.1016/j.worlddev.2019.104755>
- Allen, F., Demirgüç-Kunt, A., Klapper, L., & Martinez Peria, M. S. (2016). The foundations of financial inclusion: Understanding ownership and use of formal accounts. *Journal of Financial Intermediation*, 27, 1–30. <https://doi.org/10.1016/j.jfi.2015.12.003>
- Amidžić, G., Massara, A., & Mialou, A. (2014). *Assessing countries' financial inclusion standing: A new composite index* (IMF Working Paper No. 14/36). International Monetary Fund. <https://doi.org/10.5089/9781475569681.001>
- Asuming, P. O., Osei-Agyei, L. G., & Mohammed, J. I. (2019). Financial inclusion in Sub-Saharan Africa: Recent trends and determinants. *Journal of African Business*, 20(1), 112–134. <https://doi.org/10.1080/15228916.2018.1484209>
- Aterido, R., Beck, T., & Iacovone, L. (2013). Access to finance in sub-Saharan Africa: Is there a gender gap? *World Development*, 47, 102–120. <https://doi.org/10.1016/j.worlddev.2013.02.013>
- Bartlett, M. S. (1954). A note on the multiplying factors for various χ^2 approximations. *Journal of the Royal Statistical Society: Series B*, 16(2), 296–298. <https://doi.org/10.1111/j.2517-6161.1954.tb00174.x>
- Bank of Tanzania (BOT). (2018). *National financial inclusion framework 2018–2022*. Bank of Tanzania.
- Breusch, T. S., & Pagan, A. R. (1979). A simple test for heteroscedasticity and random coefficient variation. *Econometrica*, 47(5), 1287–1294. <https://doi.org/10.2307/1911963>



- Cámara, N., & Tuesta, D. (2014). *Measuring financial inclusion: A multidimensional index* (BBVA Research Working Paper No. 14/26). BBVA.
- Chakravarty, S. R., & Pal, R. (2010). *Measuring financial inclusion: An axiomatic approach* (IGIDR Working Paper No. WP-2010-003). Indira Gandhi Institute of Development Research.
- Chambers, R., & Conway, G. R. (1992). *Sustainable rural livelihoods: Practical concepts for the 21st century* (IDS Discussion Paper No. 296). Institute of Development Studies.
- Demirgüç-Kunt, A., Klapper, L., & Singer, D. (2018). Household finance and economic development. In *Handbook of finance and development* (pp. 534–549). Edward Elgar Publishing. <https://doi.org/10.4337/9781785360510.00029>
- Demirgüç-Kunt, A., Hu, B., & Klapper, L. (2019). Financial inclusion in the Europe and Central Asia region: Recent trends and a research agenda. *World Bank Policy Research Working Paper*, 8830. <https://doi.org/10.1596/1813-9450-8830>
- Department for International Development. (1999). *Sustainable livelihoods guidance sheets*. DFID.
- Fan, S., & Rue, C. (2020). The role of smallholder farms in a changing world. In S. Gomez y Paloma, L. Riesgo, & K. Louhichi (Eds.), *The role of smallholder farms in food and nutrition security* (pp. 13–28). Springer. https://doi.org/10.1007/978-3-030-42148-9_2
- Financial Sector Deepening Trust Tanzania. (2023). *FinScope Tanzania 2023 report*. FSDT. <https://www.bot.go.tz/webdocs/DFDI/FinscopeSurvey2023.pdf>
- Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika*, 39(1), 31–36. <https://doi.org/10.1007/BF02291575>
- Kalu, I. A., & Obera, J. J. (2021). An analytical study of financial inclusion through electronic banking in Nigeria. *Fuoye Journal of Accounting and Management*, 4(2).
- Koomson, I., Villano, R. A., & Hadley, D. (2020). Effect of financial inclusion on poverty and vulnerability to poverty: Evidence using a multidimensional measure of financial inclusion. *Social Indicators Research*, 149(2), 613–639. <https://doi.org/10.1007/s11205-019-02263-0>
- Kothari, C. R. (2004). *Research methodology: Methods and techniques* (2nd ed.). New Age International.
- Kuder, G. F., & Richardson, M. W. (1937). The theory of the estimation of test reliability. *Psychometrika*, 2(3), 151–160. <https://doi.org/10.1007/BF02288391>
- Lotto, J. (2018). Examination of the status of financial inclusion and its determinants in Tanzania. *Sustainability*, 10(8), 2873. <https://doi.org/10.3390/su10082873>
- Malm, M. K., & Toyama, K. (2021). The burdens and the benefits: Socio-economic impacts of mobile phone ownership in Tanzania. *World Development Perspectives*, 21, 100283. <https://doi.org/10.1016/j.wdp.2020.100283>
- Mbowe, W. E., Shirima, F. R., & Kimolo, D. (2020). Role of financial innovation in enhancing MSMEs access to credit: An empirical investigation on Tanzania. *Applied Economics and Finance*, 7(3), 126–144. <https://ideas.repec.org/a/rfa/aefjnl/v7y2020i3p126-144.html>
- Mhella, D. J. (2020). The role of mobile money in moderating financial exclusion: A Tanzanian experience. *Social Review*, 9(2), 83–104. <https://doi.org/10.37467/gka-revsocial.v9.2614>
- Mndolwa, F., & Alhassan, A. L. (2020). Gender disparities in financial inclusion: Insights from Tanzania. *African Development Review*, 32(4), 578–590. <https://doi.org/10.1111/1467-8268.12462>
- Mpogole, H., Dimoso, P., & Mayaya, H. (2020). Agriculture for rural development in Tanzania. *The Game Changer; President Magufuli's First Term in Office*. TEMA Publishers Co. Limited.
- NBS. (2020). *Tanzania Mainland poverty assessment*. NBS.
- Ozili, P. K. (2020). Theories of financial inclusion. In *Uncertainty and challenges in contemporary economic behaviour* (pp. 89–115). Emerald Publishing Limited. <https://doi.org/10.1108/978-1-80043-095-220201008>



- Papke, L. E., & Wooldridge, J. M. (1996). Econometric methods for fractional response variables with an application to 401(k) plan participation rates. *Journal of Applied Econometrics*, 11(6), 619–632.
- Sanka, M. B., & Nkilijiwa, A. L. (2021). Access to agricultural credit for smallholder farmers in Shinyanga region–Tanzania. *East African Journal of Social and Applied Sciences*, 3(1), 181–191. <https://doi.org/10.63444/eaj-sas.v3i1.109>
- Sarma, M. (2008). *Index of financial inclusion* (ICRIER Working Paper No. 215). Indian Council for Research on International Economic Relations. <https://econpapers.repec.org/RePEc:ind:icrier:215>
- Stephen, K., Raphael, G., & Shayo, F. (2022). Financial literacy and financial inclusion in Rungwe, Mbeya-Tanzania. *The International Review of Economics Studies*, TIRES-106/ 1000106.
- Tobin, J. (1958). Estimation of relationships for limited dependent variables. *Econometrica*, 26(1), 24–36. <https://doi.org/10.2307/1907382>
- URT. (2021). *National sample census of agriculture: Key findings report for crops and livestock sectors and fish farming*. <https://www.nbs.go.tz/statistics/topic/agriculture-census-2019-20>
- White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica*, 48(4), 817–838. <https://doi.org/10.2307/1912934>
- Yorulmaz, R. (2018). An analysis of constructing global financial inclusion indices. *Borsa Istanbul Review*, 18(3), 248–258. <https://doi.org/10.1016/j.bir.2018.05.001>
- Zins, A., & Weill, L. (2016). The determinants of financial inclusion in Africa. *Review of Development Finance*, 6(1), 46–57. <https://doi.org/10.1016/j.rdf.2016.05.001>