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# Determinants of Financial Access for Smallholder Farmers in Thailand: Challenges, Credit Assessment Criteria, Credit Literacy, and Loan Access

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**Abstract**

This study examines the factors that influence access to funding sources for small-scale farmers in Thailand, focusing on challenges in accessing financial resources (CAF), credit assessment criteria (CAC), credit knowledge (CL), and loan accessibility (LA). The objectives are: 1) to analyze the problems and obstacles farmers face when seeking financial support, 2) to assess the confirmatory components of the causal factors, and 3) to develop a structural equation model explaining how these factors relate to farmers' access to funding sources. Data were collected through questionnaires from 442 small-scale farmers across 18 provinces, using stratified sampling. Structural equation modeling and confirmatory factor analysis were used to evaluate the relationships among the four latent variables. The findings indicate that the major barriers to accessing funding are the lack of collateral, limited credit knowledge, and insufficient financial documentation. More flexible credit criteria and improved credit knowledge can substantially increase loan accessibility, while difficulty in accessing loans may further restrict farmers' credit knowledge. The study introduces a model that can support the development of more comprehensive and sustainable financial services and policies for small-scale farmers.

## Introduction

Agriculture remains a cornerstone of Thailand's economy and society, contributing significantly to both GDP and employment. In 2022, the agricultural sector accounted for 8.81% of Thailand's GDP, with 11.63 million workers, representing 29.31% of the total workforce. Thailand's agricultural raw materials rank among the top 10 globally, underscoring the sector's importance (Thansettakij, 2024). However, the majority of Thai farmers are smallholders, operating on limited landholdings, with a persistent decline in the size of agricultural plots (Attavanich et al., 2019). According to the 2022 Agricultural Statistics of Thailand, the country's total agricultural land spans 149,745,431 rai, of which only 48.31% (72,354,962 rai) is owned by farmers, while 51.68% (77,390,469 rai) is leased, mortgaged, or used without ownership (Office of Agricultural Economics, 2022). This disparity highlights a critical issue: over half of Thai farmers lack land ownership, exacerbating their vulnerability as smallholders.

Smallholder farmers face significant challenges, including low agricultural income, reliance on non-farm



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earnings, and limited access to productive resources such as land, water, finance, and modern technology (Office of Agricultural Economics [OAE], 2021; Stiglitz et al., 2009). Land inequality restricts their ability to fully utilize their labor and skills, directly impacting household economic development, as land is a primary production factor for income generation (de Janvry et al., 2001). Additionally, smallholders contend with environmental risks such as floods, droughts, and pest outbreaks, further undermining their productivity and financial stability (Stiglitz et al., 2009). Historically, smallholder agriculture has received inadequate government support because policies are often biased against smallholders, who are viewed as outdated and inefficient in the digital economy. This perception has contributed to a declining agricultural workforce, with the average age of farmers exceeding 50, as younger generations increasingly abandon farming (World Bank, 2022; Szabo et al., 2021).

A critical barrier for smallholders is access to finance, which is essential for adopting modern technologies, improving production inputs, and enhancing agricultural productivity (Von Pischke, 1978; Khandker & Yamano, 2025). However, smallholders face significant obstacles in securing credit due to high perceived risks by financial institutions, driven by volatile incomes, small-scale operations, lack of collateral, and asymmetric information between lenders and borrowers (Stiglitz & Weiss, 1981; Maia & Eusébios, 2016). These constraints limit investment in production factors, resulting in lower yields and the perpetuation of a cycle of poverty and debt, with over a quarter of farming households resorting to informal, high-interest loans (Kislat, 2015). Despite the catalytic role of credit in transitioning from subsistence to commercial agriculture (Apata et al., 2011; Barry & Robison, 2001), financial institutions remain hesitant to lend to smallholders due to seasonal production risks, irregular cash flows, and natural disasters (International Finance Corporation [IFC], 2014; Maurer, 2014).

Considering these challenges, this study aims to examine the barriers to accessing funding sources for smallholder farmers in Thailand using Structural Equation Modeling (SEM) and Confirmatory Factor Analysis (CFA). The research will analyze the causal relationships affecting access to funding sources and aims to empower smallholder farmers to optimize land use, expand market opportunities, and enhance global competitiveness, ultimately promoting sustainable livelihoods and supporting Thailand's economic growth.

**Objectives**

1) To investigate the challenges faced by smallholder farmers in accessing financial resources in Thailand.

2) To analyze the components of the causal factors of access to financial sources of small-scale farmers in Thailand (CFA)

3) To develop a structural equation model that explains the causal relationships influencing smallholder farmers' access to financial resources in Thailand.

**Literature Review**

Access to finance has long been recognized as a fundamental pillar for rural development and poverty alleviation. According to Beck & Demirgüç-Kunt (2008), access to financial services facilitates capital accumulation, promotes productive investment, and smoothens consumption, which is particularly important for farming households facing seasonal income fluctuations. However, smallholder farmers in developing countries are often financially excluded due to structural, informational, and institutional constraints, with various related concepts as follows.

**The Concept of Challenges in Accessing Finance (CAF)**

Smallholder farmers play a vital role in agricultural economies, especially in developing countries. However, this group often faces multifaceted challenges in accessing financial services, which hinders productivity, investment capacity, and overall economic resilience. One of the most critical barriers is the lack of collateral and the inherent risk associated with agricultural income, which is highly susceptible to price fluctuations, climate variability, and production uncertainty. These conditions make financial institutions hesitant to extend credit to smallholder farmers, perceiving them as high-risk clients (Mikolajczyk et al., 2021).

In addition, many smallholder farmers lack formal financial records and credit histories, making it difficult for lenders to evaluate their creditworthiness. This is especially true for those who have never engaged with formal banking institutions or who reside in rural areas with limited financial infrastructure (Collins et al., 2020).

**The Concept of Credit Assessment Criteria (CAC)**

Credit assessment is an important factor in determining the eligibility of borrowers and the viability of loan disbursement, particularly in the context of smallholder farmers, whose operations are often

characterized by informality, vulnerability to shocks, and limited access to financial services. Among the widely used frameworks for credit evaluation, the 5Cs model—comprising character, capacity, capital, collateral, and conditions—remains foundational across financial institutions globally (Texas Farm Credit, 2021).

Character refers to the borrower's creditworthiness and trustworthiness, often assessed through repayment history or, in the case of informal economies, through social reputation and relationships with local suppliers and cooperatives (Farm Credit of the Virginias, 2023). For smallholder farmers who typically lack formal credit records, community-based reputation and participation in local cooperatives are often used as proxies (Barry & Robison, 2001).

Capacity assesses the borrower's ability to repay loans based on income, cash flows, and financial commitments. However, smallholder farmers often experience irregular and seasonal income tied to agricultural cycles, which complicates standard financial evaluations. A study by Lelisho & Lelisho (2024) using an approach based on propensity score matching showed that access to and appropriate evaluation of credit capacity significantly increased productivity and gross income among smallholders in Ethiopia.

Capital involves the borrower's financial stake or investment in their enterprise. While traditional lenders assess tangible assets, smallholder farmers often have limited documented capital. Innovative studies have suggested incorporating indirect capital such as livestock, irrigation tools, and labor as indicators of economic engagement (Assouto & Houngbeme, 2023).

Collateral is the security that the borrower pledges to mitigate lender risk. The lack of formal land titles and documentation among smallholder farmers remains a major barrier (AgAmerica, 2023). In response, Jonnalagadda and Sabbineni (2024) emphasized the role of fintech in introducing alternative credit scoring systems that incorporate behavioral data and mobile transaction histories to replace traditional collateral mechanisms.

Conditions refer to the terms of the loan and broader contextual risks such as weather, crop prices, and policy volatility. Timu et al. (2024) explored this dimension through the lens of climate-smart lending frameworks, advocating for condition-based lending that adapts to seasonal cycles and natural resource dependencies.

While the 5C's model is widely recognized, its application among smallholder farmers necessitates contextual adaptation. Recent innovations in digital finance, including AI-based credit scoring and remote sensing data, offer pathways to address the data asymmetry faced by rural borrowers (Zhang & Li, 2024). Furthermore, studies highlight that training on the 5C's among both farmers and rural loan officers can bridge perception gaps and foster trust-based financial relationships (Brewer & Langemeier, 2021).

**The Concept of Credit Literacy (CI)**

Credit knowledge, an integral component of financial literacy, is deemed a crucial competency for obtaining financial services and making borrowing decisions among smallholder farmers, particularly in developing areas. Understanding credit is essential for obtaining financial services, and prudent borrowing choices can enhance agricultural productivity and elevate living standards. A study conducted in Nigeria by Onah et al. (2024) demonstrates that farmers with elevated financial literacy achieve superior financial performance, characterized by increased returns on investment and enhanced profit margins relative to their less financially literate counterparts. The research emphasizes that financial literacy, attitudes, and awareness substantially influence the forecasting of the effects of utilizing credit facilities on financial performance. Moreover, the expertise and competencies required for making informed credit decisions, including comprehension of loan conditions, interest rates, repayment schedules, and the implications of borrowing, are crucial for smallholder farmers in obtaining financial services and making judgments. Comprehending loan terms, interest rates, repayment schedules, and the ramifications of borrowing is essential for smallholder farmers to access financial services and make educated decisions.

Furthermore, a survey carried out by the Syngenta Foundation for Sustainable Agriculture and Ebdaa Bank (2024) in Sudan assessed the financial practices and perspectives of 150 farmers across four states. The study's findings highlight the significance of financial education in empowering smallholder farmers, asserting that education is essential for attaining financial inclusion and agricultural advancement.

**The Concept of Loan Access (LA)**

Access to credit refers to the ability of individuals or groups to obtain loans from financial institutions or lenders under fair, reasonable, and genuinely accessible conditions. This concept is not limited to merely applying for and receiving loans but also encompasses a broader

context, such as knowledge about financial products. Qualifying criteria for loans include creditworthiness, where financial institutions' adaptability, along with awareness of social, economic, and geographical limitations, are all factors to consider (World Bank, 2014). For smallholder farmers, especially in developing countries, access to credit is an important tool for increasing productivity and economic stability. It enables them to invest in production factors such as seeds, fertilizers, tools, or irrigation systems, thereby reducing reliance on informal lending sources and enhancing their ability to cope with various risks (Savoy, 2022). However, smallholder farmers often face limitations in accessing credit from the formal financial sector, such as a lack of collateral, no credit history, or a lack of financial knowledge (Suryani & Siregar, 2023).

Björkegren & Grissen's (2018) research indicates that the traditional credit assessment mechanisms used by banks and financial institutions prevent farmers from accessing credit. This is due to the traditional credit process's emphasis on regular income, income documentation, and collateral, all of which are significantly at odds with the characteristics of smallholder farmers. As a result, this group of farmers is either denied credit or forced to rely on informal lending sources, which often have high interest rates and unfair conditions. Access to credit for smallholder farmers, therefore, needs to be given comprehensive attention, not only covering the policies and infrastructure of institutions but also including social equity, income-generating capacity, and financial literacy.

**Conceptual Framework and Hypotheses**

This conceptual framework was developed to study the causal relationships affecting the access to financial resources of smallholder farmers in Thailand. The model includes three main latent variables: Challenges in Accessing Finance (CAF), Credit Approval Criteria (CAC), and Credit Knowledge (CL), which ultimately affect Loan Access (LA). The structure and hypotheses are designed for empirical testing using Structural Equation Modeling (SEM) through the LISREL8.80 program (Jöreskog & Sörbom, 2006).

H1: Challenges in accessing financial resources among small-scale farmers influence their credit literacy.

H2: Credit assessment criteria for financial institutions influence farmers' credit literacy.

H3: Credit assessment criteria set by financial institutions influence access to financial resources.

H4: Credit literacy among small-scale farmers influences their access to financial resources.

**Table 2** Summary of Research Hypotheses

| Hypothesis | Statement | Expected Direction |
|---|---|---|
| H1 | CAF → CL | Negative |
| H2 | CAC → CL | Positive |
| H3 | CAC → LA | Positive |
| H4 | CL → LA | Positive |

**Table 1** Summary of Latent Variables and Related Literature

| Latent Variable | Indicators / Dimensions | Key Academic Sources | Key Research Findings / Theoretical Contributions |
|---|---|---|---|
| Challenges in Accessing Finance (CAF) | Lack of collateral, unstable income, absence of credit history, limited presence of financial institutions in rural areas, lack of financial information, low financial literacy, incomplete documents, lack of access to digital technology | CSIS (2021); Collins et al. (2020); Suksamran & Channarong (2020); FAO (2023); TDRI (2022) | Agricultural income is highly risky; absence of documents and credit history makes it difficult for banks to assess risks, leading to reluctance in lending. Structural limitations and inadequate support systems are key contributing factors. |
| Credit Assessment Criteria (5C's) – CAC | Character, Capacity, Capital, Collateral, Conditions | Texas Farm Credit (2021); Lelisho & Lelisho (2024); Jonnalagadda & Sabbineni (2024); OECD (2005); Comrey & Lee (1992); BAAC (2023) | Smallholders often lack traditional collateral or formal documentation. There's a need to adapt the 5C model contextually, including use of alternative data and fintech tools to assess creditworthiness. |
| Credit Literacy (CI) | Understanding of credit processes, interest calculation, loan conditions, credit bureaus, liquidity management, debt repayment | Onah et al. (2023); Syngenta Foundation & Ebdaa Bank (2024); Lusardi & Mitchell (2011); OECD (2018); Wikran (2017) | Financial knowledge enhances borrowing decisions and agricultural returns. It reduces default risks and increases the ability to access financial services. |
| Loan Access (LA) | Trust, service flexibility, staff competency, access channels, financial products, understanding of products, eligibility criteria, institutional flexibility, social and geographical constraints | Ghatak & Guinnane (1999); BAAC (2023); TCG (2022); World Bank (2014); CSIS (2022); Suryani & Siregar (2023); Björkegren & Grissen (2018) | A variety of accessible channels and user-centered services are essential. A holistic approach considering policy, equity, and farmers' capacity is required to improve credit accessibility. |

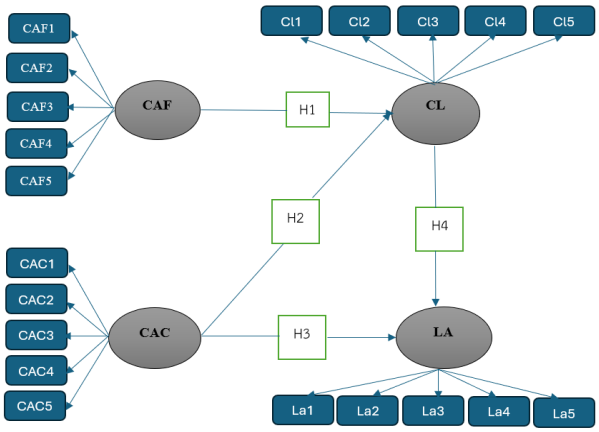


**Figure 1** Conceptual Framework and Hypotheses

The conceptual framework of this research illustrates the hypotheses and the relationships between latent variables and observable variables as follows.

1. Challenges in Accessing Finance (CAF) are measured by five observable variables (CAF1 to CAF5). CAF1 refers to the lack of accurate and timely credit information, especially among smallholder farmers living in remote rural areas who lack financial literacy and decision-making capacity regarding credit (Balana & Oyeyemi, 2022). CAF2 involves a lack of financial management knowledge, including insufficient understanding of credit conditions, loan eligibility criteria, and credit limits that fail to meet actual production needs (Soekarni et al., 2024). CAF3 highlights a key structural barrier—the absence of formal income records—which impedes smallholder farmers' eligibility for formal credit; additionally, uncertainty or lack of transparency in loan interest rates discourages engagement with financial institutions and hinders informed financial decision-making (Kinda & Sawadogo, 2023). CAF4 points to the absence of sufficient collateral—such as land, buildings, or formal savings—combined with structural social inequality, which significantly limits access to formal financial services (Somasundaram & Devadason, 2023). Finally, CAF5 identifies a critical constraint in effective farm financial management, namely the lack of cost-analysis skills, awareness of suitable financing options, and limited access to agricultural and digital technologies (Savoy, 2022).

2. Credit Approval Criteria (CAC) are analyzed based on the 5C's framework of credit analysis, which includes income requirements, financial documentation, and institutional lending policies (CAC1 to CAC5). CAC1 refers to farmer characteristics, encompassing socio-demographic and operational attributes such as age, education level, farming experience, farm size, and type of agricultural activity (Akram, W. et al., 2008; Chandio et al., 2017). CAC2 focuses on farmer capability, including technical, financial, and managerial competencies essential for effective planning, operation, and optimization of agricultural activities (Saqib et al., 2018; Djoumessi et al., 2018). CAC3 concerns farmer capital resources, particularly the availability, adequacy, and sources of financial capital accessible for supporting agricultural production and investment (Munyua et al., 2023; Abdul Latif Jameel Poverty Action Lab, 2018). CAC4 addresses the collateral capacity of farmers, referring to the availability and legal status of tangible assets—such as land titles, buildings, or formal savings—that can be used as security for loan approval (Akram, A. et al., 2008; Domeher & Abdulai, 2012; Casaburi & Willis (2018). Finally, CAC5 represents the broader economic and policy environment in which credit decisions are made; for smallholder farmers, restrictive lending conditions—such as inflexible repayment periods, high interest rates, or risk-averse institutional policies—can significantly constrain access to financial services (Balana & Oyeyemi, 2022; Kumar et al., 2023).

3. Credit Literacy (CL) is assessed through understanding of interest rates, repayment plans, credit tools, financial planning, and risk management (CL1 to CL5). CL1 refers to possessing knowledge of documentation procedures and demonstrating mathematical skills, including the ability to calculate compound interest (BAAC, 2023; Moenjak et al., 2020; Kenan Foundation Asia, 2023). CL2 involves knowledge of credit bureau systems and an understanding of the time value of money (Office of Agricultural Economics [OAE], 2024; TDRI, 2022). CL3 indicates knowledge of the credit assessment process and the ability to maintain liquidity in daily financial management (BAAC, 2023) . CL4 includes understanding debt repayment procedures and the principles of loan repayment and interest rates (Kumar et al., 2023; BAAC, 2023). Finally, CL5 pertains to knowledge of available credit sources and the ability to plan financially for fund utilization and debt repayment (OAE, 2024; TDRI, 2022).

4. Loan Access (LA) refers to the actual utilization of credit services, borrowing frequency, and satisfaction with financial institutions, as represented by five observable variables (LA1 to LA5). LA1 highlights trust in financial institutions and the willingness of

individuals to engage directly with credit providers (OAE, 2024; Tilleke & Gibbins, 2024) . LA2 reinforces this trust and engagement through additional perspectives from other stakeholders (OAE, 2024). . LA3 continues to reflect confidence in credit providers, emphasizing consistent findings across different sources (TDRI, 2022; Tilleke & Gibbins, 2024). LA4 focuses on the quality of service, noting that staff with good interpersonal skills who provide prompt and accurate services, especially through mobile application platforms, significantly enhance borrower satisfaction (Moenjak et al.,2020; Kenan Foundation Asia, 2023; OAE, 2024). Finally, LA5 underlines the importance of diverse and adaptable credit products in promoting financial inclusion, stating that financial institutions offering flexible lending terms and customizable products are more likely to meet the financial needs of rural borrowers and reduce barriers to credit access (Tilleke & Gibbins, 2024; Chandio et al., 2017).

## Research Methodology

This research aims to study the fundamental factors affecting the access to funding sources for smallholder farmers in Thailand, specifically to; (1) examine the issues faced by farmers in accessing funding sources, (2) analyze the confirmatory factor analysis (CFA) of the causal factors, and (3) develop a Structural Equation Model (SEM) that explains the relationship of these factors with access to funding sources in the system.

### 1. Population and Sampling

The study targets smallholder farming households registered in Thailand's 2022 Agricultural Registry, totaling 2,426,171 households (Department of Agricultural Extension, 2023). The sample focuses on farmers without land ownership, operating on leased, mortgaged, or freely used land, selected from the top three provinces with the largest non-owned agricultural areas (OAE, 2022). Using Raymond's table and a sample size formula with a 5% margin of error, the required

**Table 3** Summary Literature Review on Observable Variables

| Latent Variable | Observable Variables (Code) | Supporting Literature / Source | Related Hypothesis | Indicator Description |
|---|---|---|---|---|
| CAF (Challenges in Access to Finance) | CAF1: Lack of credit information | Balana & Oyeyemi (2022) | H1 | Lack of credit information, poor financial literacy, lack of collateral, incomplete documentation, poor access to digital/ agricultural technologies |
| | CAF2: Lack of financial management knowledge | Soekarni et al. (2024) | | |
| | CAF3: Lack of income records & unclear loan terms | Kinda & Sawadogo (2023) | | |
| | CAF4: Lack of collateral & social inequality | Bread for the World (2023) | | |
| | CAF5: Lack of cost-analysis skills & digital access | Ksapa (2023); Farmtopia (2023) | | |
| CAC (Credit Assessment Criteria) | CAC1:Farmer characteristics | Chandio et al. (2017) | H2, H3 | Farmer's character, capability, capital, collateral capacity, and external credit conditions |
| | CAC2: Farmer capabilities | Djoumessi et al. (2018) | | |
| | CAC3: Capital resources | J-PAL (2018) | | |
| | CAC4: Collateral capacity | Akram, W. et al. (2008); Domeher & Abdulai (2012); Casaburi & Willis (2018) | | |
| | CAC5: Economic/policy environment | Moenjak et al. (2020); Kenan Foundation Asia (2023); Kumar et al. (2023) | | |
| CL (Credit Literacy) | Cl1: Documentation and math skills | BAAC (2023) | H4 | Understanding of interest rates, credit bureaus, financial planning, risk and repayment knowledge |
| | Cl2: Knowledge of credit bureau and time value of money | Office of Agricultural Economics (OAE, 2022); TDRI (2022) | | |
| | Cl3: Credit assessment knowledge & liquidity | BAAC (2023) | | |
| | Cl4:Repayment procedure & interest understanding | Kumar et al (2023); BAAC (2023) | | |
| | Cl5: Financial planning & credit source awareness | OAE (2024); TDRI (2022) | | |
| LA (Loan Access) | LA1: Trust in financial institutions | OAE (2024); Tilleke & Gibbins (2024) | H4 | Trust in institutions, service accessibility, product flexibility, digital platforms, usage frequency |
| | LA2: Engagement with credit providers | Moenjak et al. (2020); Kenan Foundation Asia (2023); OAE (2024) | | |
| | LA3: Accessibility and staff competency | TDRI (2022) | | |
| | LA4: Mobile application and fast service | Moenjak et al. (2020); Kenan Foundation Asia (2023) | | |
| | LA5: Flexible and diverse credit products | Tilleke & Gibbins (2024); Chandio et al. (2017) | | |

sample size is calculated as 400 households. To account for potential incomplete responses, an additional 15% was collected, targeting 460 households. Ultimately, 442 valid responses (96% of the target) were obtained using stratified random sampling, proportional to each province's household count.

The sample size aligns with Structural Equation Modeling (SEM) requirements, with a 22:1 ratio of observations to variables (442 samples for 20 observed variables), exceeding the recommended 10:1 to 20:1 ratio for robust SEM analysis (Bentler & Chou, 1987; Hair et al., 2014). The ratio ensures statistical reliability, falling between "good" and "very good" per Comrey and Lee's (1992) guidelines. Details are as per the table 4.

Content validity was established by three experts specializing in social science research, agricultural credit, and evaluation. The Index of Item-Objective Congruence (IOC) was calculated at 0.958, which exceeds the acceptable threshold of 0.80 (Rovinelli & Hambleton, 1977). Reliability was confirmed through a pilot test involving 30 households across 18 provinces, yielding a Cronbach's alpha coefficient of 0.80, which surpasses the minimum acceptable value of 0.70 (Nunnally & Bernstein, 1994). The finalized and validated questionnaire was then administered to the 442 sampled households.

**3. Collection of Data**

The Provincial Agricultural Extension Office coordinated the distribution of questionnaires to household heads in 18 provinces. The questionnaires were checked for completeness, and incomplete questionnaires were eliminated, leaving 442 valid questionnaires for analysis.

**4. Data Analysis**

Descriptive statistics—including frequencies, percentages, means, and standard deviations—were employed to summarize demographic and financial information. Inferential statistics were applied to analyze demographic and socioeconomic characteristics of

**Table 4** Population and Sample of the Study

| Region | Province | Total Agricultural Land Area (Rai)* | Number of Agricultural Households (Households) | Target Sample Size (Percentage) | Actual Sample Collected (Sets) |
|---|---|---|---|---|---|
| North | Chiang Rai (1) | 1,107,407 | 172,549 | 33 (7.17%) | 29 |
| | Chiang Mai (2) | 1,096,613 | 164,783 | 31 (6.74%) | 28 |
| | Nan (3) | 1,067,748 | 87,429 | 16 (3.48%) | 18 |
| Northeastern | Nakhon Ratchasima (1) | 4,436,721 | 322,320 | 61 (13.26%) | 61 |
| | Ubon Ratchathani (2) | 2,183,198 | 326,143 | 62 (13.48%) | 56 |
| | Buriram (3) | 1,991,338 | 237,767 | 45 (9.78%) | 40 |
| Eastern | Sa Kaeo (1) | 2,065,591 | 70,985 | 13 (2.83%) | 13 |
| | Chachoengsao (2) | 1,534,225 | 50,795 | 10 (2.17%) | 11 |
| | Chonburi (3) | 1,334,807 | 35,706 | 7 (1.52%) | 10 |
| Western | Kanchanaburi (1) | 1,570,463 | 73,823 | 14 (3.04%) | 16 |
| | Tak (2) | 1,087,076 | 66,450 | 13 (2.83%) | 13 |
| | Ratchaburi (3) | 838,797 | 47,663 | 9 (1.96%) | 11 |
| Central | Nakhon Sawan (1) | 2,669,864 | 138,111 | 26 (5.65%) | 22 |
| | Kamphaeng Phet (2) | 2,537,308 | 96,762 | 19 (4.13%) | 16 |
| | Phetchabun (3) | 2,493,545 | 125,631 | 24 (5.22%) | 22 |
| South | Surat Thani (1) | 2,669,639 | 133,524 | 25 (5.43%) | 17 |
| | Nakhon Si Thammarat (2) | 1,428,475 | 190,188 | 36 (7.83%) | 31 |
| | Chumphon (3) | 1,311,070 | 85,542 | 16 (3.48%) | 28 |
| | **Total** | **33,423,885** | **2,426,171** | **460 (100%)** | **442** |

* **Note**: "Total Agricultural Land Area" refers to land areas not owned by the farmer, such as rented, mortgaged, or provided for free. (Unit: Rai)

**Source**: Agricultural Household Registry Database (2022); Department of Agricultural Extension; and Land Ownership Statistics in Agriculture, Office of Agricultural Economics (2022: 193–195)

**2. Instrument Development and Validation**

A questionnaire was developed to collect quantitative data, covering five dimensions: (1) general household information, (2) barriers to financial access, (3) preparedness for loan applications based on the 5C's credit criteria (character, capacity, capital, collateral, and condition), (4) knowledge of loan processes and repayment, and (5) reasons for selecting financial sources. The questionnaire comprised 86 items, including checklists, 5-point Likert scales, and open-ended questions.

smallholder farmers, as well as the challenges they face in accessing financial sources in Thailand. Structural Equation Modeling (SEM) was conducted using the LISREL 8.80 program (Jöreskog & Sörbom, 2006) to examine causal relationships, incorporating both SEM and confirmatory factor analysis (CFA). The CFA results indicated an adequate factor structure, with a Kaiser-Meyer-Olkin (KMO) measurement of 0.863 and a significant Bartlett's Test of Sphericity ($p < 0.05$), confirming the appropriateness of the data for factor analysis (Hair et al., 2014). A Principal Components Analysis with Varimax rotation extracted five factors, accounting for 71.54% of the total variance, with communalities ranging from 0.745 to 0.891. Model fit was evaluated using standard fit indices to ensure consistency between the hypothesized model and the empirical data.

## Results

The research results are split into information regarding small-scale farmers' demographics and socio-economic status, the difficulties they encounter in getting financial support, an analysis of the reasons behind their access to financial sources, and the creation of a structural equation model to show how these reasons are connected to their access to financial sources in Thailand. The details are as follows.

### Demographic and Socio-Economic Characteristics of Smallholder Farmers

To contextualize the analysis of financial access among smallholder farmers in Thailand, this study surveyed 442 household heads across 18 provinces. The demographic and socio-economic characteristics of the respondents, summarized below, provide insights into their socio-economic vulnerabilities and financial behaviors.

### Personal and Household Characteristics

The sample was predominantly male (53.40%), with females comprising 46.60%. Most respondents were aged 41–50 years (40.95%), followed by those aged 51–60 years (35.52%), reflecting an aging farming population. The majority (74.60%) were married, which may influence household financial responsibilities. Education levels were modest, with 32.40% having completed primary education and 31.00% secondary education; only 0.50% had no formal education, indicating basic literacy but limited access to advanced training.

Households typically had 4–6 members (78.51%), with 11.54% having 1–3 members. Dependent members (children under 21 or adults over 60) numbered 1–3 in 56.79% of households, with 42.08% having 4–6 dependents, suggesting significant economic burdens. Most households had two members engaged in agriculture (30.54%), followed by three (19.46%), indicating limited labor resources.

### Geographic and Agricultural Profile

Respondents were markedly from Nakhon Ratchasima (13.81%) and Ubon Ratchathani (12.67%), provinces known for agricultural activity. Landholdings were modest, with 47.70% owning or leasing 16–20 rai and 26.50% managing 1–5 rai. Notably, 68.56% owned their land, while 26.90% leased, highlighting tenure insecurity for a significant minority. Most farmers (32.13%) had 1–10 years of agricultural experience, followed by 11–20 years, reflecting a mix of novice and seasoned farmers.

### Economic Activities and Financial Status

Primary agricultural activities included sericulture (22.85%) and upland farming (22.74%). Non-agricultural secondary occupations were common, with 76.65% engaged in hired labor and 19.53% in trading. Monthly agricultural income was low, with 55.43% earning ≤10,000 THB and 18.33% earning 10,001–15,000 THB. Non-agricultural income followed a similar pattern (66.52% ≤10,000 THB). Monthly agricultural expenses were ≤10,000 THB for 55.00% of households, and household expenses were ≤10,000 THB for 51.40%, indicating tight budgets. Debt levels were significant, with 66.10% of households owing ≤50,000 THB annually for agricultural purposes, and 17.90% owing 50,001–100,000 THB. Savings were primarily channeled through the Bank for Agriculture and Agricultural Cooperatives (BAAC) (50.00%) or agricultural cooperatives (17.62%), with 82.40% saving ≤50,000 THB annually, reflecting limited financial reserves.

### Financial Preferences

The BAAC was the preferred formal credit source (40.53%), followed by agricultural cooperatives (24.44%). Farmers sought loans primarily for production (e.g., purchasing fertilizers, hiring labor; 29.27%) or household consumption (27.51%). Most preferred short-term loans (≤1 year, 66.70%), with desired loan amounts of 50,001–100,000 THB (highest frequency) or 100,001–300,000 THB (22.40%).

## Implications

Demographic and socioeconomic data revealed a sample of elderly farmers with moderate education,

minimal land ownership, low income, and significant debt burdens. Their reliance on rented land and limited savings indicate financial vulnerability. Meanwhile, their choice of formal credit sources, such as the Bank for Agriculture and Agricultural Cooperatives (BAAC), demonstrates trust in established institutions. These characteristics underscore the structural barriers to accessing financial resources, leading to a causal analysis to explain the factors affecting smallholder farmers' access to funding in Thailand, as per the research findings. These are in accordance with the research results, as follows:

**1. To investigate the challenges faced by smallholder farmers in accessing financial resources in Thailand**

A Descriptive Statistical Analysis was conducted to examine the current situation and challenges that farmers face in accessing funding sources in Thailand. The mean scores and standard deviations of the key indicators were calculated to understand the general trend and variation of the data.

The overall issue of access to funding sources for small-scale farmers is at a high level (M = 3.65, SD = 0.59). When ranked from highest to lowest, categorized as follows: Rank 1: The lack of collateral, such as land, buildings, savings bonds, deposits, and social inequality, are overall at a high level (M = 3.68, SD = 0.59). Rank 2: The lack of accurate credit information and living in remote areas are at a high level (M = 3.66, SD = 0.58). Rank 3: The lack of evidence showing income and loan interest rates are overall at a high level (M = 3.65, SD = 0.58). Rank 4: The lack of knowledge and understanding in financial management, including credit terms, and an insufficient credit amount to meet production needs are at a high level (M = 3.64, SD = 0.57). And in the fifth rank, the lack of knowledge in cost analysis or capital suitable for agricultural operations and access to technology/digital agricultural technology is overall at a high level (M = 3.60, SD = 0.61), respectively. Details are shown in Table 5.

These issues reflect the need to develop data infrastructure and credit services that align with the context of smallholder farmers in Thailand.

**2. To analyze the components of the causal factors of access to financial sources of small-scale farmers in Thailand (CFA)**

A structural equation modeling (SEM) approach was used to analyze the causal relationships affecting smallholder farmers' access to finance in Thailand. The model consisted of 4 latent variables: Challenges to access finance (CAF), Credit Assessment Criteria (CAC), Credit Literacy (CL), and Loan Access (LA), which were measured by 20 observable indicators (CAF1–CAF5, CAC1–CAC5, CL1–CL5, LA1–LA5), as detailed in the conceptual framework and hypotheses in Figure 1. The correlations between these variables ranged from -0.303 to 0.925, indicating moderate to high relationships within the model. Details of the variables and paths determining smallholder farmers' access to finance are presented in Tables 1, 2, and 3.

The study applied a Confirmatory Factor Analysis (CFA) to identify and validate the latent constructs influencing smallholder farmers' access to financial resources. Four latent variables were identified: Challenges in Accessing Finance (CAF), Credit Assessment Criteria (CAC), Credit Literacy (CL), Loan Access (LA). Each latent construct consisted of five observed variables. The standardized factor loadings for all indicators were statistically significant ($p < .001$), with the highest loading observed in:

- CAF3: "Lack of income documentation and loan interest knowledge" ($\beta = 0.904$)
- CAC1: "Farmer's character" ($\beta = 0.895$)
- CL5: "Financial planning and debt repayment understanding" ($\beta = 0.970$)
- LA3: "Staff expertise and responsiveness" ($\beta = 0.957$)

These results confirm the strong construct validity of the proposed model, with $R^2$ values ranging from 62% to 94%, and thus achieve the objective of

**Table 5** Challenges that farmers face in accessing funding sources in Thailand

| Variable | Description | M | SD | Interpretation | Ranking |
|---|---|---|---|---|---|
| CAF1 | Lack of accurate credit information and living in remote areas | 3.66 | 0.58 | High | 2 |
| CAF2 | Lack of knowledge and understanding in financial management, including credit terms, and an insufficient credit amount to meet production needs | 3.64 | 0.57 | High | 4 |
| CAF3 | Lack of evidence showing income and loan interest rates is overall at a high level | 3.65 | 0.58 | High | 3 |
| CAF4 | Lack of collateral (land, buildings, savings bonds, deposit) and social inequality | 3.68 | 0.59 | High | 1 |
| CAF5 | Lack of knowledge in cost analysis or suitable financing for agriculture/digital technology | 3.60 | 0.61 | High | 5 |
| | **Total** | **3.65** | **0.59** | **High** | **High** |

identifying the structural dimensions of financial access barriers. With the following details

When considering the components of the problem of accessing funding, the aspect with the highest weight is the lack of evidence of income and loan interest rates. Following that is the lack of understanding in financial management, including loan criteria, conditions, and the volume of loans, which are insufficient to meet production demands. Lastly, there is the lack of collateral, such as land, buildings, savings bonds, deposits, and social inequality. These three aspects can explain the variability of the problem of accessing funding at 81.60%, 81.50%, and 81.10%, respectively.

The components of the lending criteria with the highest weight are the farmer's qualifications (Character), followed by the farmer's capacity (Capacity), and the farmer's capital (Capital), in that order. These three aspects can explain the variability of the lending criteria by 80.10%, 66.10%, and 62.00%, respectively.

The components of credit understanding, with the highest weight, are knowledge of sources of credit access and understanding of money management and debt repayment. Next came knowledge of the loan approval process and understanding of maintaining liquidity in daily life, followed by, knowledge of the debt repayment process and understanding of debt repayment/ loan interest rates. These sets of three aspects can explain the variability of credit understanding by 94.10%, 93.70%, and 92.60%, respectively.

The components of access to funding sources, with the highest weight, are employees with knowledge and expertise who can provide useful, prompt, and tailored advice, as well as the financial institution's/ credit provider's website. Next in importance are the credibility of the financial institution and direct contact with the financial institution or credit provider. Following that are employees with good interpersonal skills who provide quick, accurate service and mobile applications. These three sets of aspects can explain the variability in access to funding sources by 91.50%, 90.80%, and 90.20%, respectively.

The issue of access to funding sources and lending criteria can explain 51.80% of the variability in credit understanding. The criteria for granting loans and understanding of credit can explain the variability in access. Access to funding sources is 80.24%. Details are shown in Table 6.

**Confirmatory Factor Analysis (CFA) Results**

A Confirmatory Factor Analysis (CFA) was conducted to validate the measurement model of four latent variables—Access Problems, Credit Criteria, Credit Literacy, and Loan Access—comprising 20 observed indicators in total.

The hypothesized model demonstrated an excellent fit to the data ($x2 = 163.546$, df = 140, $x2/df = 1.168$, p = 0.085, GFI = 0.978, AGFI = 0.957, CFI = 0.977, NFI = 0.989, RMR = 0.024, RMSEA = 0.037).

**Table 6** Model Fit of the Research Model with Empirical Data

| Latent Variables | Observable variable | Standardized Regression Weights ($\beta$) | SE | t | $R^2$ |
|---|---|---|---|---|---|
| Challenges in Access to Finance – CAF | Caf1 | 0.845 | - | - | 0.7830 |
| | Caf2 | 0.903 | 0.035 | 28.301*** | 0.8150 |
| | Caf3 | 0.904 | 0.036 | 28.350*** | 0.8160 |
| | Caf4 | 0.900 | 0.036 | 28.144*** | 0.8110 |
| | Caf5 | 0.828 | 0.041 | 23.611*** | 0.6860 |
| Credit Approval Criteria | Cac1 | 0.895 | - | - | 0.8010 |
| | Cac2 | 0.679 | 0.045 | 17.645*** | 0.6610 |
| | Cac3 | 0.587 | 0.032 | 8.624*** | 0.6200 |
| | Cac4 | 0.476 | 0.051 | 3.743*** | 0.5310 |
| | Cac5 | 0.452 | 0.034 | -1.839*** | 0.5080 |
| Credit Literacy | Cl1 | 0.937 | - | - | 0.8780 |
| | Cl2 | 0.935 | 0.026 | 39.117*** | 0.8740 |
| | Cl3 | 0.968 | 0.022 | 45.705*** | 0.9370 |
| | Cl4 | 0.962 | 0.022 | 44.367*** | 0.9260 |
| | Cl5 | 0.970 | 0.022 | 46.275*** | 0.9410 |
| Loan Access (LA) | La1 | 0.949 | - | - | 0.9080 |
| | La2 | 0.936 | 0.025 | 41.327*** | 0.8760 |
| | La3 | 0.957 | 0.022 | 45.966*** | 0.9150 |
| | La4 | 0.943 | 0.024 | 42.840*** | 0.9020 |
| | La5 | 0.853 | 0.023 | 45.089*** | 0.8900 |

****p-value <.001*

All fit indices met or exceeded the recommended thresholds (Schumacker & Lomax, 2010). See Table 7 for details.

**Table 7** Model Fit Index Verification

| Fit Index | Criteria | Obtained Value | Evaluation Result |
|---|---|---|---|
| $\chi^2/df$ | Less than 2.00 | 1.168 | Acceptable |
| *p-value* | Greater than .05 | 0.085 | Acceptable |
| *GFI* | Greater than .95 | 0.978 | Acceptable |
| *AGFI* | Greater than .95 | 0.957 | Acceptable |
| *CFI* | Greater than .95 | 0.977 | Acceptable |
| *NFI* | Greater than .95 | 0.989 | Acceptable |
| *RMR* | Less than .05 | 0.024 | Acceptable |
| *RMSEA* | Less than .05 | 0.037 | Acceptable |

**3. To develop a structural equation model that explains the causal relationships influencing smallholder farmers' access to financial resources in Thailand.**

The analysis of the causal relationship model focuses on the approach to accessing funding sources for smallholder farmers in Thailand. The issue of accessing funding sources has a direct negative influence on credit understanding, with an influence size of 0.251. Additionally, the issue of accessing funding sources has an indirect negative influence on credit understanding, which in turn affects access to funding, with an influence size of 0.094.

The lending criteria have a positive direct influence on credit understanding and access to funding, with influence sizes of 0.674 and 0.822, respectively. Additionally, the lending criteria have a positive indirect effect on access to funding mediated by credit understanding, with an influence size of 0.253. Credit understanding has a direct positive influence on access to funding, with an influence size of 0.376. Details are shown in Table 8.

The results indicate that Financial Literacy (CL) exerted a significant positive direct effect on access to finance (DE = 0.674, $p < .01$), underscoring the critical role of knowledge in credit processes, financial planning, and debt management (CL1–CL5) in enabling farmers to secure funding. However, its direct negative effect on farmer productivity (DE = -0.251, $p < .01$) suggests that excessive focus on financial literacy may divert resources from productive activities, highlighting a potential trade-off. Institutional Accessibility (LA) demonstrated

**Table 8** Latent Variables, Total Effects (TE) Direct Effects (DE) and Indirect Effects (IE)

| Latent Variables | Credit Approval Criteria | | | Credit Access Constraints | | | Credit Literacy | | |
|---|---|---|---|---|---|---|---|---|---|
| | TE | De | IE | TE | De | IE | TE | De | IE |
| Financial Literacy (Cl) | 0.674*** | 0.674*** | - | -0.251*** | -0.251*** | - | - | - | - |
| Loan Access (La) | 1.135*** | 0.882*** | 0.253*** | -0.094*** | - | -0.094*** | 0.376*** | 0.376*** | - |

**Note:** TE = Total Effects, DE = Direct Effects, IE = Indirect Effects.
**p-value<.05, **p-value<.01 , ***p-value<.001*

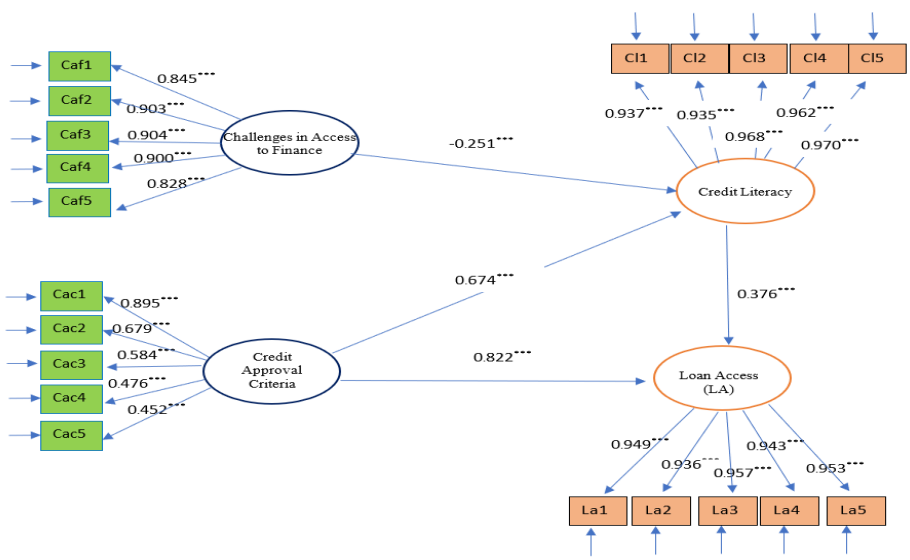


**Figure 2** Structural Equation Model of Financial Access for Smallholder Farmers in Thailand

the strongest total effect on access to finance (TE = 1.135, $p < .01$), with substantial direct (DE = 0.882, $p < .01$) and indirect effects (IE = 0.253, $p < .01$). This reflects the importance of credible institutions, convenient access, and flexible credit terms (LA1–LA5) in facilitating financial inclusion, with indirect effects likely mediated through improved trust and service efficiency. Additionally, Institutional Accessibility positively influenced financial resilience (TE = 0.376, $p < .01$), indicating its broader impact on farmers' economic stability.

From the results of the analysis of the consistency of the research model with empirical data (Model Fit) and the analysis of the components of the causal factors of access to financial sources of small-scale farmers in Thailand using the confirmatory factor analysis (CFA), including the analysis of direct and indirect effects, the results of the analysis of the causal relationship model of the approach to access to financial sources of small-scale farmers in Thailand are summarized as Figure 2.

**Hypothesis Testing Results**

The results of hypothesis testing are presented in Table 9. Each path coefficient (β) was tested for statistical significance using a significance level of .001. All four hypotheses were supported by the data, with statistically significant standardized regression weights.

**Table 9** Hypothesis Testing Results

| Hypothesis | Statement | Standardized Estimate (β) | Significance Level | Conclusion |
|---|---|---|---|---|
| H1 | Access problems negatively affect credit literacy. | -0.251*** | $p < .001$ | Accepted |
| H2 | Credit criteria positively affect credit literacy. | 0.674*** | $p < .001$ | Accepted |
| H3 | Credit criteria positively affect loan access. | 0.822*** | $p < .001$ | Accepted |
| H4 | Credit literacy positively affects loan access. | 0.376*** | $p < .001$ | Accepted |

****p-value <.001*

These findings indicate that both access-related constraints and institutional credit criteria have significant impacts on farmers' financial knowledge and access to funding. Particularly, credit criteria play a dual role by directly influencing both credit literacy and loan accessibility.

## Discussion

This study provides a robust analysis of the barriers to financial access for smallholder farmers in Thailand, confirming the critical role of structural, institutional, and individual factors in shaping loan accessibility. The findings align with the research objectives, identifying key challenges such as lack of collateral, inadequate financial literacy, and restrictive credit assessment criteria, which collectively explain 80.24% of the variance in loan access (LA). The Structural Equation Model (SEM) results, with a strong model fit ($\chi^2/df = 1.168$, GFI = 0.978, CFI = 0.977, RMSEA = 0.037), validate the causal relationships among Challenges in Accessing Finance (CAF), Credit Assessment Criteria (CAC), Credit Literacy (CL), and Loan Access (LA). These findings resonate with global literature on financial exclusion in rural contexts (Beck & Demirgüç-Kunt, 2008; Zins & Weill, 2016) and offer actionable insights for enhancing financial inclusion in Thailand's agricultural sector.

The significant negative influence of CAF on CL ($DE = -0.251$, $p < .01$) underscores the structural barriers impeding smallholder farmers' financial literacy. This aligns with financial inclusion theory, which posits that access to financial services is constrained by supply-side barriers (e.g., lack of collateral, income documentation) and demand-side factors (e.g., low financial literacy) (Demirgüç-Kunt et al., 2018). The lack of collateral (β = 0.904) and income documentation (β = 0.904) emerged as dominant barriers, consistent with studies in sub-Saharan Africa and South Asia, where smallholders are often excluded from formal credit markets due to asset poverty and informational asymmetries Kinda & Sawadogo (2023) . These barriers create a vicious cycle, as limited financial literacy further reduces farmers' ability to navigate complex loan processes, reinforcing exclusion (Collins et al., 2020).

Conversely, the positive direct effects of CAC on both CL (DE = 0.674, $p < .01$) and LA (DE = 0.822, $p < .01$) highlight the pivotal role of institutional frameworks in facilitating financial access. This finding supports institutional theory, which emphasizes that organizational practices, such as the 5C's credit assessment model (character, capacity, capital, collateral, conditions), shape access to resources (North, 1990). The high factor loading for "Farmer's character" (β = 0.895) suggests that community-based reputation and cooperative participation serve as critical proxies for creditworthiness in informal economies, corroborating evidence from Ethiopia and Kenya (Lelisho & Lelisho, 2024; J-PAL, 2018) . However, the reliance on traditional collateral requirements remains a bottleneck, as noted by

Jonnalagadda & Sabbineni (2024), who advocate for fintech-driven alternative credit scoring to mitigate this barrier. Unlike India's fintech innovations, where AI credit scoring has reduced such barriers (Kumar et al., 2023), in Thailand, 40.53% of farmers still use financial institutions like the Bank for Agriculture and Agricultural Cooperatives (BAAC), reflecting limited digital infrastructure. In comparison to neighboring ASEAN countries, such as Vietnam, which have much smaller financial institutions (Jumlongnark, 2024), it is evident that Thailand's agricultural credit system still heavily relies on state-supported institutions for smallholder farmers.

The positive effect of CL on LA (DE = 0.376, $p < .01$) demonstrates the transformative value of financial literacy in empowering smallholder farmers. This finding aligns with behavioral economics, which suggests that improved knowledge and decision-making skills enhance individuals' ability to engage with financial systems (Thaler & Sunstein, 2008). Farmers with strong financial planning and debt repayment understanding ($\beta = 0.970$) are better equipped to access and utilize credit effectively, as evidenced by studies in Nigeria and Sudan (Onah et al., 2024; Syngenta Foundation for Sustainable Agriculture and Ebdaa Bank, 2024) . However, the negative indirect effect of CAF on LA via CL (IE = -0.094, $p < .01$) indicates that structural barriers can undermine literacy efforts, necessitating integrated interventions that address both knowledge gaps and institutional constraints. Staff expertise ($\beta = 0.957$) and flexible credit products significantly enhance loan access (Moenjak et al., 2020; Kenan Foundation Asia, 2023; Tilleke & Gibbins, 2024). These findings suggest broader social impacts, including poverty reduction and reduced income inequality (Beck & Demirgüç-Kunt, 2008; Demirgüç-Kunt et al., 2018; Zins & Weill, 2016), aligning with Sustainable Development Goals (SDGs) 1 (No Poverty) and 8 (Decent Work and Economic Growth) (United Nations, 2015).

Although this study demonstrates statistical robustness and employs SEM with methodological rigor, the sample of 442 smallholder farmers from 18 provinces may not fully capture the regional diversity in financial access across the country (Hammond et al., 2017; Van Wijk et al., 2019). . Additionally, the use of a cross-sectional design limits the ability to observe the long-term effects of financial literacy interventions (Levin, 2006; Babbie, 2020). Future research should consider adopting longitudinal designs or expanding the sample to encompass more geographic regions to assess sustainable impacts and compare financial access constraints across ASEAN member countries (Mikolajczyk et al., 2021). These approaches would enhance the applicability of the model and support the development of actionable strategies to improve financial inclusion and reduce financial disparities within Thailand's agricultural sector.

**Suggestions**

The implications of these findings are threefold.

1. Data from the survey revealed that most farmers have savings not exceeding 50,000 baht per year, which reflects their debt repayment ability according to the 5C's principle. Therefore, there should be policies to promote savings through community funds, flexible savings products, and financial planning training to enhance financial stability and access to formal credit.

2. Policymakers should prioritize financial literacy programs integrated with agricultural extension services to address the high weight of financial planning knowledge ($\beta = 0.970$).

3. Financial institutions must adapt the 5Cs model to incorporate alternative credit indicators, such as livestock or mobile transaction histories, to reduce reliance on collateral (Jonnalagadda & Sabbineni, 2024).

4. Investments in digital platforms, including mobile applications, can enhance institutional accessibility, particularly in remote areas, as supported by the high factor loading for staff responsiveness ($\beta = 0.957$). These strategies align with the United Nations' Sustainable Development Goals (SDGs), particularly SDG 1 (No Poverty) and SDG 8 (Decent Work and Economic Growth), by fostering economic resilience among smallholder farmers.

**For future research**

1. Longitudinal studies could explore the long-term impact of financial literacy interventions on loan repayment rates and agricultural productivity.

2. Additionally, comparative analyses with other ASEAN countries could elucidate regional variations in financial access barriers.

3. Investigating the role of gender in financial inclusion, given the near-equal gender distribution in the sample (53.40% male, 46.60% female), could further enrich the literature, as women farmers often face unique constraints (Zins & Weill, 2016).

4. We should build upon the causal model to develop practical strategies and action plans, such as designing flexible credit assessment tools or financial

literacy promotion programs, and these should be tested in real areas to evaluate sustainable impacts.

In conclusion, this study advances the understanding of financial access for smallholder farmers in Thailand by integrating theoretical frameworks and empirical evidence. The validated SEM model provides a robust foundation for designing targeted interventions, emphasizing the interplay of financial literacy, institutional accessibility, and adaptive credit criteria in breaking the cycle of financial exclusion.

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