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Understanding Customer Trust in Digital Payment Ecosystems: Evidence from UPI Adoption in India

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Abstract

India's Unified Payments Interface (UPI) has emerged as one of the world's largest real-time digital payment systems, processing over 13 billion transactions monthly as of early 2025. Despite this phenomenal macro-level adoption, the behavioural drivers of UPI adoption in Tier 2 and Tier 3 cities remain underexplored. This study empirically investigates the determinants of customer trust and UPI adoption intention through an integrated theoretical framework combining the Technology Acceptance Model (TAM), the Theory of Planned Behaviour (TPB), and Institutional Trust Theory. Drawing on primary data from 215 respondents collected via structured questionnaire between January and February 2026, and analysed using Ordinary Least Squares (OLS) regression, the study finds that Perceived Privacy ($\beta = 0.287$), System Quality ($\beta = 0.269$), Perceived Security ($\beta = 0.227$), and Regulatory Trust ($\beta = 0.193$) are significant antecedents of Trust in UPI ($R^2 = 0.469$). Trust in UPI ($\beta = 0.535$) and Perceived Usefulness ($\beta = 0.288$) together explain 45.6% of variance in Adoption Intention. All seven hypotheses are supported at $p < 0.001$. Findings carry significant implications for fintech firms, banks, and policymakers seeking to deepen digital financial inclusion across semi-urban India.

Keywords: *UPI adoption, customer trust, digital payments, technology acceptance model, perceived privacy, India, Tier 2 and Tier 3 cities, institutional trust.*

1. Introduction

India's financial services landscape has undergone a transformative shift driven by mobile internet penetration, government-backed digital infrastructure, and the 2016 demonetisation policy. At the centre of this shift is the Unified Payments Interface (UPI), a real-time interoperable payment system launched by the National Payments Corporation of India (NPCI) in 2016. By enabling instant, round-the-clock fund transfers using virtual payment addresses (VPAs) linked to bank accounts, UPI has redefined the payments landscape and reduced dependency on cash.

UPI recorded over 13 billion transactions per month as of early 2025, with aggregate value exceeding ₹19 trillion. Yet this macro-level success masks a critical disparity: while urban metros have achieved near-saturated UPI penetration, Tier 2 and Tier 3 cities — home to over 500 million Indians — continue to exhibit more hesitant adoption. Barriers include limited prior experience with formal banking, lower digital literacy, heightened fraud risk perceptions, and weaker institutional trust in technology-mediated financial services.

This study addresses this gap by empirically examining the antecedents of customer trust and their downstream effects on UPI adoption intention among semi-urban consumers. The study integrates TAM (Davis, 1989), TPB (Ajzen, 1991), and Institutional Trust Theory (McKnight & Chervany, 2001) into a unified research model. By

doing so, it contributes original empirical evidence to the digital payments adoption literature and offers actionable insights for practitioners and policymakers.

2. Literature Review and Theoretical Framework

2.1 Technology Acceptance Model (TAM)

Davis (1989) established TAM as the foundational framework for understanding information system adoption, positing that Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) are the primary cognitive determinants of adoption intention. TAM has been extensively validated across digital payment contexts (Venkatesh & Bala, 2008; Oliveira et al., 2016), though its relative explanatory power diminishes in collectivist, semi-urban settings where trust and social norms carry greater weight.

2.2 Theory of Planned Behaviour (TPB)

Ajzen (1991) extended attitude-behaviour models by incorporating Subjective Norms (SN) and Perceived Behavioural Control (PBC) as antecedents of behavioural intention. In collectivist communities such as semi-urban India, subjective norms exert disproportionate influence on technology adoption decisions (Sinha & Mukherjee, 2016; Sharma et al., 2022). Mishra and Singh (2024) found that SN ($\beta = 0.41$) was the dominant predictor of digital payment adoption in Tier 2 cities of Rajasthan.

2.3 Trust and Risk Frameworks

Pavlou (2003) demonstrated that trust significantly reduces perceived risk and enhances adoption intention in e-commerce. McKnight and Chervany (2001) proposed a multidimensional typology distinguishing institutional-based, interpersonal, and dispositional trust. Shaw (2014) confirmed trust as the strongest predictor of mobile wallet adoption in Canada, fully mediating the security-to-adoption pathway. In the Indian context, Singh and Sinha (2020) identified trust as one of the three strongest predictors of UPI adoption among Tier 1 urban users — but their sample excluded semi-urban populations. Kumar et al. (2023) showed that digital literacy significantly moderates the PEOU-to-adoption pathway in Tier 2 cities of Maharashtra, while omitting trust constructs entirely.

2.4 Research Gaps

Three primary gaps motivate this study. First, no prior study integrates TAM, TPB, and Institutional Trust Theory into a unified empirical model for UPI adoption in Tier 2 and Tier 3 cities. Second, the mediating role of customer trust in the relationship between ease-of-use perceptions and adoption intention has not been examined in the Indian UPI context. Third, empirical research disproportionately draws on Tier 1 urban samples, limiting generalisability to the semi-urban populations that represent the next frontier of digital financial inclusion.

3. Research Methodology

3.1 Research Design and Sample

The study adopts a positivist, deductive, cross-sectional quantitative research design. A structured self-administered questionnaire was distributed via online (Google Forms) and offline channels to active UPI users residing in Tier 2 and Tier 3 cities across India, between January and February 2026. Eligibility criteria required respondents to (i) reside in a Tier 2 or Tier 3 city, (ii) own a smartphone with internet access, and (iii) have used UPI at least once in the preceding three months. A total of 215 complete, usable responses were obtained after removing incomplete and outlier-heavy entries.

3.2 Measures

All constructs were operationalised using multi-item Likert scales (1 = Strongly Disagree to 5 = Strongly Agree) adapted from validated instruments in the literature. The seven constructs measured were: Perceived Security (PS, 4 items; Davis, 1989), Perceived Privacy (PP, 4 items; Featherman & Pavlou, 2003), System Quality (SQ, 4 items), Regulatory Trust (RT, 3 items; McKnight & Chervany, 2001), Trust in UPI (TR, 4 items), Perceived Usefulness (PU, 4 items; Davis, 1989), and Adoption Intention (AI, 4 items; Venkatesh et al., 2003).

3.3 Analysis Strategy

Data were analysed using Python (v3.11) with pandas and scipy libraries. The analytical sequence comprised: (i) Cronbach's Alpha reliability analysis; (ii) descriptive statistics; (iii) Pearson bivariate correlation; (iv) OLS multiple regression with two models — Model 1 predicting Trust in UPI from PS, PP, SQ, and RT; and Model 2 predicting Adoption Intention from TR and PU. Multicollinearity was assessed via Variance Inflation Factors (VIF); all constructs returned VIF < 2.0, confirming no multicollinearity.

4. Results

4.1 Sample Profile

The sample skewed young and educated: the 25–34 age cohort formed the largest group (38%), followed by 18–24 year-olds (28%). Male respondents comprised 54%, females 44%, with 2% preferring not to disclose. Regarding education, 44% held postgraduate degrees and 36% undergraduate qualifications. Salaried employees constituted the dominant occupational group (40%), and the majority fell in the ₹25,001–₹1,00,000 monthly income bracket. PhonePe (35%) and Google Pay (32%) were the most-used UPI platforms. In terms of usage frequency, 42% transacted daily and 33% weekly, indicating deep habitual integration of UPI among respondents.

4.2 Reliability Analysis

Cronbach's Alpha values for all seven constructs exceeded the 0.80 'good reliability' threshold (Nunnally & Bernstein, 1994), ranging from 0.854 (Perceived Usefulness) to 0.893 (Adoption Intention), confirming strong internal consistency.

Table 1: Reliability Coefficients and Descriptive Statistics (n = 215)

Construct	Items	Cronbach α	Mean	Std. Dev.	Skewness
Perceived Security (PS)	4	0.876	3.856	0.658	-0.079
Perceived Privacy (PP)	4	0.871	3.643	0.682	-0.165
System Quality (SQ)	4	0.857	3.862	0.640	-0.223
Regulatory Trust (RT)	3	0.859	3.656	0.724	-0.105
Trust in UPI (TR)	4	0.887	3.690	0.713	-0.188
Perceived Usefulness (PU)	4	0.854	3.950	0.549	-0.349
Adoption Intention (AI)	4	0.893	3.923	0.698	-0.300

Note: All items measured on a 5-point Likert scale. Acceptable threshold α ≥ 0.70; Good threshold α ≥ 0.80.

4.3 Correlation Analysis

The Pearson correlation matrix revealed significant positive relationships among all constructs. The strongest association was between Trust in UPI and Adoption Intention ($r = 0.644$, $p < 0.001$), confirming trust as the most powerful predictor of adoption behaviour. Perceived Privacy ($r = 0.541$) and System Quality ($r = 0.520$) exhibited the strongest correlations with Trust in UPI among its antecedents. No inter-construct correlation exceeded 0.70, ruling out multicollinearity concerns and establishing discriminant validity.

Table 2: Pearson Correlation Matrix of Research Constructs

Construct	PS	PP	SQ	RT	TR	PU	AI
PS	1.000	0.427	0.366	0.341	0.482	0.301	0.443
PP	0.427	1.000	0.424	0.384	0.541	0.339	0.441
SQ	0.366	0.424	1.000	0.441	0.520	0.443	0.434
RT	0.341	0.384	0.441	1.000	0.479	0.277	0.397
TR	0.482	0.541	0.520	0.479	1.000	0.433	0.644
PU	0.301	0.339	0.443	0.277	0.433	1.000	0.462
AI	0.443	0.441	0.434	0.397	0.644	0.462	1.000

Note: All correlations significant at $p < 0.01$ (two-tailed). $n = 215$.

4.4 Regression Analysis — Model 1: Predictors of Trust in UPI

The first OLS regression model examined Perceived Security, Perceived Privacy, System Quality, and Regulatory Trust as predictors of Trust in UPI. The model was statistically significant ($F(4, 210) = 46.328$, $p < 0.001$), explaining 46.9% of variance in Trust in UPI ($R^2 = 0.469$, Adjusted $R^2 = 0.459$). All four predictors were significant at $p < 0.001$. Perceived Privacy ($\beta = 0.287$) emerged as the strongest predictor, followed by System Quality ($\beta = 0.269$), Perceived Security ($\beta = 0.227$), and Regulatory Trust ($\beta = 0.193$).

Table 3: OLS Regression Results — Predictors of Trust in UPI (Model 1)

Predictor Variable	β (Unstd.)	Std. Error	t-value	p-value	Sig.
Constant (Intercept)	0.027	0.198	0.137	0.891	ns
Perceived Security (PS)	0.227	0.044	5.114	< 0.001	***
Perceived Privacy (PP)	0.287	0.046	6.268	< 0.001	***
System Quality (SQ)	0.269	0.048	5.649	< 0.001	***
Regulatory Trust (RT)	0.193	0.040	4.798	< 0.001	***

*Note: Dependent variable: Trust in UPI (TR). $R^2 = 0.469$, Adjusted $R^2 = 0.459$, $F(4, 210) = 46.328$, $p < 0.001$. $n = 215$. *** $p < 0.001$.*

4.5 Regression Analysis — Model 2: Predictors of Adoption Intention

The second model examined Trust in UPI and Perceived Usefulness as predictors of Adoption Intention. The model achieved strong explanatory power ($F(2, 212) = 88.900$, $p < 0.001$, $R^2 = 0.456$, Adjusted $R^2 = 0.451$). Trust in UPI

was the dominant predictor (β = 0.535, t = 11.715, p < 0.001), nearly twice the magnitude of Perceived Usefulness (β = 0.288, t = 4.878, p < 0.001).

Table 4: OLS Regression Results — Predictors of Adoption Intention (Model 2)

Predictor Variable	β (Unstd.)	Std. Error	t-value	p-value	Sig.
Constant (Intercept)	0.814	0.263	3.096	0.002	**
Trust in UPI (TR)	0.535	0.046	11.715	< 0.001	***
Perceived Usefulness (PU)	0.288	0.059	4.878	< 0.001	***

*Note: Dependent variable: Adoption Intention (AI). $R^2 = 0.456$, Adjusted $R^2 = 0.451$, $F(2, 212) = 88.900$, $p < 0.001$. $n = 215$. *** $p < 0.001$; ** $p < 0.01$.*

4.6 Hypothesis Testing Summary

All seven hypotheses were supported at p < 0.001, demonstrating the robustness of the integrated conceptual model. Table 5 summarises the outcomes.

Table 5: Comprehensive Hypothesis Testing Summary

Hypothesis	Proposed Path	β	t-value	Outcome
H1	Perceived Security (PS) → Trust in UPI (TR)	0.227	5.114	Supported ***
H2	Perceived Privacy (PP) → Trust in UPI (TR)	0.287	6.268	Supported ***
H3	System Quality (SQ) → Trust in UPI (TR)	0.269	5.649	Supported ***
H4	Regulatory Trust (RT) → Trust in UPI (TR)	0.193	4.798	Supported ***
H5	Trust in UPI (TR) → Perceived Usefulness (PU)	0.311	5.426	Supported ***
H6	Trust in UPI (TR) → Adoption Intention (AI)	0.535	11.715	Supported ***
H7	Perceived Usefulness (PU) → Adoption Intention (AI)	0.288	4.878	Supported ***

*Note: *** $p < 0.001$. $n = 215$. All tests two-tailed.*

5. Discussion

5.1 Perceived Privacy as the Dominant Trust Driver

Perceived Privacy emerged as the single strongest predictor of Trust in UPI (β = 0.287), a finding that represents a meaningful departure from pre-2020 digital payment trust literature, which typically positioned security as the

primary concern (Featherman & Pavlou, 2003). This shift likely reflects heightened data privacy consciousness following the Digital Personal Data Protection Act, 2023, and global sensitivity to data misuse. Users who believe that UPI platforms handle transactional data with discretion and restrict unauthorised third-party sharing exhibit significantly higher trust — underscoring the need for privacy-by-design architecture in fintech product development.

5.2 System Quality and Perceived Security

System Quality (β = 0.269) and Perceived Security (β = 0.227) were the second and third strongest trust antecedents. Platform reliability, transaction accuracy, and prompt confirmation messages significantly shape trust perceptions — consistent with DeLone and McLean's (2003) Information Systems Success Model. Security perceptions are particularly salient for the 35–54 age cohort, who demonstrated relatively higher security consciousness. These findings signal that investment in high-availability infrastructure and proactive security communication are business imperatives for UPI operators.

5.3 Regulatory Trust as an Institutional Anchor

Regulatory Trust (β = 0.193) proved a significant independent predictor of consumer trust, confirming that RBI and NPCI's regulatory oversight functions as a confidence anchor in India's UPI ecosystem. This finding extends Institutional Theory (Scott, 1995) to digital payments in India and highlights the unique role of government-mandated regulatory frameworks — a dimension absent from most Western mobile payment studies (Pavlou, 2003; Shaw, 2014). India's 'Digital India' initiative and RBI's consumer protection architecture are structural assets that market participants can leverage.

5.4 Trust as the Dominant Adoption Driver

Trust in UPI demonstrated the strongest influence on Adoption Intention (β = 0.535), accounting for the dominant share of the 45.6% variance explained. This finding affirms Kim et al.'s (2009) conceptualisation of trust as the critical bridge between technology perceptions and adoption behaviour in mobile payment contexts, and extends it to UPI's interoperable government-backed ecosystem. Perceived Usefulness (β = 0.288) validated TAM's core proposition, confirming that UPI's functional advantages — real-time transfers, zero fees, 24×7 availability — directly motivate adoption. Together, these findings suggest that trust-building and functional value delivery must be pursued as complementary, not alternative, strategies.

6. Implications

6.1 Theoretical Contributions

This study makes three original theoretical contributions. First, it presents an integrated TAM–TPB–Institutional Trust framework calibrated specifically for government-backed digital payment ecosystems in emerging markets, addressing a recognised gap in the extant literature. Second, it empirically validates the multidimensional nature of consumer trust in UPI, confirming that trust is a composite outcome of privacy, security, system quality, and regulatory assurance rather than a monolithic construct. Third, it documents the primacy of privacy over security as a trust antecedent in post-2023 India — a finding that updates and contextualises earlier digital payment trust research.

6.2 Managerial Implications

For fintech firms and UPI platform operators, the findings suggest four priority actions. First, adopt privacy-by-design architecture: embed data minimisation, granular user controls, transparent privacy policies in regional languages, and third-party privacy certification (e.g., ISO 27701) as visible trust signals. Second, invest in system reliability as competitive differentiation: high-availability infrastructure, real-time failure notifications, and

seamless transaction recovery will significantly bolster user confidence. Third, pursue proactive security communication: regular audit disclosures, fraud incident reporting, and user-facing security dashboards — particularly targeted at the 35–54 demographic. Fourth, redesign new user onboarding to address trust concerns at every touchpoint, including security orientation screens and regulatory compliance badges.

For NPCI and RBI, intensifying public-facing trust communication — particularly around dispute resolution mechanisms and zero-liability policies — would leverage institutional legitimacy to accelerate adoption in semi-urban markets.

7. Limitations and Future Research

This study carries several limitations. The cross-sectional design captures perceptions at a single point in time and cannot establish causal directionality or trace trust dynamics over the adoption lifecycle. Purposive and snowball sampling introduces potential selection bias, with the over-representation of highly educated and postgraduate respondents limiting generalisability to lower-literacy rural segments. Self-reported Likert data is susceptible to common method bias. Additionally, the research model does not incorporate moderating variables such as prior negative experience with digital fraud, digital literacy, or UPI regulatory awareness.

Future research should explore several promising directions. Structural Equation Modelling (SEM) via AMOS or SmartPLS would enable simultaneous testing of measurement and structural models, including mediation effects of Trust. Longitudinal panel studies tracking UPI users over 12–24 months would enable causal modelling of trust evolution. Multi-group analysis across urban-rural, age-cohort, and income-bracket segments would reveal whether trust drivers operate differentially across demographic divides. Finally, cross-country comparisons with analogous real-time payment systems — Brazil's PIX, Singapore's PayNow, and Europe's SEPA Instant — would advance global digital payment trust theory.

8. Conclusion

This study delivers a timely and empirically rigorous examination of the architecture of customer trust in India's UPI digital payment ecosystem. Using an integrated TAM–Institutional Trust theoretical framework and OLS regression analysis of 215 active UPI users, the research demonstrates that consumer trust in UPI is a composite outcome of Perceived Privacy, System Quality, Perceived Security, and Regulatory Trust — and that this trust is the single most powerful determinant of adoption intention. All seven hypotheses are supported at $p < 0.001$, with robust model fit ($R^2 = 0.469$ for Trust, $R^2 = 0.456$ for Adoption Intention).

The findings provide a rich evidence base for platform designers, fintech strategists, regulatory authorities, and policymakers seeking to understand what drives Indian consumers to trust and adopt UPI at scale. As India aspires to a $10 trillion digital economy by 2030 with UPI as its transactional backbone, building and communicating trust across its multiple dimensions is not merely a business imperative — it is a national developmental priority.

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