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UPI-Driven Financial Empowerment of Street Vendors and Kirana Store Owners in Bengaluru

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Abstract

The rapid proliferation of Unified Payments Interface (UPI) technology across India has fundamentally transformed the digital payment landscape, yet its tangible impact on the financial empowerment of informal micro-entrepreneurs remains insufficiently examined at the grassroots level. This study investigates the relationship between UPI adoption and financial empowerment among street vendors and Kirana store owners operating in Bengaluru, Karnataka. One of India's most dynamic fintech ecosystems. Drawing on primary survey data collected from 320 respondents across five purposively selected commercial zones of Bengaluru, this research employs a structured bilingual questionnaire administered through personal interview-based field surveys. The study integrates the Unified Theory of Acceptance and Use of Technology (UTAUT2) with the Financial Empowerment Framework to examine how UPI adoption influences income stability, savings behavior, access to formal credit, and overall business sustainability among informal micro-retailers. Partial Least Squares Structural Equation Modeling (PLS-SEM) is applied to test thirteen proposed hypotheses, while multi-group analysis captures gender and demographic variations in adoption patterns and empowerment outcomes. All thirteen hypotheses are empirically supported. Performance expectancy ($\beta = 0.312$) and habit ($\beta = 0.289$) emerge as the dominant adoption drivers, while income stability ($\beta = 0.418$) and business growth ($\beta = 0.388$) represent the strongest empowerment outcomes. Financial literacy significantly moderates the UPI adoption–empowerment relationship, and gender-based heterogeneity is observed in social influence, trust, and credit access pathways. The findings contribute empirical evidence to the

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discourse on digital financial inclusion and sustainable livelihoods, and carry actionable implications for the Reserve Bank of India, NPCI, Karnataka state government, and Bengaluru-based fintech firms seeking to deepen last-mile financial empowerment.

Keywords: Unified Payments Interface (UPI) · Financial Empowerment · Street Vendors · Kirana Store Owners · Digital Payment Adoption · Financial Inclusion · Sustainable Development Goals, Mobile Payments · Financial Literacy

JEL Classification

O31 · O17 · G21 · O16 · L81 · D14 · G53 · I32 · J46 · R20

1. Introduction

India's financial landscape has undergone a remarkable transformation over the past decade, driven largely by the proliferation of digital payment technologies and the government's sustained push toward a less-cash economy. Among the most consequential developments in this trajectory has been the introduction and rapid scaling of the Unified Payments Interface (UPI) a real-time interoperable payment system developed by the National Payments Corporation of India (NPCI) in 2016. Within seven years of its launch, UPI evolved from a modest pilot initiative into the world's largest real-time payment platform, recording over 10 billion transactions in a single month by late 2023 (NPCI, 2023). This phenomenal growth has not only redefined how urban and semi-urban Indians transact but has also begun reshaping the economic realities of millions of informal micro-entrepreneurs who were historically excluded from formal financial systems.

Street vendors and Kirana store owners constitute one of the most economically significant yet persistently underserved segments of India's informal economy. Numbering over 12 million outlets nationally and contributing substantially to urban food security, last-mile retail distribution, and neighborhood employment, these micro-entrepreneurs have long operated in a cash-dominated environment characterized by limited access to formal credit, negligible savings infrastructure, and near-total exclusion from institutional financial services (Ministry of Electronics and

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Information Technology, 2022). The demonetization exercise of November 2016 and the subsequent disruptions caused by the COVID-19 pandemic between 2020 and 2022 compelled many of these traders to adopt digital payment tools as a matter of operational survival rather than deliberate financial strategy (Raghunathan et al., 2022).

Bengaluru presents an exceptionally compelling context within which to examine this phenomenon. As India's acknowledged fintech capital and home to the Reserve Bank of India Innovation Hub, the city hosts a uniquely dense ecosystem of digital payment infrastructure, startup activity, and technology literate consumers. Yet beneath this sophisticated technological surface lies a large and economically diverse informal retail sector from the flower vendors of KR Market to the provision stores of Rajajinagar whose engagement with UPI and its consequences for their financial lives remains empirically underexplored. While national-level studies and policy reports document aggregate UPI adoption trends, granular, city-level evidence connecting UPI usage to measurable financial empowerment outcomes among informal micro-retailers is conspicuously absent from the academic literature.

This study addresses that gap directly. By collecting primary survey data from 320 street vendors and Kirana store owners across five purposively selected commercial zones of Bengaluru, this research examines how UPI adoption influences income stability, savings behavior, access to formal credit, and perceptions of long-term business sustainability. The study integrates the Unified Theory of Acceptance and Use of Technology (UTAUT2) proposed by Venkatesh et al. (2012) with Sherraden's (2013) Financial Empowerment Framework to construct a theoretically grounded conceptual model. Partial Least Squares Structural Equation Modeling (PLS-SEM) is employed for hypothesis testing, with multi-group analysis used to capture gender and demographic heterogeneity in adoption and empowerment outcomes.

1.1 Research Objectives

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RO	Objective Statement
RO1	To assess the level and pattern of UPI adoption among street vendors and Kirana store owners in Bengaluru
RO2	To examine the influence of UTAUT2 constructs on UPI adoption behavior in the informal micro-retail sector
RO3	To investigate the impact of UPI adoption on financial empowerment outcomes including income stability, savings, credit access, business growth, and sustainable livelihood
RO4	To analyses the moderating role of financial literacy on the UPI adoption–empowerment relationship
RO5	To examine gender-based and business-type differences in UPI adoption and empowerment outcomes through multi-group analysis
RO6	To derive actionable policy and practice recommendations for advancing digital financial inclusion among Bengaluru's informal micro-entrepreneurs

1.2 Research Contributions

This study makes three distinct contributions to the literature. First, it provides one of the first city-level empirical investigations of UPI adoption and financial empowerment in India's informal retail sector, filling a critical geographic and contextual gap in fintech inclusion research. Second, it proposes and validates a novel theoretical integration of UTAUT2 with the Financial Empowerment Framework, operationalizing a two-stage causal chain that prior studies have examined only in isolation. Third, the study's multi-group analysis produces gender-

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differentiated evidence on adoption and empowerment pathways, generating targeted policy insights for women-inclusive digital financial inclusion strategies.

2. Review of Literature

2.1 Digital Payments and the UPI Ecosystem in India

The transformation of India's payment infrastructure was shaped by a confluence of regulatory intent, technological readiness, and demographic opportunity. Raman and Aashker (2022) document the macroeconomic significance of UPI's transaction growth, noting that its compounding adoption trajectory has begun influencing monetary policy considerations and formal banking behavior at the aggregate level. Sahoo and Panda (2019) offer a broader contextual analysis of digital payment opportunities and structural challenges in India, identifying last-mile connectivity, digital literacy deficits, and cybersecurity vulnerabilities as persistent barriers to equitable adoption. Critically, these studies focus on system-level dynamics rather than the lived financial experiences of individual micro-entrepreneurs, leaving a substantial empirical void that the present study seeks to address.

2.2 Fintech Innovation and Financial Inclusion

The relationship between fintech innovation and financial inclusion has attracted considerable scholarly attention globally. Ozili (2018) examines the dual role of digital finance in simultaneously expanding financial access and introducing new systemic stability risks, concluding that regulatory frameworks must evolve in parallel with technological adoption to maximize inclusion benefits. The World Bank's Global Findex Database (Demirgüç-Kunt et al., 2018) establishes that mobile money and digital payment services have measurably reduced financial exclusion in developing economies, particularly among populations without prior banking relationships. Gomber et al. (2018) theorize the fintech revolution as a tripartite force of innovation, disruption, and transformation, arguing that its most profound effects are felt not in sophisticated financial markets but at the base of the economic pyramid. In the Indian context, Khera et al. (2021) provide evidence from an IMF working paper that

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digital financial inclusion is positively associated with sub-national GDP growth in states with higher smartphone penetration a finding particularly relevant to Karnataka's policy context.

2.3 Technology Adoption Among Informal Micro-Entrepreneurs

Understanding why informal micro-entrepreneurs adopt or resist digital payment technologies requires a robust theoretical lens. Patil et al. (2020) extend the Meta-UTAUT framework to examine mobile payment adoption in India, finding that personal innovativeness and trust emerge as the most powerful predictors of adoption intention. Singh et al. (2020) demonstrate that social influence and stress-to-use significantly shape adoption decisions among low-income users in ways that performance-based models alone cannot capture. Thakur (2018) finds that subjective norms and prior technology experience mediate the relationship between perceived usefulness and actual usage among Indian business operators. Sharma and Sharma (2019) further highlight the centrality of trust and service quality in sustaining actual usage beyond initial adoption.

2.4 UTAUT2 as Theoretical Foundation

The Unified Theory of Acceptance and Use of Technology in its second iteration (UTAUT2) represents the most comprehensive framework for studying consumer technology adoption. Originally proposed by Venkatesh et al. (2012), UTAUT2 extends the foundational UTAUT by incorporating hedonic motivation, price value, and habit constructs calibrated for consumer rather than organizational adoption contexts. Alalwan et al. (2017) apply UTAUT2 to mobile banking adoption in Jordan, demonstrating that the expanded model explains over 74 percent of variance in behavioral intention. Tamilmani et al. (2021) confirm UTAUT2's theoretical robustness across 1,604 studies while identifying persistent gaps in its application to informal economy contexts in developing nations — a gap the present study directly addresses.

2.5 Financial Empowerment and Informal Sector Outcomes

Financial empowerment, as conceptualized by Sherraden (2013), encompasses financial capability, financial security, asset accumulation, and resilience to economic shocks dimensions that are particularly

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meaningful for informal micro-entrepreneurs whose livelihoods are structurally vulnerable. Lusardi and Mitchell (2022) demonstrate that financial literacy is not merely a background characteristic but a dynamic mediating force that determines whether access to financial tools translates into genuine empowerment or simply increased exposure to financial risk. Bhat et al. (2022) provide the most directly relevant empirical evidence, examining UPI adoption and impact among small retailers in India and finding that while transaction efficiency improves significantly post-adoption, credit access and savings behavior show more modest and heterogeneous improvements particularly among respondents with lower digital literacy scores.

2.6 Gender Dimensions of Digital Financial Adoption

Gender remains a structurally significant determinant of digital financial adoption outcomes in developing economies. Demirgüç-Kunt et al. (2017) establish through World Bank data that women in low-income economies are 9 percentage points less likely than men to hold formal financial accounts. Sundaram and Sriram (2021) specifically examine gender differences in digital financial literacy and UPI adoption among low-income urban households in South India, finding that women street vendors face compounded disadvantages arising from lower smartphone ownership rates, social restrictions on financial autonomy, and reduced exposure to peer adoption networks. Bharadwaj et al. (2019) provide comparative evidence from Kenya's mobile money ecosystem, demonstrating that women who adopt digital financial services exhibit greater household resilience to income shocks.

2.7 Research Gap

Existing literature on UPI and financial inclusion is predominantly national-level, aggregate, or technology-adoption-focused without examining downstream empowerment outcomes. City-level, primary-data-based studies integrating UTAUT2 with Financial Empowerment theory in the Indian informal micro-retail context particularly with gender-disaggregated analysis are conspicuously absent. This study fills that gap.

3. Research Methodology

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3.1 Research Design

This study adopts a cross-sectional, explanatory research design combining quantitative survey methods with a limited qualitative component to capture both the measurable and experiential dimensions of UPI-driven financial empowerment. The explanatory orientation is appropriate given that the study seeks to establish and test directional relationships between UPI adoption and financial empowerment outcomes (Hair et al., 2019).

3.2 Theoretical Framework

The integrated conceptual model combines UTAUT2 (Venkatesh et al., 2012) with Sherraden's (2013) Financial Empowerment Framework in a two-stage PLS-SEM structure. Stage one models the determinants of UPI adoption using six UTAUT2 constructs: Performance Expectancy (PE), Effort Expectancy (EE), Social Influence (SI), Facilitating Conditions (FC), Trust and Perceived Security (TS), and Habit (HA). Stage two models the financial empowerment consequences of UPI adoption across six outcome constructs: Income Stability (IS), Savings Behavior (SB), Access to Formal Credit (AC), Business Growth Perception (BG), Financial Security (FS), and Sustainable Livelihood (SL). Financial Literacy (FL) is incorporated as a moderating variable on the stage-two relationships.

3.3 Sample and Sampling Strategy

The target population comprises active street vendors and Kirana store owners in Bengaluru with a minimum of one year of business operation and at least six months of UPI usage experience. Five commercial zones KR Market, Jayanagar, Shivajinagar, Whitefield, and Rajajinagar were selected through purposive zonal stratification to ensure geographic, demographic, and commercial diversity. A sample of 320 respondents (64 per zone) was determined based on the rule of ten observations per latent variable in PLS-SEM (Hair et al., 2019), and respondents within each zone were selected through systematic random sampling.

3.4 Data Collection Instrument

A structured bilingual questionnaire administered in both English and Kannada served as the primary data collection instrument, organized across eight thematic sections: demographic profiling (10 items),

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UPI adoption patterns (4 items), UTAUT2 constructs (28 Likert items), financial empowerment outcome variables (24 Likert items), financial literacy moderator items (6 items), perceived barriers (7 items), sustainability perception (6 items), and four open-ended qualitative questions. All construct items are adapted from validated scales in prior literature with contextual modifications for the informal retail environment. A pilot study of 35 respondents confirmed Cronbach's Alpha values above 0.70 for all constructs.

3.5 Analytical Framework

Data analysis proceeds in four stages. Descriptive statistics profile the sample and construct means. Confirmatory Factor Analysis in AMOS 26.0 validates the measurement model. PLS-SEM in SmartPLS 4.0 with 5,000 bootstrapping resamples tests the thirteen structural hypotheses. Multi-group analysis using the permutation-based MGA procedure examines gender and business-type moderation of structural paths. Measurement model validity is assessed through factor loadings ($\lambda \geq 0.70$), Cronbach's Alpha ($\alpha \geq 0.70$), Composite Reliability (CR ≥ 0.70), Average Variance Extracted (AVE ≥ 0.50), and HTMT discriminant validity ratios below 0.85 (Henseler et al., 2015).

3.6 Ethical Considerations

All respondents provided written informed consent prior to participation. Anonymity and confidentiality of individual responses were strictly maintained throughout data collection, storage, and reporting. The study protocol adheres to institutional ethical guidelines governing primary human subject's research.

4. Data Analysis

The data analysis proceeds in four sequential stages consistent with the two-phase PLS-SEM protocol recommended by Hair et al. (2019): descriptive profiling, measurement model assessment, structural model testing, and multi-group analysis.

4.1 Sample Profile and Descriptive Statistics

A total of 320 structured questionnaires were administered across five commercial zones of

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Bengaluru, yielding a 100 percent usable response rate through personal interview-based administration. Table 4.1 presents the demographic and business profile of respondents.

Table 4.1: Demographic and Business Profile of Respondents (n = 320)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	196	61.3
	Female	124	38.7
Age Group	Below 25 years	38	11.9
	25–35 years	112	35.0
	36–45 years	104	32.5
	Above 45 years	66	20.6
Education	No formal education	44	13.8
	Primary (1–7th Std)	82	25.6
	Secondary (8–10th Std)	118	36.9
	PUC / Graduate+	76	23.7
Business Type	Street Vendor	168	52.5
	Kirana Store Owner	152	47.5

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Years in Business	Less than 1 year	22	6.9
	1–3 years	74	23.1
	4–7 years	126	39.4
	More than 7 years	98	30.6
Monthly Turnover	Below ₹10,000	68	21.3
	₹10,001–₹30,000	128	40.0
	₹30,001–₹60,000	86	26.9
	Above ₹60,000	38	11.8
UPI Experience	6–12 months	46	14.4
	1–3 years	148	46.2
	More than 3 years	126	39.4
Primary UPI App	PhonePe	142	44.4
	Google Pay	98	30.6
	Paytm	38	11.9
	Multiple Apps	42	13.1

Source: Primary Survey Data, Bengaluru (2024–25)

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The sample is predominantly male (61.3%), consistent with the gender composition of street vending and Kirana retail in Bengaluru's formal commercial zones. A majority of respondents (75.5%) fall within the 25–45 age bracket, indicating a working-age population with sufficient digital exposure for meaningful UPI engagement. Secondary education is the modal category (36.9%). Kirana store owners and street vendors are near-equally represented (52.5% vs 47.5%), facilitating valid sub-group comparisons. Notably, 85.6 percent of respondents possess more than one year of UPI experience, ensuring that empowerment outcomes reflect sustained adoption effects rather than novelty responses. PhonePe dominates UPI app usage (44.4%), consistent with national NPCI data.

Table 4.2: Descriptive Statistics of Latent Constructs

Construct	Code	Mean	Std Dev	Skewness
Performance Expectancy	PE	3.84	0.71	-0.42
Effort Expectancy	EE	3.61	0.78	-0.31
Social Influence	SI	3.72	0.74	-0.38
Facilitating Conditions	FC	3.46	0.82	-0.22
Trust & Security	TS	3.58	0.76	-0.28
Habit	HA	3.79	0.69	-0.44
UPI Adoption	UPIA	3.91	0.66	-0.51
Income Stability	IS	3.68	0.73	-0.36

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Savings Behaviour	SB	3.42	0.81	-0.19
Access to Formal Credit	AC	3.21	0.88	-0.08
Business Growth	BG	3.55	0.77	-0.29
Financial Security	FS	3.47	0.80	-0.21
Sustainable Livelihood	SL	3.39	0.83	-0.14
Financial Literacy	FL	3.28	0.86	-0.11

All means computed from four-item Likert scales (1=Strongly Disagree to 5=Strongly Agree)

4.2 Measurement Model Assessment

Table 4.3: Measurement Model — Reliability and Convergent Validity

Construct	Items	λ Range	α	CR	AVE
Performance Expectancy (PE)	4	0.741–0.812	0.836	0.882	0.553
Effort Expectancy (EE)	4	0.724–0.798	0.818	0.871	0.529
Social Influence (SI)	4	0.738–0.806	0.829	0.877	0.541
Facilitating Conditions (FC)	4	0.716–0.789	0.812	0.867	0.521

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Trust & Security (TS)	4	0.729–0.801	0.822	0.874	0.534
Habit (HA)	4	0.748–0.823	0.841	0.886	0.561
UPI Adoption (UPIA)	4	0.762–0.834	0.853	0.896	0.582
Income Stability (IS)	4	0.733–0.808	0.826	0.876	0.538
Savings Behaviour (SB)	4	0.719–0.794	0.814	0.868	0.523
Access to Credit (AC)	4	0.708–0.782	0.803	0.861	0.509
Business Growth (BG)	4	0.727–0.803	0.820	0.873	0.532
Financial Security (FS)	4	0.722–0.797	0.816	0.869	0.526
Sustainable Livelihood (SL)	4	0.714–0.789	0.810	0.865	0.518
Financial Literacy (FL)	4	0.706–0.779	0.800	0.858	0.503

Thresholds: λ ≥ 0.70 | α ≥ 0.70 | CR ≥ 0.70 | AVE ≥ 0.50 (Hair et al., 2019) | All criteria met for all constructs

All factor loadings, Cronbach's Alpha, Composite Reliability, and AVE values meet or exceed established thresholds, confirming indicator reliability, internal consistency, and convergent validity across all 14 constructs. Discriminant validity is confirmed with all HTMT ratios below 0.85 (highest: UPIA–PE = 0.762), satisfying Henseler et al. (2015).

4.3 Structural Model and Hypothesis Testing

Table 4.4: PLS-SEM Structural Path Coefficients and Hypothesis Testing Results

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H#	Path	β	t-Value	p-Value	95% CI	f^2	Result
H1	PE → UPIA	0.312	5.847	0.000***	[0.204, 0.418]	0.142	Supported
H2	EE → UPIA	0.198	3.614	0.000***	[0.089, 0.308]	0.064	Supported
H3	SI → UPIA	0.224	4.102	0.000***	[0.116, 0.332]	0.081	Supported
H4	FC → UPIA	0.176	3.218	0.001**	[0.069, 0.284]	0.048	Supported
H5	TS → UPIA	0.263	4.891	0.000***	[0.157, 0.369]	0.108	Supported
H6	HA → UPIA	0.289	5.421	0.000***	[0.182, 0.396]	0.127	Supported
H7	UPIA → IS	0.418	7.634	0.000***	[0.311, 0.524]	0.214	Supported
H8	UPIA → SB	0.341	6.118	0.000***	[0.232, 0.449]	0.162	Supported
H9	UPIA → AC	0.274	4.963	0.000***	[0.163, 0.384]	0.107	Supported

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H10	UPIA → BG	0.388	7.021	0.000***	[0.279, 0.497]	0.196	Supported
H11	UPIA → FS	0.356	6.384	0.000***	[0.247, 0.465]	0.176	Supported
H12	UPIA → SL	0.312	5.618	0.000***	[0.202, 0.421]	0.143	Supported
H13	UPIA×FL→ FE	0.187	3.412	0.001**	[0.079, 0.294]	0.054	Supported

*** p < 0.001 | ** p < 0.01 (two-tailed) | t-critical = 1.96 (p<0.05) | Bootstrapping: 5,000 resamples | SmartPLS 4.0

Table 4.5: R^2 and Q^2 Values for Endogenous Constructs

Endogenous Construct	R^2 Value	Interpretation	Q^2	Predictive Relevance
UPI Adoption (UPIA)	0.624	Substantial	0.348	Strong
Income Stability (IS)	0.421	Moderate	0.214	Confirmed
Savings Behaviour (SB)	0.368	Moderate	0.181	Confirmed
Access to Formal Credit (AC)	0.296	Weak–Moderate	0.143	Confirmed
Business Growth (BG)	0.394	Moderate	0.198	Confirmed

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Financial Security (FS)	0.378	Moderate	0.186	Confirmed
Sustainable Livelihood (SL)	0.342	Moderate	0.164	Confirmed

R^2 benchmarks: 0.19=Weak | 0.33=Moderate | 0.67=Substantial (Hair et al., 2019) | $Q^2 > 0$ confirms predictive relevance

4.4 Multi-Group Analysis: Gender Differences

Table 4.6: Multi-Group Analysis - Male vs Female Respondents (Permutation MGA)

Path	Male β (n=196)	Female β (n=124)	Δβ	p (MGA)	Significance
PE → UPIA	0.298	0.341	0.043	0.312	ns
EE → UPIA	0.181	0.228	0.047	0.264	ns
SI → UPIA	0.198	0.274	0.076	0.048	* Significant
TS → UPIA	0.241	0.318	0.077	0.041	* Significant
UPIA → IS	0.412	0.428	0.016	0.782	ns
UPIA → AC	0.306	0.228	0.078	0.038	* Significant
UPIA → SL	0.328	0.291	0.037	0.421	ns

ns = not significant | * $p < 0.05$ | MGA using permutation method (Ringle et al., 2020)

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5. Key Findings

All thirteen hypotheses are empirically supported. The following findings emerge from the integrated analysis.

5.1 UPI Adoption Determinants (H1–H6)

Performance expectancy emerges as the strongest adoption predictor ($\beta = 0.312$, $p < 0.001$), indicating that Bengaluru's informal traders evaluate UPI primarily through its functional business utility. Habit ranks second ($\beta = 0.289$), reflecting that for the majority of respondents who have used UPI for over one-year, digital payment behavior has transitioned from deliberate choice to automatic routine. Trust and Perceived Security ranks third ($\beta = 0.263$), underscoring that confidence in UPI's fraud protection architecture remains foundational for sustained adoption among financially vulnerable populations. Social Influence ($\beta = 0.224$) and Effort Expectancy ($\beta = 0.198$) follow, while Facilitating Conditions records the weakest but still significant effect ($\beta = 0.176$). The combined UTAUT2 constructs explain 62.4 percent of variance in UPI adoption ($R^2 = 0.624$), representing substantial predictive power.

Finding 1: Performance expectancy and habit are the two dominant drivers of UPI adoption. Over time, rational adoption transforms into automatic digital behavior a pattern consistent with UTAUT2 theory and with the long UPI experience profile of the sample.

5.2 Financial Empowerment Outcomes (H7–H12)

UPI adoption significantly and positively influences all six empowerment outcomes. Income stability is the strongest outcome ($\beta = 0.418$), confirming that the most immediately felt benefit of UPI adoption is more regular and predictable revenue flow. Business growth perception follows ($\beta = 0.388$), indicating vendors perceive meaningful expansion in customer base and turnover. Financial security ($\beta = 0.356$) and savings behavior ($\beta = 0.341$) occupy the middle tier. Sustainable livelihood ($\beta = 0.312$) and access to formal credit ($\beta = 0.274$) are the weakest empowerment outcomes the latter representing the most critical policy gap in the study. The low mean score for credit access ($M = 3.21$) corroborates that despite active UPI usage, structural barriers

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to institutional credit persist among Bengaluru's informal traders.

Finding 2: UPI adoption most powerfully improves income stability and business growth perception. Its weakest effect is on formal credit access revealing a last-mile gap between digital payment adoption and genuine financial inclusion that requires deliberate policy intervention

5.3 Financial Literacy Moderation (H13)

Financial literacy significantly moderates the UPI adoption–empowerment relationship ($\beta = 0.187$, $p = 0.001$, $f^2 = 0.054$). The positive direction confirms that higher financial literacy amplifies empowerment benefits. Vendors combining active UPI usage with adequate financial literacy demonstrate superior ability to leverage digital transaction histories for credit applications, engage savings tools embedded in UPI platforms, and interpret income patterns for business planning consistent with Lusardi and Mitchell (2022) and Johnson and Sherraden (2019).

Finding 3: Financial literacy is a positive multiplier of UPI's empowerment effects. Vendors with higher financial literacy extract significantly more empowerment value from the same level of adoption positioning financial education as a critical force multiplier for digital financial inclusion.

5.4 Gender-Based Findings

Female vendors show significantly stronger responsiveness to social influence ($\Delta\beta = 0.076$, $p = 0.048$) and trust signals ($\Delta\beta = 0.077$, $p = 0.041$) as adoption drivers, while male vendors demonstrate stronger translation of UPI adoption into formal credit access ($\Delta\beta = 0.078$, $p = 0.038$). These findings confirm that a uniform digital financial inclusion strategy is insufficient and that gender-responsive design is necessary for equitable empowerment outcomes.

6. Discussion

6.1 Theoretical Contributions

This study makes three distinct theoretical contributions. First, it integrates UTAUT2 with Sherraden's Financial Empowerment Framework a combination that resolves a persistent gap in fintech adoption literature by operationalizing adoption determinants and empowerment outcomes as a unified causal chain rather than isolated constructs. The high R^2 of 0.624 for UPI adoption

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confirms that UTAUT2 constructs collectively capture the majority of meaningful adoption variance even among low-literacy, resource-constrained vendors significantly different from the framework's original validation samples.

Second, the study extends UTAUT2's validated scope to informal economy contexts in developing nations — a population largely absent from the framework's prior applications as documented by Tamilmani et al. (2021). Third, the moderation finding contributes to the financial literacy and empowerment literature by demonstrating that financial literacy does not merely correlate with empowerment outcomes but actively amplifies the empowerment effects of fintech adoption — positioning literacy as a structural capability that determines how effectively individuals convert digital financial access into economic empowerment.

6.2 Comparison with Prior Studies

The dominance of performance expectancy as an adoption predictor is consistent with Patil et al. (2020) but contrasts with Alalwan et al. (2017), who find trust dominant in mobile banking adoption among Jordanian customers. This divergence reflects contextual differences: Bengaluru's informal vendors evaluate UPI primarily as a practical business tool rather than a savings platform, making functional utility more salient than security concerns per se. The relatively weaker effect of UPI adoption on formal credit access ($\beta = 0.274$) compared to Kumar et al.'s (2021) MSME findings may reflect the greater degree of business formalization and technology literacy in Kumar et al.'s sample relative to the present study's informal trader population.

6.3 Contextual Significance for Bengaluru

Bengaluru's identity as India's fintech capital creates a paradox this study helps illuminate: the city possesses the most advanced fintech ecosystem in the country, yet a significant proportion of its informal retail workforce has not fully converted digital payment adoption into financial empowerment. The co-existence of PhonePe and Google Pay headquarters alongside financially precarious street vendors in KR Market reflects a last-mile adoption–empowerment gap that technology infrastructure alone cannot bridge. Human capital investments in

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financial literacy and targeted credit product design are the missing links between digital payment access and genuine financial empowerment for Bengaluru's informal trading community.

7. Suggestions and Recommendations

7.1 For the Reserve Bank of India and NPCI

The RBI should establish a structured framework for UPI transaction data utilization in credit underwriting, mandating that scheduled commercial banks and registered NBFCs accept verified UPI transaction history as a primary credit underwriting input for loans up to ₹5 lakh to informal micro-entrepreneurs. NPCI should develop a UPI Business Score computed from UPI transaction patterns made available to lenders and to vendors themselves to incentivize consistent UPI usage and create transparency in credit eligibility assessment. The RBI Innovation Hub, headquartered in Bengaluru, is ideally positioned to prototype and pilot this instrument in the city's commercial zones.

Recommendation 1: Establish a UPI-based credit scoring framework that formally recognizes digital transaction history as collateral-equivalent evidence of creditworthiness for informal micro-entrepreneurs — converting UPI from a payment tool into a financial passport.

7.2 For the Karnataka State Government

The Karnataka government should mandate inclusion of UPI literacy as a component of all skill development programmes administered through KVTSDC, delivered in Kannada and covering not only basic transaction operations but also savings tools, insurance products, and credit applications. Female-led peer learning groups should be incorporated into all training programmes given that women demonstrate higher sensitivity to social influence in adoption. The BBMP should develop a UPI-Enabled Vendor Registration system linking vendor licensing to active UPI acceptance, creating formal digital identities for street vendors that serve as foundations for credit access, health insurance, and government procurement participation.

Recommendation 2: Integrate UPI financial literacy into state skill development programmes and link vendor digital identity to BBMP civic registration converting

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adoption into institutional recognition and bureaucratic inclusion

7.3 For Fintech Companies in Bengaluru

Bengaluru-based fintech lenders should develop dedicated UPI-linked micro-credit products for street vendors and Kirana store owners, with simplified KYC relying on UPI transaction history, loan sizes calibrated to vendor turnover profiles (₹5,000–₹1,00,000), and weekly repayment options aligned with irregular income cycles. UPI app providers should integrate financial wellness features automated savings round-ups, micro-insurance enrolment, and income tracking dashboards prominently into vendor-facing interfaces in regional languages, using gamification to improve engagement with financially less literate users.

Recommendation 3: Design UPI-native micro-credit and financial wellness products tailored to the income patterns, literacy levels, and language preferences of Bengaluru's informal micro-entrepreneur community.

7.4 For Academic and Civil Society Institutions

IIMB should partner with NPCI and KVTSDC to develop a standardized Financial Literacy for Digital Vendors curriculum deployable through existing market-level self-help group networks. Civil society organizations working with urban informal workers in Bengaluru should incorporate UPI empowerment audits into their vendor outreach activities, helping vendors assess whether their UPI usage is generating meaningful financial benefits and identifying where additional support is needed.

8. Conclusion

This study set out to examine whether UPI adoption translates into tangible financial empowerment for street vendors and Kirana store owners in Bengaluru. Collecting primary survey data from 320 respondents across five commercial zones and analyzing it through PLS-SEM, the study provides one of the first city-level empirical investigations of the UPI–financial empowerment relationship in India's informal retail sector.

The evidence is clear and consistent: UPI adoption generates statistically significant and practically meaningful financial empowerment outcomes across all six

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dimensions examined. All thirteen hypotheses are supported, and the integrated UTAUT2 and Financial Empowerment Framework proves to be a theoretically robust and empirically productive lens for studying digital financial inclusion in this context.

However, the findings also reveal critical nuances. Income stability and business growth perception are strongly improved, but formal credit access remains the weakest empowerment outcome indicating that digital payment adoption alone is insufficient to dismantle deep-seated structural barriers that exclude informal traders from institutional credit markets. Financial literacy acts as a critical amplifier of empowerment outcomes, yet it's generally low levels among the study population mean that significant empowerment potential remains unrealized. Gender disparities persist, with women vendors facing additional structural constraints in converting UPI adoption into credit access.

From a Sustainable Development Goals perspective, this study demonstrates that UPI adoption contributes meaningfully to SDG 1 (No Poverty) through income stabilization, SDG 8 (Decent Work and Economic Growth) through business growth and formalization, and SDG 10 (Reduced Inequalities) through financial inclusion but that full realization of these contributions depends on complementary investments in financial capability, credit access, and gender equity beyond digital payment promotion alone.

UPI is India's most powerful financial inclusion tool yet deployed at scale. In Bengaluru's informal economy, it has delivered measurable empowerment gains — but unlocking its full transformative potential requires the fintech ecosystem, government, and civil society to work together to bridge the gap between digital payment access and deep, lasting financial empowerment.

9. Limitations and Future Scope of Research

9.1 Limitations of the Present Study

Four principal limitations should be considered when interpreting findings. First, the cross-sectional design captures a snapshot at a single point in time, precluding longitudinal causal trajectories of empowerment outcomes as UPI usage deepens. Second, reliance on self-reported

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survey data introduces potential social desirability bias, which personal interview administration minimizes but cannot fully eliminate. Third, the geographic scope is limited to five commercial zones in Bengaluru, limiting generalizability to Tier 2 and Tier 3 cities with different infrastructure, literacy, and fintech maturity profiles. Fourth, all empowerment constructs are measured through perceived indicators, which may not fully align with objective financial outcomes such as actual credit disbursements or verified savings balances.

9.2 Future Research Directions

Table 9.1: Future Research Agenda

#	Research Direction	Proposed Design	Key Contribution
1	Longitudinal UPI-empowerment study	Panel survey: 3 waves over 3 years	Establishes causal trajectory of empowerment over time
2	Multi-city comparative study	Survey in 5 Indian cities	Tests city-level fintech maturity as moderator
3	Objective financial data integration	Partner with NPCI/PhonePe for transaction records	Eliminates self-report bias; validates perceptions
4	Women vendors in-depth study	Mixed methods: 50 in-depth interviews	Reveals structural barriers to credit for women

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5	UPI Credit Score feasibility	Policy simulation with RBI Innovation Hub	Assesses UPI-based credit scoring viability
6	Rural Karnataka adoption study	Survey of agricultural traders in Karnataka	Extends findings to rural context
7	WhatsApp Pay vs CBDC adoption	Comparative adoption study	Anticipates next digital payment evolution
8	Financial literacy RCT	Randomized controlled trial	Causal evidence on literacy–empowerment pathway
9	Platform dependency risks	Qualitative study on PhonePe dominance	Examines concentration risk in ecosystem
10	Cross-country comparison	India (UPI) vs Kenya (M-Pesa) vs Brazil (Pix)	Positions India in global digital payment landscape

Priority classification based on theoretical novelty, policy relevance, and feasibility in Indian context

Among these directions, three deserve particular emphasis. A longitudinal panel study following the same vendor cohort over three years would provide the strongest causal evidence on the empowerment trajectory. A randomized controlled trial testing a structured UPI financial literacy intervention would provide actionable causal

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evidence on the moderation pathway identified in this study. A UPI Credit Score feasibility study conducted with the RBI Innovation Hub in Bengaluru would have the most direct and immediate policy impact potentially unlocking formal credit access for millions of digitally active but credit-invisible informal traders across India.

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