

Theoretical Framework For Upi Adoption: Integrating Tam And Utaut Models

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ABSTRACT

Unified Payment Interface, the most preferred mode of payment has dethroned cash in transactions. The payment platform has found its way into every corner of India, from street vendors to shopping malls, from tech savvy users to first time smartphone users. Since its inception in 2016, the transaction volume has gradually increased from 2 crore transactions in the FY 2016-17 to 24,162 crore transactions in the FY 2026-27 (Press Release: Press Information Bureau, 2026), the mammoth growth in volume of transactions shows how UPI has become synonymous for cashless transactions in India. UPI is not just popular in India, it is embraced by foreign countries such as Nepal, Bhutan, Sri Lanka, Singapore, UAE, France, Mauritius and so on ("Focusing on Making the UPI and RuPay Truly Global, Says RBI Governor," 2024). Thus, the UPI adoption and its usage is substantial in a short period. The study develops and validates a theoretical framework to understand drivers that influence adoption of UPI, by integrating constructs from the "Technology Acceptance Model" (TAM) and the "Unified Theory of Acceptance and Use of Technology" (UTAT) model (Venkatesh et al., 2003), widely tested models for technology adoption and usage. The current model is distinct from prior integrations as PEOU is replaced with User Experience to cater broader concern with reference to the Indian digital payment ecosystem. Structural Equation Modelling is used to examine explanatory and predictive power of this integrated theoretical framework....

INTRODUCTION:

With technological development, the transactional landscape has undergone extensive transformation reshaping the consumer financial behaviour (Venkatesh et al., 2003). The evolution of the payment ecosystem in India stands exceptionally unique with enormous technological evolution and reformation. The journey towards a Cashless Economy is facilitated through Unified Payment Interface (UPI) represents a remarkable innovation in the payment system. National Payment Corporation of India (NPCI) launched UPI in the year 2016, the interface offers instant, secure, interoperable real-time transfer of funds amongst peer to peer, peer to merchant around the clock (Ranapriya et al., 2021). The architecture of the interface features a user-friendly platform that facilitates instant transfer of funds by using users' mobile number linked to a bank account without needing to enter other bank sensitive details. Further, the platform facilitates linkage of multiple bank accounts and provides other utility services varying from mobile recharge to financial services such as investment in stock, gold, mutual funds and so on. The usage of UPI accelerated with Demonetization in 2016 and further fueled with COVID-19 in 2019 (Patil et al., 2020). Besides these political and environmental factors, massive adoption of UPI is associated with other drives such as spur in the usage of smartphones, deployment of 4G/5G networks in internet infrastructure and supportive government policies such Zero Merchant Discount Rates (MDR) (Patil et al., 2020). The success of UPI is evidenced by the volume of transactions; the interface has

processed approximately around 24,162 crore transactions valued over Rs. 314 lakh crores in the FY 2025-26 (Press Information Bureau, 2026). The rapid increase in the volume of adoption and value of transactions have established India as a global leader in the digital payment landscape and the platform has been embraced by international economies such as Nepal, Bhutan, Sri Lanka, the UAE, Mauritius due to its secure infrastructure and operational convenience (Press Release: Press Information Bureau, 2026).

Despite the exponential growth in domestic economy and global acceptance, a critical theoretical gap still exists in determining the factors that drive the behavioural intention of consumers to adopt and use UPI. The adoption metrics vary across different demographics, regions and socio-economic groups, the penetration remains minimal in rural economies due to low income level and limited digital awareness (Sharma & Sharma, 2019), further the UPI faces backlash in urban economies due to security concerns, trust issues, technical issues (Chawla & Joshi, 2021), with high digital literacy and robust infrastructure. Thus, creating digital divide obstructing the objective of financial inclusion.

This paper examines the factors that influence adoption of UPI by integrating existing theoretical frameworks of technological adoption (TAM & UTAUT) systematically.

REVIEW OF LITERATURE

Cognitive Foundation: The "Technology Acceptance Model"

Davis et al. (1989) developed “Technology Acceptance Model” (TAM) to explore the factors influencing adoption of new technology in his study. “Perceived Usefulness”, “Perceived Ease of Use”, were found essential in demonstrating User Acceptance of Information Technology. This model emphasises the importance of user-friendly interfaces in the adoption of technology, the users are highly inclined to adopt a technology when they perceive it as both beneficial and simple to operate. Since then, TAM has been one of the most widely accepted benchmarks in assessing the acceptance of technology. Davis et al. (1989) subsequently evaluated TAM against the “Theory of Reasoned Action” (TRA) and found “TAM” to be the stronger predictor of individual-level adoption. However, because TAM centres exclusively on cognitive beliefs, it leaves out the behavioural, organisational, and contextual influences that matter for digital-payment adoption, specifically a gap that becomes especially apparent in markets like India.

Extending the model: Social and Facilitating Conditions

TAM focuses only on cognitive beliefs, which poses significant limitations in the Indian context as the Indian users adopt payment technologies through peer and family influence. Further, the UPI adoption rate is fueled by factors such as increased use of smartphones, enhanced internet connectivity, supporting infrastructure development and government promotional policies. This gap of ignoring organizational context such as social influence and facilitating factors in exploring the factors that drive UPI adoption is explained with theory “Unified Theory of Acceptance and Use of Technology” (Venkatesh et al., 2003), the theory identifies the role of social and environmental factors in adoption and use of payment systems in Indian context. Thus integrating TAM and UTAUT (Davis, 1989) (Venkatesh et al., 2003) is significant for understanding UPI adoption in emerging markets like India. The study reveals that adoption of technology is not just associated with users’ perception but it is also influenced by facilitating infrastructure and social influence.

TAM and UTAUT models have been adopted in various research studies to understand the digital payment adoption determinants. (Widiawati et al. 2026) used TAM, UTAUT, and TRAM in a systematic study to identify the factors influencing Indonesia's adoption of the QRIS digital payment system. According to the study's findings, adoption and usage of the payment interface are significantly influenced by “Perceived Usefulness”, “Performance Expectancy”, and “Trust”. The results also show that contextual elements like government regulation, fintech infrastructure development, and supporting infrastructure are critical to the uptake and utilisation of digital payment systems.

Research Gap

The review of current academic study signifies limitations in the study of Unified Payments Interface (UPI) adoption as the studies exclude social and technological factors such as user psychology, social influence and supporting policies

Further, currently the researchers either apply the foundation technological adoption model “Technology Acceptance Model” (TAM) or “Unified Theory of Acceptance and Use of Technology” (UTAUT) from foundational theories by (Venkatesh et al., 2003) (Davis, 1989). The integration of these two foundational models is lacking. Such an integrated framework will leverage both model’s perspective to gain better understanding of TAM's emphasis on core usability beliefs with UTAUT's perspective on social and facilitating conditions to understand the UPI adoption.

OBJECTIVES

To determine and validate the factors that influence UPI adoption.

To develop a theoretical framework integrating TAM & UTAUT frameworks to explain UPI adoption

RESEARCH METHODOLOGY

The current study is based on quantitative research to explore the determinants that influence adoption of UPI among Indian Consumers. The theoretical framework is built on “Technology Acceptance Model” (Davis, 1989) and “Unified Theory of Acceptance & Use of Technology” (Venkatesh et al., 2003)

A structured questionnaire to examine adoption of UPI in India’s unique payment ecosystem, the questionnaire is adapted from validated constructs of TAM (Davis, 1989) & UTAUT constructs (Venkatesh et al., 2003). The constructs were modified in the current study to measure unique factors that accelerated adoption of UPI in the Indian context such as facilitating factors, user experience and wide acceptance by merchants. The questionnaires were administered through GForms among UPI users. The questionnaire is broadly classified into demographic factors and TAM & UTAUT constructs with five-point likert scale responses. The target population comprises smartphone users in urban and semi-urban areas, who are actively involved in UPI transactions. Mall Intercept convenience sampling technique is used with a sample size of 128.

The data is analysed using SPSS and SmartPLS. The respondent’s characteristics are summarised using descriptive statistics, and constructs were tested for reliability with Cronbach's alpha. Further the model is examined through “Factor loadings”, “Composite Reliability”(CR), “Average Variance Extracted”(AVE), and “Discriminant validity” tests. “Structural Equation Modelling” (SEM) is later applied to explore the relationships between the constructs of “TAM” & “UTAUT” and UPI adoption.

The proposed model posits that Perceived Usefulness, Social Influence, Facilitating Conditions, User Experience, and Trust each exert a positive influence on Behavioural Intention, which subsequently shapes actual UPI Adoption.

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Demographic Profile of the sample

Fig.1 presents the socio-demographic composition of the respondents.

Gender Distribution: Males constitute 56.3% (72 out of 128) of the respondents, while females make up 43.7% (56 out of 128). There is a noticeable gender imbalance, with more male users than female users

Age Groups: 54% of respondents fall into the 25-35 age group, followed by 23.4% of 36-45 age group (29.2%). 21.9% of respondents are aged 25 and below. Thus, we could conclude that the predominant sample size falls within the younger to middle age groups of 25-35 years.

Educational Qualification: More than half of the respondents (53.1%) are postgraduate qualifications,

followed by 25.0% with undergraduate degrees and 21.9% with doctoral or professional qualifications. The sample represents a highly educated cluster, indicating that users with higher educational qualification will contribute to greater awareness, better understanding leading to acceptance of digital payment technologies such as UPI.

Occupation: 45.3% of the sample represents salaried employees representing the largest group, further business/self-employed individuals constitute 24.2%, students constitute around 17.2%, and others by 13.3%. This indicates that salaried professionals are more willing to use UPI due to the convenience, speed, and efficiency associated with the platform.

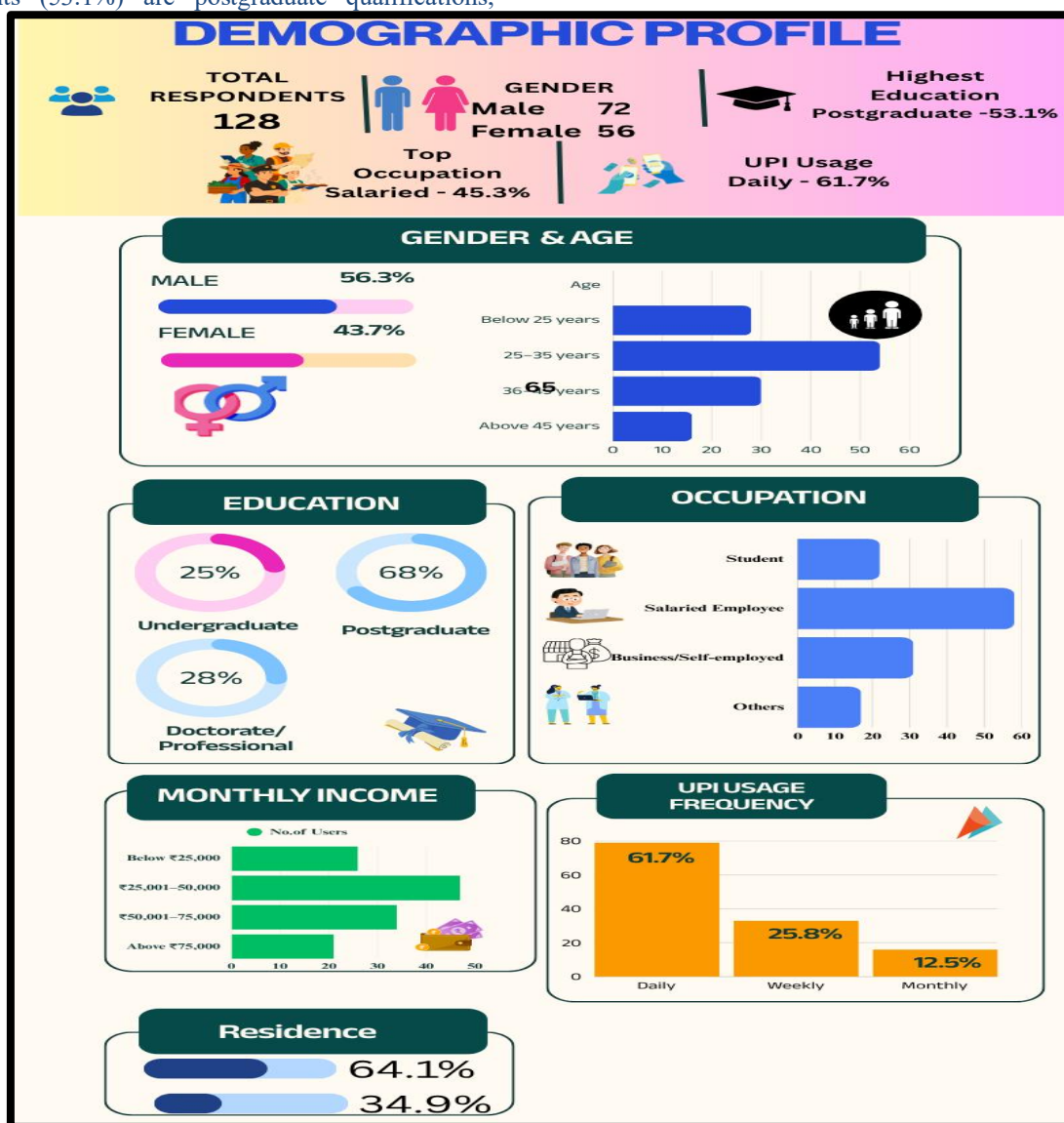


Fig 1: Demographic Profile of Respondents (n=128)

Source: Primary data

Monthly Income: 36.7% of respondents constitute a group with a monthly income bracket of ₹25,001 and ₹50,000, followed by 26.6% of individuals with an income bracket of ₹50,001 and ₹75,000. 20.3% of Respondents with income below ₹25,000 accounted and 16.4% earned above ₹75,000 per month. The findings reveal that the usage of UPI is common across varied

income groups, with moderate-income earners forming the largest section of users.

Frequency of UPI Usage: Majority of respondents (61.7%) uses UPI everyday, while 25.8% used it weekly and 12.5% used it monthly. Daily users' high frequency

usage indicates the prominence of UPI into everyday financial transactions.

Overall Demographic Summary

Thus, the demographic data illustrates that the sample predominantly represents young to middle-aged, well-educated, salaried professionals with moderate income levels and frequent engagement with UPI transactions. The high proportion of daily users demonstrates a strong level of familiarity and experience with digital payment systems, making the sample appropriate for examining factors influencing UPI adoption through the integrated TAM-UTAUT framework.

Reliability and Convergent Validity

Construct	Cronbach's α	CR	AVE
Perceived Usefulness	0.901	0.881	0.768
User Experience	0.819	0.893	0.649
Social Influence	0.819	0.893	0.649
Facilitating Conditions	0.819	0.893	0.649
Trust	0.819	0.893	0.649
Behavioral Intention	0.819	0.893	0.649
UPI Adoption	0.819	0.893	0.649

Table 1: Reliability and Convergent Validity - Source: Primary data

Note:

● indicates excellent measurement quality (Cronbach's Alpha and CR ≥ 0.90 ; AVE ≥ 0.70); ● indicates acceptable measurement quality (Cronbach's Alpha and CR = 0.70–0.89; AVE = 0.50–0.69);

● indicates values below the recommended threshold.

Table-1 reports each construct in the model meets the standard reliability and validity bars. “Cronbach's α ” values across constructs range from 0.819 to 0.901, which signifies the consistency of constructs as the values are above the standard value of 0.70. The “Composite Reliability” scores range between 0.881 to 0.930, exceeding the 0.70 threshold, confirming the measurement model's reliability. The value of “Average Variance Extracted” lies between 0.649 and 0.768, surpassing the minimum value of 0.50, indicating adequate convergent validity (Hair et al., 2019). Together, these results confirm that all constructs meet the required standards, supporting the model's suitability for structural analysis.

Discriminant Validity

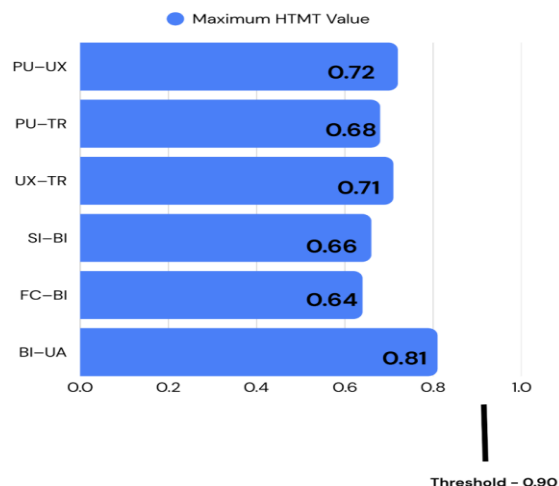


Fig 2. Discriminant Validity -Source: Primary data

Fig 2 reports the “Heterotrait–Monotrait” (HTMT) ratios, which is used to measure the construct’s discriminant validity. Since, all the values are below the threshold value of 0.85, varying from 0.61 to 0.81, and the highest ratio is observed between constructs of Behavioral Intention and UPI Adoption (0.81) and the value is within acceptable limits. (Hair et al., 2019). Thus, the findings confirm that the constructs are distinct and adequately represent separate dimensions demonstrating UPI adoption behavior. Hence, discriminant validity of the model is valid.

Structural Path Estimates

Path	β	t	p	f ²
PU $\rightarrow$ BI	0.412	6.842	<0.001	0.24
UX $\rightarrow$ BI	0.278	4.615	<0.001	0.13
SI $\rightarrow$ BI	0.194	3.228	0.001	0.08
FC $\rightarrow$ BI	0.167	2.891	0.004	0.06
TR $\rightarrow$ BI	0.231	4.112	<0.001	0.15
BI $\rightarrow$ UA	0.721	14.853	<0.001	0.71

Table 2 : Structural Path Estimates - Source: Primary data

Table 2 results lay out the structural results, showing how each construct relates to UPI adoption using “path coefficients”(β), “t-values”, “p-values”.

The Significance of the structural path is examined through the bootstrapping with 5,000 resamples, and the results show most of the hypothesized relationships are statistically significant and each contributes positively to UPI adoption behavior (Hair et al., 2019). UTAUT model by (Venkatesh et al., 2003) recognises constructs such as “Perceived Usefulness”, “Trust”, “Social Influence”, “Facilitating Conditions”, and “Perceived Ease of Use”, in the current study PEOU is replaced by User experience to demonstrates holistic experience of the digital platform, the values represented by variables demonstrate the positive impact on Behavioral Intention, which further influences adoption and use UPI. Users adopt UPI, when they perceive the platform as useful, trustworthy, socially accepted, and supported by adequate infrastructure. Behavioral Intention plays a vital role in predicting the actual usage behavior.

The effect size (f^2) value shows that” Behavioural Intention” has a large impact on UPI Adoption, while “Perceived Usefulness” has a medium effect on Behavioural Intention. The remaining constructs show small effect sizes, indicating that each construct contributes in explaining behavioural intention, although their relative influence varies (Cohen, 2013).

Co-efficient Determination (R^2) and Predictive Relevance (Q^2)

Endogenous Construct	R^2	Q^2
Behavioral Intention	0.68	0.42
UPI Adoption	0.52	0.36

Table 3: Co-efficient Determination and Predictive Relevance-Source: Primary data

Table 3 reports the model's explanatory and predictive performance through a structural model using the “coefficient of determination” (R^2) and “Stone–Geisser” predictive relevance (Q^2). The R^2 values show that the proposed model explains for 68% variance in Behavioral Intention and 52% variance in UPI Adoption, indicating substantial and moderate explanatory power, respectively. The positive Q^2 value of 0.420 for Behavioral Intention and 0.360 for UPI Adoption confirms that the model exhibits satisfactory predictive relevance. Hence, the results demonstrate that the integrated TAM–UTAUT model is considerable in explaining the behavioural intention and UPI adoption, further the model also exhibits adequate predictive capability for the endogenous constructs (Cohen, 2013).

Model Fit Assessment

Indicator	Value	Threshold
SRMR	0.067	<0.08
NFI	0.912	>0.90
VIF Range	1.21–2.84	<3.3

Table 4: Model Fit Assessment - Source: Primary data

Table 4 reports the “model fit” and “collinearity indices”. The “Standardized Root Mean Square Residual value” is 0.067, and thus satisfies the required criteria of a good model fit, and The “NFI value” of 0.912 is above the threshold value, supporting the proposed framework relevance in explaining UPI adoption in Indian context. VIF value is also below the threshold value, signifying the absence of multicollinearity among the variables. Thus, the results suggest that the model is significant and suitable for explaining UPI adoption behavior (Hair et al., 2017).

Common Method Bias Assessment

Test	Result
Harman Single Factor	34.6%
Full Collinearity VIF	1.21–2.84

Table 5: Common Method Bias Assessment- Source : Primary data

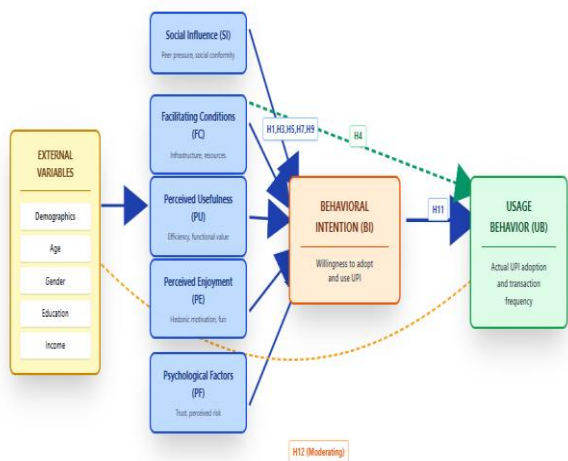
Table 5 represents the results of “Harman’s Single-Factor Test” and “Full Collinearity VIF Assessment”. The values indicate absence of significant common method bias and thus supports the reliability of the structural model (Hair et al., 2022)

Overall SEM Conclusion

Collectively, the structural model assessment results strongly signifies the relevance of the integrated TAM–UTAUT framework in demonstrating UPI adoption behavior. The factors of the model “Perceived Usefulness”, “User Experience”, “Social Influence”, “Facilitating Conditions”, and “Trust” (Venkatesh et al., 2003) exerts positive and significant influence on Behavioral Intention, which in turn drives UPI Adoption.

INTEGRATED TAM-UTAUT THEORETICAL FRAMEWORK FOR UPI ADOPTION

The proposed integrated theoretical framework replicates the core constructs from “TAM” (Davis, 1989) and “UTAUT” (Venkatesh et al., 2003) to demonstrate the journey of technology adoption in UPI context. The model uses cognitive, affective, and social determinants in predicting the behavioural intention of users and its implication on the adoption process.



Direct Effect ——— Alternative Path ———
Moderating Effect ———

Fig 3: INTEGRATED CONCEPTUAL FRAMEWORK

Source: Primary source

Discussion

The findings indicate that adoption of UPI is primarily driven by functional and technological factors, besides demographic and behavioural factors (Widiawati et al., 2026). Amongst all the constructs, Perceived Usefulness is one of the strongest determinants, indicating the relevance of the functionality features of the interface in the adoption process. Consumers adopt UPI as it aids in increasing the efficiency of transaction, convenience, and accessibility. Facilitating conditions is another significant factor and it emphasises the importance of accessibility to smartphones, internet connectivity, and large-scale acceptance by merchants in the adoption of UPI.

Social Influence exerts positive influence on UPI adoption highlighting the positive role of family, friends, and peers in shaping technology acceptance (Venkatesh et al., 2003), while User Experience further strengthens the UPI adoption by making digital transactions simple and enjoyable. Trust remains a crucial determinant, indicating the importance of “security”, “reliability”, and “confidence” in digital payment systems in adoption process

Thus, the findings collectively support the relevance of “TAM” and “UTAUT” in explaining UPI adoption behavior among Indian consumers.

Conclusion

The study investigates the various determinants that influence UPI adoption by integrating TAM–UTAUT theoretical framework. The results of the study indicates that drivers such as Perceived Usefulness, Facilitating Conditions, Social Influence, User Experience, and Trust positively influence Behavioral Intention, which in turn drives UPI adoption, (Patil et al., 2020). Amongst the stated factors, “Perceived Usefulness” and “Facilitating Conditions” stands as significant determinants driving UPI adoption.

These findings add to the existing literature on digital payment adoption by highlighting the importance of functional benefits and social technological support systems promote adoption of digital payment systems (Venkatesh et al., 2003). Further, the results provide practical input for banks, fintech firms, payment service providers, and policymakers to think on designing interfaces that accelerates digital payment adoption.

Theoretical Contribution:

The current study strengthens the existing technology acceptance models by integrating the constructs of TAM and UTAUT with an additional construct being Trust in demonstrating digital payment adoption (Widiawati et al., 2026). The study indicates that Behavioral Intention serves as a key mediating mechanism through the technological perception and social influence in the adoption of UPI.

Practical Implications

The Banks and Fintech firms should enhance the features of the interface to provide a user friendly platform that enhances the adoption process.

The players should prioritize trust-building mechanisms as trust plays a crucial role in UPI adoption.

Conducting awareness programmes on digital payment systems and incentives for merchants will increase the number of users and merchants onboard.

Policymakers should focus on strengthening the digital payment infrastructure and enrich digital payment awareness programs in semi-urban and rural areas.

Service providers should focus on simplifying onboarding procedures and build strong grievance redressal systems to enhance the user base of UPI.

Limitations

The study is based on mall-intercept convenience sampling.

The sample size is limited to 128 respondents, enhancing the number would strengthen the study.

The study applies cross-sectional design.

The respondents are predominantly from urban/semi-urban regions, concentrating on rural areas would throw light on obstacles and require measures to enhance the user base.

Future Research

Increasing the sample size to diverse and larger diverse respondents to enhance the model reliability.

Longitudinal study will help to cater to the perceptual inputs of the diverse economy.

Enhancing the sample base to rural areas will broaden the understanding of the obstacles of adoption.

Using additional constructs such as perceived risk, habit, digital trust, and financial literacy will further lead to an enriched model that demonstrates acceptance of UPI.

The study could include respondents across varied age and income segments.

The present study substitutes “PEOU” with User Experience (UX) used in the traditional “TAM” model and thus broadens the constructs by inclusion of ease of navigation, interface design, transaction convenience, and overall interaction satisfaction.

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