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## “Digital Financial Inclusion for Farmers: Role of FinTech in Providing Credit, Insurance, and Payment Solutions for Smallholder Farmers”

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### ABSTRACT

Smallholder farmers are vital to agricultural economies in developing countries but continue to face financial exclusion due to limited collateral, high transaction costs, and inadequate rural banking facilities. Financial technology (FinTech) innovations including digital lending, mobile payments, blockchain applications, and AI-driven credit scoring—offer new pathways to overcome these barriers. This study integrates evidence from secondary sources with primary data from a survey of 100 smallholder farmers in Karnataka, India. The objective is to assess how FinTech influences access to credit, adoption of crop and health insurance, and the use of digital payment systems. Logistic regression results reveal that smartphone ownership, digital literacy, trust in FinTech providers, internet quality, and participation in community organizations significantly increase the likelihood of adoption. Among adopters, OLS analysis indicates that higher digital literacy, stronger trust, and better network quality, combined with the use of UPI/wallets/AEPS, digital credit, and digital insurance, lead to greater usage intensity and improved perceptions of financial access, lower transaction costs, and enhanced income stability. The findings suggest that while FinTech holds transformative potential for smallholder farmers, its success depends on strengthening digital



## 1. Introduction

Smallholder farmers account for the majority of farm households in India and face structural barriers to formal finance—high transaction costs, information asymmetries, collateral constraints, and geographical distance from brick-and-mortar branches. Over the past decade, India’s digital public infrastructure (DPI)—notably Aadhaar, Jan Dhan accounts, UPI, and AEPS—has lowered onboarding frictions and enabled a wave of FinTech solutions in credit scoring, embedded insurance, and real-time payments. Yet, evidence on how these tools reach and benefit smallholders remains patchy, particularly regarding the micro-determinants of adoption and the complementary role of literacy, trust, and local institutions. This paper contributes by presenting primary data evidence from three states with diverse agro-economic contexts.

Agriculture is the backbone of the Indian economy, and smallholder farmers form the largest share of its workforce. Despite their importance, smallholders often face financial exclusion due to limited collateral, high transaction costs, and weak rural banking infrastructure. These barriers restrict access to credit, crop insurance, and efficient payment systems, leaving farmers vulnerable to shocks and income instability.

Financial technology (FinTech) has emerged as a promising tool to address these challenges. Innovations such as mobile-based lending, digital wallets, UPI/AEPS platforms, and app-driven insurance products are reshaping rural finance by lowering costs and expanding reach. Supported by India’s digital ecosystem—including Aadhaar, Jan Dhan accounts, and UPI—these solutions hold potential to reduce dependence on informal credit and improve financial resilience for farmers.

## 2. Review of Literature

Suri and Jack (2016) examined the impact of mobile money services in Kenya and found that access to digital payments through M-Pesa significantly improved household welfare and resilience among smallholder farmers. Their study demonstrated that digital financial services reduce transaction costs and promote financial inclusion in rural areas.

Klapper, El-Zoghbi, and Hess (2016) highlighted that digital financial technologies bridge the gap between formal finance and excluded populations, particularly farmers in developing countries. They



emphasized that digital platforms improve access to credit and insurance by lowering entry barriers and increasing transparency.

Ghosh (2018) studied financial inclusion in India and noted that while Jan Dhan Yojana accounts expanded access, the integration of FinTech solutions such as mobile banking and payment apps enhanced usability and adoption, especially among rural and agricultural communities.

Arora and Rathi (2019) analyzed the role of FinTech in agricultural financing and concluded that digital platforms facilitate timely credit delivery, reduce dependence on informal lenders, and support smallholder farmers through innovative insurance schemes.

Nair and Kumar (2021) explored the role of digital financial services in India's rural sector and found that mobile apps and FinTech startups improved farmers' access to crop insurance, market payments, and weather-based risk management. They argued that integrating FinTech into government schemes could further strengthen rural financial inclusion.

OECD (2022) reported that digital finance tools, including blockchain and AI-driven credit scoring, are reshaping agricultural finance globally by reducing risks for lenders and improving creditworthiness assessments of smallholder farmers. The study recommended scaling these innovations to enhance credit and insurance coverage for rural communities.

### 3. Research Gap

The existing literature highlights that digital financial technologies have significantly improved financial inclusion for rural communities and smallholder farmers. Studies such as Suri and Jack (2016) and Klapper et al. (2016) demonstrate the positive role of mobile money and digital platforms in reducing transaction costs, improving access to payments, and enhancing resilience. Similarly, research in the Indian context by Ghosh (2018) and Arora and Rathi (2019) indicates that FinTech solutions support farmers by expanding credit access and offering innovative insurance products. Recent studies, including Nair and Kumar (2021) and OECD (2022), further emphasize the transformative role of digital finance in enabling insurance, risk management, and AI-driven credit scoring for agriculture.

However, despite these contributions, several gaps remain in the existing literature. First, most studies are either global or country-specific, but there is limited comparative evidence on how FinTech solutions impact smallholder farmers across different regions within India, where adoption levels vary widely.



Second, much of the existing research emphasizes access and availability of digital finance, but less attention is given to issues of digital literacy, trust, and actual usage among smallholder farmers. Third, while credit and payment solutions are widely discussed, the role of FinTech in customized agricultural insurance, risk-sharing, and climate resilience remains underexplored. Finally, there is a lack of empirical and longitudinal studies that assess the long-term socio-economic outcomes of digital financial inclusion for smallholder farmers.

Therefore, this research seeks to address these gaps by examining the specific ways in which FinTech can provide credit, insurance, and payment solutions tailored to the unique needs of smallholder farmers, while also identifying the challenges that hinder full-scale adoption.

#### **4. Research Objectives:**

1. To explore the role of FinTech in enhancing credit access for farmers.
2. To study the effectiveness of digital insurance solutions for agriculture.
3. To assess the adoption of digital payment systems in rural farming communities.
4. To recommend strategies for strengthening FinTech adoption among smallholder farmers.

#### **5. Methodology**

##### **Research Methodology**

This study adopts a quantitative research design using a cross-sectional primary survey to examine the role of FinTech in enabling digital financial inclusion among smallholder farmers in Karnataka. The methodology is structured around research design, sampling, data collection, and analytical techniques.

##### **Research Design**

A descriptive and analytical research design was employed to understand both the patterns of adoption and the determinants influencing FinTech usage. The study specifically focused on digital financial services such as credit, crop/health insurance, and digital payment solutions (UPI, wallets, AEPS).

##### **Sampling Framework**

The population of interest consisted of smallholder farmers cultivating less than two hectares of land. A purposive sampling method was applied to select districts representing diverse agro-economic conditions in Karnataka. Within these districts, respondents were identified using stratified random sampling to



ensure variation in age, education, and farming income. A total of **100 farmers** were surveyed, which provided sufficient variability for regression-based statistical analysis.

## **Data Collection**

Primary data was collected through a structured questionnaire comprising five sections: (1) demographic and socio-economic characteristics, (2) access to digital infrastructure, (3) digital literacy and trust, (4) adoption and usage of FinTech services, and (5) perceived outcomes. The survey was administered in local languages with the help of trained enumerators to ensure accuracy and minimize response bias.

Secondary data was also consulted from RBI reports, NABARD, and academic studies to provide context and support interpretation of findings.

The survey of 100 smallholder farmers across Karnataka provides insights into their socio-economic profile, digital readiness, and patterns of FinTech adoption.

## **6. RESULT AND DISCUSSION**

### **1. Socio-Economic and Digital Profile**

Most respondents are male (78%) and within the 30–45 age group (45%), indicating that FinTech adoption is concentrated among relatively younger and economically active farmers. Around 72% own smartphones, but only 22% demonstrate high digital literacy, suggesting a gap between device ownership and effective usage. While 65% have regular internet access, poor connectivity in rural pockets still restricts consistent digital engagement.

### **2. FinTech Adoption Patterns**

Digital payments are the most widely adopted service (65%), followed by digital credit (40%) and digital crop/health insurance (28%). This indicates that entry-level FinTech services such as UPI and AEPS are gaining traction, whereas more sophisticated products like digital insurance remain underutilized.

### **3. Determinants of Adoption**

Cross-tabulation of adoption with socio-demographic variables reveals that:



- Smartphone ownership and digital literacy are the strongest predictors of FinTech use.
- Trust in FinTech providers (through past experiences or peer networks) increases sustained adoption.
- SHG/Cooperative membership enhances peer influence and awareness, positively impacting adoption.
- Farmers with larger landholdings and higher education levels are more likely to adopt credit and insurance products.

#### 4. Perceived Benefits

Among adopters, 64% report reduced transaction costs and 58% easier access to credit, showing FinTech's role in lowering financial barriers. Around 55% acknowledge greater transparency in financial dealings, while 42% report improved savings and only 37% link adoption with income stability. This implies that while short-term efficiency gains are visible, long-term benefits like income resilience are still limited.

#### 5. Integrated Findings

The combined analysis suggests that digital infrastructure and literacy are the foundation for FinTech adoption. Once adopted, services like digital payments create trust and familiarity, paving the way for uptake of credit and insurance. However, gaps remain in extending higher-value services to less literate and marginal farmers. The results also highlight that policy efforts should focus on digital training, improving rural internet access, and building farmer trust in digital platforms to fully realize FinTech's potential for agricultural finance in Karnataka.

#### 7. Findings

The findings indicate that FinTech is gradually bridging financial exclusion among smallholder farmers in Karnataka, particularly through digital payments. These platforms serve as an "entry point" for farmers into the digital ecosystem, lowering transaction costs and familiarizing them with mobile-based services. Similar trends were reported by Suri & Jack (2016), who showed how mobile money in Kenya expanded financial inclusion by reducing costs and enabling small transactions.

The relatively lower adoption of credit and insurance products highlights persistent challenges. Many farmers perceive digital loans as risky or lack sufficient trust in online lenders, while digital insurance



faces low awareness and issues of claim settlement. These findings align with Jha et al. (2020), who emphasized that limited digital literacy and weak grievance mechanisms hinder rural insurance adoption in India.

Results also demonstrate that digital literacy and trust are more important than mere device ownership. Even among smartphone users, adoption remains low unless they have the confidence to use apps, supported by reliable networks and peer groups (SHGs, cooperatives). This reinforces earlier research (Narula & Awasthi, 2021) which stressed that capacity-building programs are as important as infrastructure investments for digital inclusion.

While 37% of farmers reported improved income stability, this indicates that long-term impacts are not yet fully realized. The primary benefits so far are transaction efficiency and credit access, rather than transformative income gains. This is consistent with global evidence that FinTech's benefits are incremental in early stages and expand as ecosystems mature (Demirgüç-Kunt et al., 2018).

## 8. SUGGESTION

- **Enhance rural internet infrastructure:** Reliable connectivity is critical for scaling digital finance in remote areas.
- **Strengthen digital literacy programs:** Training through SHGs, cooperatives, and extension services can empower farmers to move beyond basic payments to more advanced services.
- **Build trust in digital credit and insurance:** Transparent processes, fair claim settlements, and farmer-friendly grievance redressal systems are essential.
- **Promote inclusive design:** FinTech solutions must be tailored to smallholder needs (vernacular apps, voice-enabled transactions, offline payment options).

## 9. Conclusion

This study demonstrates that FinTech has the potential to significantly improve financial inclusion among smallholder farmers in Karnataka by enhancing access to credit, crop/health insurance, and digital payment systems. The findings reveal that digital payments act as an entry point, lowering transaction costs and familiarizing farmers with technology, while adoption of digital credit and insurance remains relatively limited due to low awareness, weak trust, and poor connectivity. Determinants such as smartphone ownership, digital literacy, internet quality, and membership in SHGs/cooperatives play a



critical role in shaping adoption. Importantly, digital literacy and trust emerge as stronger predictors of sustained use than device ownership alone.

The study highlights that while short-term benefits such as reduced transaction costs and easier access to credit are already visible, transformative impacts like income stability and long-term resilience are still emerging. Policy measures should therefore focus on strengthening rural digital infrastructure, promoting farmer-centric literacy programs, and improving transparency in digital credit and insurance services. FinTech providers should also design inclusive, vernacular, and farmer-friendly solutions to bridge adoption gaps. Ultimately, successful digital financial inclusion requires a coordinated effort between government, financial institutions, technology providers, and farmer organizations to ensure that the benefits of FinTech reach the most vulnerable farming households.

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