The Impact of Digital Payment Adoption on Financial Inclusion Among Farmers in Rural Karur District, Tamil Nadu

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***Abstract*—In India, a farmer can now pay for fertilizer by scanning a QR code at the village shop, yet many of the same farmers still walk to a bank branch to withdraw cash. This study examines whether adopting digital payments actually translates into deeper financial inclusion among farmers in rural Karur District, Tamil Nadu. Using a structured questionnaire, primary data were collected from 110 farmers selected through stratified random sampling across four blocks, and secondary data were drawn from RBI, NPCI, NABARD and World Bank publications. Financial inclusion was measured across four dimensions: access, usage, quality, and welfare. Descriptive statistics, Pearson correlation, one-way ANOVA and simple linear regression were applied. Results show that 80.9% of respondents use UPI or QR-based payments, and that digital payment adoption is strongly and positively associated with financial inclusion ($r = .68$, $p < .001$), explaining 46% of its variance. Education and landholding size significantly shaped adoption, while poor network connectivity and limited digital literacy emerged as the most serious barriers. The study concludes that digital payments are a powerful but incomplete bridge to inclusion, and recommends village-level digital literacy drives, agent banking, and vernacular-interface design.**

***Index Terms*—digital payments, financial inclusion, UPI, farmers, rural India, Karur, Tamil Nadu**

I. INTRODUCTION

For most of India's farming history, money moved slowly. Crop sales were settled in cash, loans were negotiated face to face, and the nearest bank was often a long bus ride away. The last decade has changed this picture. The Pradhan Mantri Jan Dhan Yojana (PMJDY) opened hundreds of millions of basic bank accounts, the Aadhaar and mobile phone ecosystem made identity verification easier, and the Unified Payments Interface (UPI), launched by the National Payments Corporation of India (NPCI), made instant, near-zero-cost transfers possible from a basic smartphone.

Financial inclusion, defined as the availability and equitable access of formal financial services at an affordable cost for all sections of society (Sarma & Pais, 2011), is widely treated as a foundation for poverty reduction and resilient rural livelihoods. Globally, account ownership has expanded rapidly, with digital payments driving much of the recent growth (Demiurgic-Kunt et al., 2022). India has contributed substantially to that trend, but owning an account is not the same as using it. Many Jan Dhan accounts remain dormant, and farmers frequently withdraw subsidies in cash on the day they arrive.

Karur District in Tamil Nadu offers a useful setting. It is known for textiles and small industry, yet a large share of its rural population still depends on agriculture, growing crops such as banana, sugarcane, maize, groundnut and vegetables. Farmers here operate on small landholdings, sell through local markets and regulated mandis, and increasingly receive income-support and subsidy transfers directly into bank accounts. This blend of traditional practice and fast-moving digital infrastructure makes the district a meaningful case for asking a simple question: when farmers adopt digital payments, are they in fact more financially included?

This paper addresses that question empirically. It contributes local evidence from a part of Tamil Nadu that is under-represented in the literature, and it measures inclusion as a multi-dimensional outcome rather than a simple count of bank accounts.

II. REVIEW OF LITERATURE

Recent studies have highlighted the transformative role of digital payment systems in enhancing financial inclusion. For instance, a study on the adoption of digital payment systems in India emphasized the importance of factors such as ease of use, security, and accessibility in influencing adoption rates (Arora & Saini, 2020). Similarly, research focusing on rural areas of Tamil Nadu has shown that digital payment adoption can lead to increased financial inclusion, though challenges like digital illiteracy and infrastructure deficits persist (Dinesh Kumar & Rahini, 2025).

Financial Inclusion and Development

Sarma and Pais (2011) showed that financial inclusion is closely tied to broader development, with income, literacy, and infrastructure shaping national inclusion levels. Chakravarty and Pal (2013) proposed an axiomatic index of financial inclusion for India, arguing that access, availability and usage must be considered together. This multi-dimensional view underpins the measurement approach used in the present study.

Digital Payments, Mobile Money, and Household Welfare

Evidence from East Africa is particularly influential. Jack and Suri (2014) found that mobile money users in Kenya were better able to smooth consumption aftershocks because they could receive remittances quickly through their networks. Later, Suri and Jack (2016) estimated that access to the M-PESA mobile money system lifted around 2% of Kenyan households out of poverty, with especially strong effects among women-headed households. Aker and Mbiti (2010) similarly argued that mobile phones lower search and transaction costs for rural producers. Ozili (2018) reviewed digital finance more broadly and concluded that it can widen inclusion, though concerns about fraud, privacy and cyber-risk must be managed.

Technology Adoption Perspectives

Why do some farmers adopt while others hesitate? The Technology Acceptance Model suggests that perceived usefulness and perceived ease of use drive acceptance (Davis, 1989). The Unified Theory of Acceptance and Use of Technology adds social influence and facilitating conditions (Venkatesh et al., 2003). Rogers (2003) emphasized that innovations spread through social networks, where early adopters shape the confidence of their neighbours. In village settings, therefore, a trusted shopkeeper or a neighbour's positive experience may matter as much as any advertisement.

III. RESEARCH GAP

Most Indian studies examine urban consumers or national-level data. Few focus on farmers in a specific district of Tamil Nadu, and fewer still test whether payment adoption is associated with the *quality* and *welfare* dimensions of inclusion rather than just access. This study addresses that gap.

IV. OBJECTIVES OF THE STUDY

The study was guided by the following objectives:

1. To examine the socio-economic profile of farmers in rural Karur District.
2. To assess the level and pattern of digital payment adoption among the respondents.
3. To measure the level of financial inclusion across access, usage, quality, and welfare dimensions.
4. To analyse the relationship between digital payment adoption and financial inclusion.
5. To identify the barriers farmers face in using digital payments and to suggest practical measures.

HYPOTHESES.

H_1: Digital payment adoption has a significant positive effect on financial inclusion.

H_2: Digital payment adoption differs significantly across education levels.

V. RESEARCH METHODOLOGY

Research Design

The study follows a descriptive and analytical research design with a cross-sectional survey approach.

Study Area and Sampling

The study was conducted in rural Karur District, Tamil Nadu. A stratified random sampling technique was used, with blocks as strata, and respondents were then selected randomly from farmer lists within each block. The final sample comprised 110 farmers, a size

adequate for the correlation, ANOVA, and simple regression procedures used here (Hair et al., 2019).

Sources of Data

Primary data were collected through a structured, pre-tested questionnaire administered in person in Tamil by the researcher and trained assistants. Responses on attitudinal items used a five-point Likert scale (1 = strongly disagree, 5 = strongly agree).

A pilot test with 12 farmers (excluded from the final sample) led to minor changes in wording. Participation was voluntary, and respondents were informed of the study's purpose and assured of anonymity.

Secondary data were obtained from Reserve Bank of India (RBI) reports, NPCI payment statistics, NABARD publications, the World Bank Global Findex Database, government portals, and peer-reviewed journals.

VI. THE RESEARCH INSTRUMENT

Table 1 presents the complete questionnaire in a single table.

Table 1 *Structured Questionnaire Used for Data Collection*

Code	Construct	Item	Response Format
A1	Profile	Age group	<30 / 30–45 / 46–60 / >60
A2	Profile	Gender	Male / Female
A3	Profile	Education level	No formal / Primary–Middle / Secondary–HSC / Graduate
A4	Profile	Landholding size	<2.5 / 2.5–5 / >5 acres
A5	Profile	Main crop and annual farm income	Open / range
A6	Profile	Owns a smartphone and has internet access	Yes / No
B1	Digital payment adoption	I regularly use UPI/QR code to make payments	5-point Likert
B2	Digital payment adoption	I use debit/RuPay card or ATM for transactions	5-point Likert
B3	Digital payment adoption	I use mobile or internet banking	5-point Likert
B4	Digital payment adoption	I receive crop payments or subsidies in my bank account	5-point Likert
B5	Digital payment adoption	I pay input suppliers (seed, fertilizer) digitally	5-point Likert
B6	Digital payment adoption	Modes of digital payment used (UPI, card, mobile banking, AEPS, internet banking)	Multiple choice
C1	Access	A bank branch or banking agent is easily reachable	5-point Likert
C2	Access	Opening and operating my account is easy	5-point Likert
C3	Access	I have a bank account in my own name	5-point Likert
C4	Usage	I use my account frequently, not only for subsidies	5-point Likert
C5	Usage	I save regularly in a formal account	5-point Likert
C6	Usage	I use insurance, credit, or pension services	5-point Likert
C7	Quality	Financial services meet my farming needs	5-point Likert
C8	Quality	I understand the charges and terms of services	5-point Likert
C9	Quality	I trust formal financial institutions	5-point Likert
C10	Welfare	I can manage emergencies without borrowing from moneylenders	5-point Likert
C11	Welfare	My access to institutional credit has improved	5-point Likert
C12	Welfare	Digital payments have saved me time and travel cost	5-point Likert

Code	Construct	Item	Response Format
D1	Barriers	Poor network connectivity	5-point Likert
D2	Barriers	Limited digital literacy	5-point Likert
D3	Barriers	Fear of fraud or wrong transfers	5-point Likert
D4	Barriers	Language and interface difficulty	5-point Likert
D5	Barriers	Transaction or data costs	5-point Likert

Variables and Tools of Analysis

The independent variable was digital payment adoption (mean of B1–B5), and the dependent variable was financial inclusion (mean of C1–C12).

Data were analysed using SPSS, applying percentage analysis, means and standard deviations, Pearson correlation, one-way ANOVA, and simple linear regression. Internal consistency was satisfactory, with Cronbach's α = .87 for the adoption scale and .89 for the financial inclusion scale, both above the conventional .70 threshold.

VII. DATA ANALYSIS AND INTERPRETATION

Socio-Economic Profile of Respondents

Table 2 *Demographic Profile of Respondents (N = 110)*

Variable	Category	f	%
Age	Below 30	18	16.4
	30–45	41	37.3
	46–60	37	33.6
	Above 60	14	12.7
Gender	Male	82	74.5
	Female	28	25.5
Education	No formal schooling	19	17.3
	Primary/Middle	31	28.2
	Secondary/HSC	38	34.5
	Graduate	22	20.0
Landholding	Below 2.5 acres	52	47.3
	2.5–5 acres	38	34.5
	Above 5 acres	20	18.2

Most respondents (70.9%) were between 30 and 60 years old, and three-quarters were men, reflecting the pattern of land ownership in the district.

Nearly half were marginal farmers with fewer than 2.5 acres, and about four in five had completed at least primary education.

Pattern of Digital Payment Adoption

Table 3 *Digital Payment Modes Used by Respondents (Multiple Responses, N = 110)*

Payment Mode	f	%
UPI / QR code	89	80.9
Debit / RuPay card or ATM	78	70.9
Mobile banking	47	42.7
AEPS (Aadhaar-enabled payments)	36	32.7
Internet banking	12	10.9

UPI is by far the most widely used mode, which fits its low cost and simple interface. Farmers' use of more advanced channels such as internet banking remains minimal. See Figure 1.

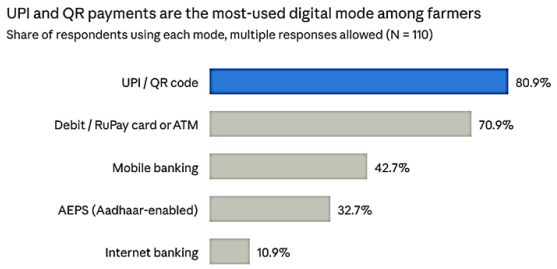

Figure 1: *Digital Payment Modes Used by Farmers*

Survey data, N = 110 farmers, rural Karur District

Level of Financial Inclusion

Table 4 *Descriptive Statistics for Adoption and Financial Inclusion Dimensions*

Variable	M	SD	Level
Digital payment adoption	3.84	0.69	High
Access	4.02	0.71	High
Usage	3.78	0.80	Moderate–High
Quality	3.61	0.77	Moderate
Welfare	3.69	0.74	Moderate–High
Overall financial inclusion	3.78	0.66	Moderate–High

Access scored highest, confirming that the basic banking infrastructure is now largely in place. Quality scored lowest: farmers have accounts and use them, but many still find charges and terms hard to understand and feel services are not designed around the farm calendar. See Figure 2.

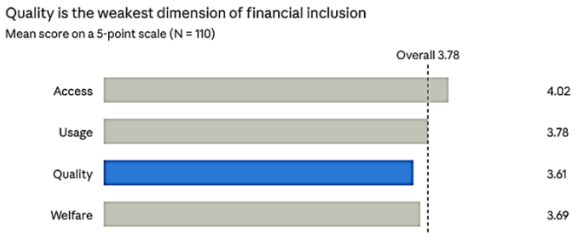

Figure 2: *Mean Scores of Financial Inclusion Dimensions*

Survey data, N = 110 farmers, rural Karur District

Digital Payment Adoption and Education

Table 5 *One-Way ANOVA: Digital Payment Adoption by Education Level*

Education	n	M	SD
No formal schooling	19	3.31	0.72
Primary/Middle	31	3.69	0.66
Secondary/HSC	38	4.02	0.58
Graduate	22	4.31	0.49

The difference across groups was statistically significant, $F(3, 106) = 11.84$, $p < .001$, supporting H_2. Adoption rises steadily with each level of schooling.

Relationship between Adoption and Financial Inclusion

A Pearson correlation showed a strong, positive relationship between digital payment adoption and overall financial inclusion, $r(108) = .68$, $p < .001$.

Table 6 *Simple Linear Regression Predicting Financial Inclusion from Digital Payment Adoption*

Predictor	B	SE	β	t	p
Constant	1.28	0.26		4.92	< .001
Digital payment adoption	0.65	0.07	.68	9.63	< .001

Note. $R^2 = .46$, adjusted $R^2 = .46$, $F(1, 108) = 92.70$, $p < .001$.

Digital payment adoption explained 46% of the variance in financial inclusion. Each one-point increase in adoption was associated with a 0.65-point increase in inclusion, so H_1 is supported.

Barriers to Digital Payment Use

Table 7 *Mean Scores of Barriers (N = 110)*

Barrier	M	SD
Poor network connectivity	3.92	0.88
Limited digital literacy	3.85	0.91
Fear of fraud or wrong transfers	3.71	0.95
Language and interface difficulty	3.40	1.02
Transaction or data costs	2.76	1.10

Connectivity and digital literacy were the most serious obstacles. Interestingly, cost was the least concerning, which suggests that the main problem is no longer affordability but confidence and infrastructure. See Figure 3.

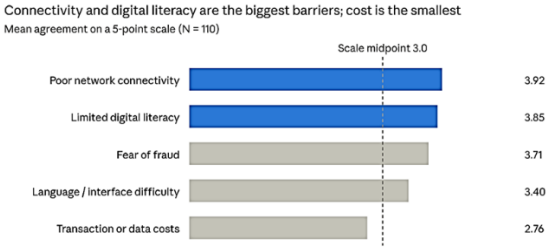

Figure 3: *Barriers to Digital Payment Use*

Survey data, N = 110 farmers, rural Karur District

VIII. FINDINGS

- Most respondents were male (74.5%), aged 30–60 years, with secondary schooling or below and holdings under five acres.
- UPI/QR payments were the most common mode (80.9%), followed by debit cards (70.9%) and mobile banking (42.7%). Internet banking was rarely used (10.9%).
- Overall financial inclusion was moderate to high (M = 3.78). Access was strongest (M = 4.02) and quality weakest (M = 3.61).
- Digital payment adoption differed significantly by education level, $F(3, 106) = 11.84$, $p < .001$.
- Adoption was a strong and significant predictor of financial inclusion ($\beta = .68$, $R^2 = .46$, $p < .001$).
- Network connectivity, digital literacy, and fear of fraud were the leading barriers, while cost was the least.

- Farmers with larger holdings and more schooling were more likely to use multiple payment modes and formal credit.

IX. SUGGESTIONS

- Make digital literacy local and practical. Short, repeated sessions at village panchayat offices, cooperative societies and Rythu/Uzhavar-style farmer meetings, taught in Tamil with live demonstrations, will do more than printed pamphlets.
- Strengthen rural connectivity. Telecom operators and the government should prioritise network coverage in farm areas and offer offline-capable options such as USSD-based *99# and AEPS.
- Build trust against fraud. Banks should run awareness campaigns on common scams, set up simple helplines in the local language, and make dispute resolution quick.
- Use trusted local agents. Business correspondents, cooperative staff, and agri-input dealers can help first-time users and elderly farmers complete transactions confidently.
- Design for farmers. Vernacular, voice-based, and icon-driven app interfaces, with credit and insurance products linked to crop cycles, would improve the quality of inclusion.
- Bring women farmers in. Targeted training through self-help groups can narrow the gender gap observed in the sample.
- Link payments to credit. Using digital transaction history to support Kisan Credit Card limits and micro-insurance would turn payment adoption into real financial resilience.

X. CONCLUSION

This study set out to find out whether digital payments move farmers closer to full financial inclusion. The answer from rural Karur is a qualified yes. Farmers who adopt digital payments are markedly more included, and the relationship holds across access, usage, quality, and welfare. Yet adoption is uneven. Education, landholding, connectivity, and confidence in the system still decide who benefits, and the quality of services lags behind access.

The lesson is that technology alone does not create inclusion; people, trust, and design do. Policymakers, banks, and fintech providers who invest in literacy, local agents, and farmer-friendly products are likely to convert today's wave of QR-code payments into lasting financial security for rural households.

XI. LIMITATIONS AND FUTURE RESEARCH.

The study covers a single district with a modest sample of 110, relies on self-reported data, and uses a cross-sectional design, so causality cannot be firmly established. Future work could use larger multi-district samples, panel data, and structural equation modelling.

REFERENCES

[1] M. Sarma and J. Pais, “Financial inclusion and development,” *Journal of International Development*, vol. 23, no. 5, pp. 613–628, 2011, doi: 10.1002/jid.1698.

[2] W. Jack and T. Suri, “Risk sharing and transactions costs: Evidence from Kenya's mobile money revolution,” *American Economic Review*, vol. 104, no. 1, pp. 183–223, 2014, doi: 10.1257/aer.104.1.183.

[3] J. C. Aker and I. M. Mbiti, “Mobile phones and economic development in Africa,” *Journal of Economic Perspectives*, vol. 24, no. 3, pp. 207–232, 2010, doi: 10.1257/jep.24.3.207.

[4] P. K. Ozili, “Impact of digital finance on financial inclusion and stability,” *Borsa Istanbul Review*, vol. 18, no. 4, pp. 329–340, 2018, doi: 10.1016/j.bir.2017.12.003.

[5] M. Ponraj and R. Padmanaban, “The impact of online agricultural education on farming practices in Karur City,” *International Journal of Scientific Research and Technology*, vol. 3, no. 9, pp. 178–189, 2026.

[6] G. Dinesh Kumar and S. Rahini, “Leveraging digital technology to enhance financial inclusion through microfinance in Tamil Nadu,” *International Journal of Engineering and Management Research*, vol. 15, no. 1, pp. 126–133, 2025.