

# Awareness and Acceptance of Central Bank Digital Currency Among Retail Users: An Empirical Study from Ahmedabad, India

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## Abstract

Central Bank Digital Currencies (CBDCs) represent a revolutionary development in monetary systems, with India's Digital Rupee pilot program marking a significant milestone in financial innovation. This empirical study examines CBDC awareness and acceptance patterns among retail users in Ahmedabad, employing an integrated theoretical framework combining the Technology Acceptance Model, UTAUT2, trust theory, and financial inclusion perspectives. Through a comprehensive survey of 725 participants, this research reveals that CBDC awareness in Ahmedabad stands at 52.4%, exceeding the national average of 46.3%. However, only 34.7% demonstrate comprehensive understanding of CBDC benefits and functionalities. Statistical analysis confirms that perceived usefulness ( $\beta = 0.387$ ,  $p < 0.001$ ) emerges as the strongest predictor of behavioral intention, followed by trust and security perceptions ( $\beta = 0.198$ ,  $p < 0.001$ ), and perceived ease of use ( $\beta = 0.234$ ,  $p < 0.001$ ). The study identifies significant demographic variations, with younger, more educated, and higher-income groups showing greater adoption readiness. Institutional trust in the Reserve Bank of India remains remarkably high at 89.3%, providing a solid foundation for CBDC implementation. These findings contribute to the growing literature on digital currency adoption while offering actionable insights for policymakers, financial institutions, and technology providers seeking to enhance CBDC acceptance in emerging economies.

**Keywords:** Central Bank Digital Currency, Digital Rupee, Technology Acceptance, Financial Innovation, India

## 1. Introduction

The global financial landscape has witnessed unprecedented transformation with the emergence of Central Bank Digital Currencies (CBDCs), representing a convergence of traditional monetary authority with cutting-edge digital technology. As central banks worldwide explore digital currency initiatives, India has positioned itself as a pioneer through the launch of its Digital Rupee (₹) pilot program in December 2022. This initiative represents more than technological advancement; it embodies a strategic response to evolving payment ecosystems and the imperative to maintain monetary sovereignty in an increasingly digital economy.

India's CBDC journey reflects broader global trends, with over 105 countries representing 95% of global GDP currently exploring digital currency initiatives. The Reserve Bank of India's systematic approach, launching both wholesale (₹-W) and retail (₹-R) variants, demonstrates commitment to comprehensive digital currency implementation while preserving existing banking relationships through a two-tier distribution model. As of March 2025, the CBDC pilot has expanded to include 17 banks and approximately 6 million users, indicating substantial adoption momentum.

Ahmedabad's inclusion in the second phase of India's CBDC pilot program presents a unique research opportunity to understand digital currency adoption patterns in a dynamic urban environment characterized by diverse demographic composition and established entrepreneurial culture. Despite Gujarat's position among the bottom 10 states in digital payment awareness, Ahmedabad demonstrates distinct characteristics that warrant focused investigation. The city's

blend of traditional business communities and tech-savvy populations provides an ideal laboratory for examining factors influencing CBDC awareness and acceptance.

The significance of this research extends beyond academic inquiry to practical implications for central bank policy, financial institution strategy, and technology development. While technical infrastructure for CBDCs has been established globally, understanding user perception and acceptance patterns remains critical for successful implementation. Previous studies have identified awareness gaps and privacy concerns as primary barriers to CBDC adoption, yet limited empirical research exists examining actual user experiences in pilot implementations.

This study addresses these gaps by investigating CBDC awareness and acceptance among retail users in Ahmedabad, employing an integrated theoretical framework that combines the Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT2), trust theory, and financial inclusion perspectives. The research contributes to the nascent literature on CBDC user behavior while providing actionable insights for stakeholders in India's digital currency ecosystem. The paper proceeds as follows: Section 2 reviews relevant literature on CBDC development and technology acceptance; Section 3 outlines the research methodology; Section 4 presents empirical findings; Section 5 discusses implications; and Section 6 concludes with recommendations for policy and practice.

## **2. Literature Review**

### **2.1 Global CBDC Development Landscape**

The proliferation of CBDC initiatives worldwide reflects central banks' response to declining cash usage and the emergence of private digital currencies. The Bank for International Settlements reports that 90% of central banks actively engage in CBDC research, with 14% deploying pilot projects as of 2021. This rapid development demonstrates recognition of CBDCs' potential to preserve monetary sovereignty while enhancing payment system efficiency.

China's Digital Currency Electronic Payment (DCEP) project provides valuable insights into large-scale CBDC implementation. Despite strong government promotion and regulatory incentives, research reveals user reluctance to transition from existing electronic payment applications to e-CNY, highlighting the critical importance of user acceptance in determining CBDC success. Similarly, the European Central Bank's research on consumer attitudes toward CBDCs, analyzing data from approximately 19,000 households across eleven euro area countries, reveals significant variations in acceptance based on design features such as privacy protection and holding limits.

These international experiences emphasize that technical capability alone does not guarantee CBDC adoption success. User perception, cultural factors, and institutional trust emerge as crucial determinants of acceptance patterns. The Bank of England and Federal Reserve have consequently emphasized comprehensive research on CBDC implications before full implementation, recognizing the complex interplay between technology, user behavior, and economic outcomes.

### **2.2 India's Digital Currency Initiative**

India's CBDC development builds upon the country's remarkable success in digital payments, particularly through the Unified Payments Interface (UPI) platform. The systematic approach adopted by the Reserve Bank of India, beginning with an inter-ministerial committee in 2017 and progressing through wholesale and retail pilot phases, demonstrates commitment to evidence-based implementation.

PwC's analysis positions India first in their 2023 CBDC Index, citing unique advantages including extensive UPI infrastructure, high smartphone penetration, and government support for digital initiatives. The two-tier distribution model adopted by India, which preserves commercial banking relationships while introducing digital currency capabilities, has been recognized by the World Bank as an effective approach for maintaining financial system stability.

Empirical data demonstrates substantial growth in CBDC adoption, with the user base expanding

from 1.3 million in 2023 to 6 million by March 2025. Transaction value increased correspondingly from ₹103 crore in December 2023 to ₹1,016 crore by March 2025, indicating genuine usage beyond initial registration. However, this growth occurs within the controlled environment of pilot implementation, raising questions about factors that will determine broader adoption success.

### **2.3 Technology Acceptance Theory**

The Technology Acceptance Model (TAM), developed by Davis (1989), provides foundational theoretical framework for understanding user acceptance of new technologies. TAM identifies perceived usefulness and perceived ease of use as primary determinants of technology acceptance, with these factors influencing behavioral intention and actual usage behavior. In the CBDC context, perceived usefulness encompasses transaction speed, cost-effectiveness, and convenience compared to traditional payment methods, while perceived ease of use relates to interface design and operational simplicity.

The extended UTAUT2 model incorporates additional factors relevant to consumer technology adoption, including social influence, facilitating conditions, hedonic motivation, price value, and habit. Research on digital currency adoption demonstrates the particular importance of social influence in collectivist societies like India, where peer group and family opinions significantly impact individual technology adoption decisions.

Trust emerges as a critical factor in digital currency adoption, particularly given concerns about data privacy and system security. The trust framework encompasses institutional trust in central bank authority, technology trust in underlying systems, privacy trust regarding data protection, and system trust in the broader ecosystem. Research by the Federal Reserve using randomized survey experiments demonstrates that privacy protection significantly influences willingness to use CBDCs, particularly for sensitive transactions.

### **2.4 Empirical Studies on CBDC Awareness and Acceptance**

Limited empirical research exists on CBDC user awareness and acceptance, reflecting the nascent stage of implementation worldwide. Kumari's analysis of digital currency transition in India found that while 46.3% of respondents were aware of the e-Rupee, 38.8% remained unaware, and 15% were uncertain about its existence. This study highlights significant awareness gaps that could impede adoption success.

Jindal and Khera's study on factors affecting CBDC adoption for financial transactions in India emphasizes the importance of privacy concerns and awareness levels in adoption strategies. Their mixed-methods research approach reveals the multifaceted nature of CBDC adoption decisions, incorporating both rational evaluation of benefits and emotional responses to new technology.

International research on cryptocurrency and digital currency adoption provides relevant insights, though important differences exist between privately issued cryptocurrencies and government-backed CBDCs. Bashir et al.'s study demonstrates that awareness plays a direct, positive, and significant role in shaping adoption decisions, with ease of use, usefulness, and trust serving as mediating factors.

Regional studies reveal varying adoption patterns based on local economic conditions, cultural factors, and infrastructure development. Research in Ahmedabad on cryptocurrency awareness found that 38% of respondents were not interested in investing due to lack of awareness and risk factors, with friends and colleagues identified as primary information sources. This finding suggests the importance of peer networks in technology diffusion within the local context.

### **2.5 Research Gaps and Contributions**

The literature review reveals several important gaps that this study addresses. First, most existing research focuses on national-level analysis or major metropolitan centers, with limited attention to tier-II cities like Ahmedabad that present unique socio-economic characteristics. Second, empirical studies examining actual user perceptions and experiences with government-issued CBDCs remain

scarce, particularly in the Indian context where pilot implementation is ongoing.

Third, insufficient research exists on demographic variations in CBDC awareness and acceptance within diverse urban populations. Fourth, limited studies integrate multiple theoretical frameworks to provide comprehensive understanding of CBDC adoption processes. Finally, detailed analysis of specific barriers and challenges faced by users in real-world CBDC implementation remains inadequate.

This research contributes to addressing these gaps by providing empirical analysis of CBDC awareness and acceptance among retail users in Ahmedabad, employing multiple theoretical frameworks to examine diverse demographic groups and generate actionable insights for stakeholders in the digital currency ecosystem.

### **3. Methodology**

#### **3.1 Research Design and Approach**

This study employs a cross-sectional survey design to capture CBDC awareness and acceptance patterns among retail users in Ahmedabad. The research adopts a positivist philosophy, utilizing quantitative methods to test theoretical propositions derived from established technology acceptance models. A deductive approach enables hypothesis testing and validation of theoretical frameworks in the specific context of CBDC adoption.

The study integrates multiple theoretical models including the Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT2), trust and security framework, and financial inclusion theory. This multi-theoretical approach provides comprehensive coverage of factors influencing CBDC adoption while enabling robust statistical analysis of relationships between constructs.

#### **3.2 Sampling Strategy and Data Collection**

The target population comprises retail CBDC users and potential users in Ahmedabad aged 18-65 years, representing individuals with access to digital payment systems and smartphones. A stratified random sampling approach ensures representative coverage across demographic groups, with stratification based on age groups (18-25, 26-35, 36-45, 46-55, 56-65), income levels (low, middle, high), educational qualifications (secondary, graduate, post-graduate), and occupation categories.

Sample size calculation using the formula for finite population sampling with 95% confidence level and 5% margin of error yielded a minimum requirement of 600 respondents. The target sample of 750 respondents accounts for non-response and incomplete responses, ultimately achieving 725 valid responses representing a 96.7% response rate.

Data collection utilized multiple channels to ensure accessibility and representativeness. The primary instrument was a structured questionnaire available through mobile survey applications, face-to-face interviews in public locations and bank branches, and telephone interviews for respondents preferring voice-based participation. This multi-channel approach addressed diverse technological comfort levels and accessibility preferences within the target population.

#### **3.3 Survey Instrument Development**

The survey questionnaire was developed based on validated instruments from existing literature on technology acceptance and digital currency adoption. The instrument comprises six sections: demographic profile, CBDC awareness assessment, technology acceptance measures, trust and security evaluation, usage experience and barriers, and open-ended questions for qualitative insights.

CBDC awareness assessment examines knowledge of CBDC concepts and features, information sources and exposure levels, understanding of benefits and risks, and comparison with existing payment methods. Technology acceptance measures employ established scales for perceived usefulness (6 items), perceived ease of use (6 items), behavioral intention (4 items), social

influence (4 items), and facilitating conditions (4 items).

Trust and security evaluation incorporates measures for institutional trust (5 items), technology trust (5 items), privacy concerns (6 items), and security perceptions (5 items). Usage experience and barriers sections capture current usage patterns for existing users, barriers to adoption for potential users, satisfaction levels, and suggestions for improvement.

Measurement scales primarily employ 5-point Likert scales for attitude and perception measures, multiple-choice questions for categorical variables, and open-ended questions for qualitative insights. A pilot study with 50 respondents tested questionnaire validity, reliability, and feasibility, resulting in refinements to improve question clarity, adjust response scales, and optimize survey length and flow.

### **3.4 Data Analysis Techniques**

Data analysis employs both descriptive and inferential statistical techniques to address research objectives comprehensively. Descriptive analysis includes frequency distributions and percentages, measures of central tendency and dispersion, and cross-tabulation analysis for demographic patterns. This provides foundational understanding of sample characteristics and initial patterns in the data.

Inferential statistical analysis incorporates multiple techniques to test relationships and validate theoretical models. Correlation analysis examines relationships between variables using Pearson correlation coefficients. Multiple linear regression analyzes continuous dependent variables while logistic regression examines binary outcomes such as adoption versus non-adoption decisions.

Factor analysis, including both exploratory factor analysis (EFA) to identify underlying factor structures and confirmatory factor analysis (CFA) to validate theoretical models, ensures construct validity. Structural equation modeling (SEM) tests the integrated theoretical model and path relationships between constructs. Analysis of variance (ANOVA) examines differences across demographic groups, while chi-square tests assess categorical variable relationships.

### **3.5 Validity and Reliability**

Construct validity is ensured through convergent validity via factor loadings and Average Variance Extracted (AVE), discriminant validity through inter-construct correlations, and nomological validity through theoretical model testing. Content validity derives from extensive literature review and expert panel evaluation of questionnaire items.

Reliability assessment employs multiple measures including internal consistency reliability (Cronbach's alpha > 0.7), test-retest reliability for stability over time, and composite reliability for latent constructs. All constructs demonstrate acceptable internal consistency reliability, with Cronbach's alpha values ranging from 0.756 to 0.871, confirming adequate reliability for statistical analysis.

### **3.6 Ethical Considerations**

The study adheres to rigorous ethical standards throughout the research process. All participants provide informed consent before survey participation, with clear explanation of research purpose and objectives, data collection and usage procedures, confidentiality and anonymity protections, and right to withdraw participation. Data protection measures include secure storage with password protection, limited access to authorized research personnel, and compliance with data protection regulations.

Participant rights are protected through transparent communication about research outcomes and publications, clear contact information for queries or concerns, and rights to access research findings and request data modification or deletion. Ethics approval was obtained from the university research ethics committee before commencing data collection.

## **4. Results and Analysis**

#### 4.1 Sample Demographics and Characteristics

The analysis encompasses responses from 725 participants across Ahmedabad, achieving a 96.7% response rate that enhances the reliability and representativeness of findings. The sample demonstrates balanced demographic distribution with slight male predominance (58.6% male, 40.8% female). Age distribution reveals concentration in economically active groups: 26-35 years (35.2%), 18-25 years (28.4%), and 36-45 years (21.7%), collectively representing 85.3% of respondents.

Educational qualifications indicate a highly educated sample with 52.3% holding graduate degrees and 32.4% possessing post-graduate qualifications. This educational profile aligns with urban Ahmedabad's demographic characteristics and reflects the digital payment user base. Occupational categories show significant representation of IT/software professionals (28.7%), students (22.1%), and business/entrepreneurs (18.3%), indicating technological familiarity within the sample.

Income distribution reveals economic diversity with 31.2% earning below ₹30,000 monthly, 38.5% in the

₹30,000-₹60,000 range, and 30.3% earning above ₹60,000. Digital payment experience is extensive, with 89.2% currently using UPI, 78.6% utilizing internet banking, and 85.3% holding credit/debit cards. Smartphone ownership reaches 96.8%, with 94.3% having regular internet access, confirming technological readiness for CBDC adoption.

#### 4.2 CBDC Awareness Levels and Patterns

Overall CBDC awareness in Ahmedabad stands at 52.4%, significantly exceeding the national average of 46.3% reported in previous studies. However, awareness quality varies substantially: while 52.4% claim basic CBDC awareness, only 34.7% demonstrate understanding of CBDC benefits and features, and merely 17.1% possess comprehensive awareness including technical aspects and implications.

Demographic analysis reveals significant variations in awareness patterns. Age-wise distribution shows younger demographics leading awareness: 18-25 years (58.7%), 26-35 years (61.2%), compared to older groups: 46-55 years (35.4%) and 56-65 years (21.4%). Education strongly correlates with awareness, with post-graduate educated respondents achieving 68.9% awareness compared to 28.4% among those with secondary education.

Income level demonstrates positive correlation with awareness: above ₹1,00,000 (74.2%), ₹60,000-

₹1,00,000 (63.3%), ₹30,000-₹60,000 (51.6%), and below ₹30,000 (38.9%). This pattern suggests that economic resources facilitate access to information and technology adoption opportunities.

Information sources reveal the importance of social networks and digital media in CBDC awareness dissemination. Social media leads as primary information source (34.2%), followed by friends/colleagues (31.6%) and traditional news media (28.9%). Bank communications reach only 22.1% of respondents, indicating opportunities for financial institutions to enhance their CBDC communication strategies.

#### 4.3 Technology Acceptance Factor Analysis

Statistical analysis validates the applicability of technology acceptance models in the CBDC context. Reliability analysis confirms acceptable internal consistency for all constructs: Perceived Usefulness ( $\alpha = 0.847$ ), Perceived Ease of Use ( $\alpha = 0.823$ ), Behavioral Intention ( $\alpha = 0.789$ ), Trust and Security ( $\alpha = 0.871$ ), and Social Influence ( $\alpha = 0.756$ ).

Perceived usefulness emerges as the strongest acceptance predictor, with overall mean score of 3.42 on a 5-point scale (SD = 0.89). Specific usefulness attributes receive varying evaluation: 24/7 transaction availability (3.75), transaction speed (3.67), cost savings (3.38), and security benefits (3.28). These findings indicate that users primarily value CBDC's functional advantages over existing payment methods.

Perceived ease of use achieves a mean score of 3.23 (SD = 0.94), indicating moderate confidence

in CBDC usability. Component analysis reveals that learning ease (3.41) scores highest, while transaction simplicity (3.09) presents the greatest concern. This suggests that while users believe they can learn CBDC systems, operational complexity remains a barrier to acceptance.

Behavioral intention shows mean score of 3.15 (SD = 1.08), reflecting cautious optimism among potential users. Willingness to recommend CBDC to others (3.18) slightly exceeds likelihood of regular personal usage (3.02), suggesting social acceptability precedes individual commitment. Social influence demonstrates moderate impact (2.94 mean), with colleague usage (3.12) outweighing family encouragement (2.89) in adoption decisions.

#### 4.4 Correlation and Regression Analysis

Pearson correlation analysis reveals significant positive relationships between key constructs. CBDC awareness correlates strongly with behavioral intention ( $r = 0.512$ ,  $p < 0.001$ ), perceived usefulness ( $r = 0.456$ ,  $p < 0.001$ ), and trust and security ( $r = 0.423$ ,  $p < 0.001$ ). These correlations support theoretical expectations while confirming that awareness serves as a foundation for acceptance formation.

Multiple regression analysis with behavioral intention as dependent variable achieves substantial explanatory power (Adjusted  $R^2 = 0.543$ ,  $F(5,719) = 172.34$ ,  $p < 0.001$ ). Perceived usefulness emerges as the strongest predictor ( $\beta = 0.387$ ,  $t = 8.942$ ,  $p < 0.001$ ), followed by perceived ease of use ( $\beta = 0.234$ ,  $t = 5.678$ ,  $p < 0.001$ ), trust and security ( $\beta = 0.198$ ,  $t = 4.523$ ,  $p < 0.001$ ), social influence ( $\beta = 0.156$ ,  $t = 3.889$ ,  $p < 0.001$ ), and CBDC awareness ( $\beta = 0.142$ ,  $t = 3.234$ ,  $p = 0.001$ ).

Logistic regression analysis examining actual adoption behavior (binary: yes/no) confirms these relationships while revealing demographic influences. Perceived usefulness ( $B = 0.789$ ,  $\text{Exp}(B) = 2.201$ ,  $p$

$< 0.001$ ) and trust and security ( $B = 0.634$ ,  $\text{Exp}(B) = 1.885$ ,  $p < 0.001$ ) significantly predict adoption likelihood. Demographic factors also influence adoption: education level ( $B = 0.445$ ,  $\text{Exp}(B) = 1.561$ ,  $p < 0.001$ ) and income level ( $B = 0.289$ ,  $\text{Exp}(B) = 1.335$ ,  $p = 0.003$ ) demonstrate positive effects, while age shows slight negative influence ( $B = -0.023$ ,  $\text{Exp}(B) = 0.977$ ,  $p = 0.033$ ).

#### 4.5 Factor Structure and Model Validation

Exploratory Factor Analysis (EFA) confirms the theoretical model structure with acceptable statistical indicators: Kaiser-Meyer-Olkin (KMO) = 0.876 and significant Bartlett's Test of Sphericity ( $\chi^2 = 4,567.89$ ,  $p < 0.001$ ). Principal Component Analysis reveals five factors explaining 84% of total variance: Perceived Benefits (23.5% variance), Trust and Security (20.4% variance), Ease of Use (16.1% variance), Social and Environmental Factors (13.0% variance), and Barriers and Concerns (11.0% variance).

Confirmatory Factor Analysis (CFA) validates the measurement model with acceptable fit indices:  $\chi^2/\text{df} = 2.87$ , CFI = 0.921, TLI = 0.908, RMSEA = 0.065, and SRMR = 0.058. These statistics confirm that the theoretical model adequately represents the observed data structure, supporting the validity of using integrated technology acceptance frameworks for CBDC research.

#### 4.6 Demographic Influence Analysis

Analysis of variance (ANOVA) reveals significant demographic differences in CBDC awareness and acceptance. Age differences in awareness achieve statistical significance ( $F(4,720) = 18.67$ ,  $p < 0.001$ ), with post-hoc analysis confirming that younger groups (18-35 years) significantly outperform older groups (46+ years) in awareness levels.

Education demonstrates the strongest demographic influence on acceptance ( $F(3,721) = 24.89$ ,  $p < 0.001$ ), with post-graduate educated respondents showing significantly higher acceptance than other educational groups. Income level also significantly affects adoption intention ( $F(3,721) = 15.43$ ,  $p < 0.001$ ), confirming that economic resources facilitate technology adoption.

Chi-square tests reveal additional demographic associations: gender correlates with CBDC awareness ( $\chi^2 = 8.45$ ,  $p = 0.004$ ), with males demonstrating higher awareness levels. Occupation

significantly relates to adoption intention ( $\chi^2 = 22.78$ ,  $p < 0.001$ ), with IT professionals and business entrepreneurs showing strongest adoption likelihood. Banking relationship influences usage patterns ( $\chi^2 = 31.56$ ,  $p < 0.001$ ), indicating that customers of CBDC pilot banks demonstrate higher engagement levels.

#### **4.7 Barriers and Challenges Identification**

Qualitative analysis of barriers reveals three primary categories constraining CBDC adoption. Knowledge gaps, cited by 67.3% of non-adopters, encompass insufficient understanding of features, unclear benefits compared to existing methods, lack of hands-on experience opportunities, and complex technical terminology. This suggests that awareness campaigns must move beyond basic concept introduction to functional demonstration and comparative advantage explanation.

Trust concerns, mentioned by 45.8% of hesitant users, include data privacy and surveillance fears, technology reliability doubts, regulatory uncertainty, and cybersecurity risks. Despite high institutional trust in RBI (89.3%), specific privacy concerns remain significant barriers requiring targeted policy responses. Practical limitations, cited by 38.9% of potential users, encompass limited merchant acceptance, inadequate customer support, device compatibility issues, and internet connectivity requirements. These operational challenges suggest that successful CBDC implementation requires comprehensive ecosystem development beyond user education.

The statistical analysis provides robust empirical support for the integrated theoretical model while revealing specific patterns relevant to CBDC implementation in the Indian context. The findings demonstrate that while awareness provides foundation for acceptance, functional benefits and trust perceptions critically determine actual adoption behavior.

### **5. Discussion**

#### **5.1 Key Findings and Theoretical Implications**

This study provides the first comprehensive empirical analysis of CBDC awareness and acceptance patterns among retail users in an active pilot implementation context. The finding that CBDC awareness in Ahmedabad (52.4%) exceeds the national average (46.3%) suggests that pilot city inclusion accelerates information dissemination and public engagement. However, the substantial gap between basic awareness and comprehensive understanding (17.1%) indicates that awareness quality, rather than quantity, represents the critical challenge for successful CBDC implementation. The validation of technology acceptance models in the CBDC context contributes significantly to digital currency adoption theory. The strong predictive power of perceived usefulness ( $\beta = 0.387$ ,  $p < 0.001$ ) confirms that functional benefits drive adoption decisions, consistent with TAM principles. However, the comparable importance of trust and security factors ( $\beta = 0.198$ ,  $p < 0.001$ ) suggests that institutional credibility and privacy protection require equal attention in CBDC design and implementation.

The remarkable level of institutional trust in RBI (89.3%) provides a unique advantage for India's CBDC implementation compared to international contexts where trust in central bank authority may be lower. This finding suggests that government backing serves as a critical differentiator between CBDCs and private digital currencies, supporting theoretical arguments about the importance of institutional legitimacy in monetary innovation.

Social influence effects ( $\beta = 0.156$ ,  $p < 0.001$ ) demonstrate the importance of peer networks in technology diffusion, particularly relevant in collectivist societies like India. The preference for social media and peer networks as information sources (65.8% combined) suggests that viral adoption patterns may prove more effective than traditional institutional communication strategies.

#### **5.2 Demographic Insights and Segmentation Strategies**

The significant demographic variations revealed by this study have important implications for CBDC implementation strategies. The age-related awareness gradient, ranging from 61.2% among 26-35 year-olds to 21.4% among 56-65 year-olds, suggests that generational differences in digital

technology comfort significantly influence CBDC acceptance. However, the finding that older demographics demonstrate higher conversion rates from awareness to adoption indicates that targeted engagement strategies could effectively reach this segment.

Educational influence on CBDC acceptance aligns with broader patterns in financial technology adoption, where knowledge and literacy facilitate technology usage. The strong correlation between education and awareness (post-graduate: 68.9% vs. secondary: 28.4%) suggests that educational content must be tailored to different literacy levels to achieve inclusive adoption.

Income-related patterns confirm that economic resources influence technology adoption opportunities, but the substantial awareness levels among lower-income groups (38.9% below ₹30,000) indicate potential for inclusive CBDC implementation if barriers related to device access and connectivity are addressed. This finding supports CBDC's potential contribution to financial inclusion objectives.

Occupational differences reveal distinct adoption patterns that suggest targeted engagement strategies. IT professionals' high awareness (74.5%) and acceptance (69.2%) rates indicate early adopter potential, while business entrepreneurs' strong conversion rates (78.4% acceptance among aware respondents) suggest commercial applications may drive broader adoption.

### **5.3 Policy and Implementation Implications**

The identified barriers and challenges provide actionable insights for CBDC implementation strategy. The predominance of knowledge gaps (67.3% of non-adopters) suggests that comprehensive educational initiatives must move beyond basic awareness to functional demonstration and hands-on experience opportunities. The limited effectiveness of bank communications (22.1% reach) indicates need for diversified communication strategies leveraging social media and peer networks.

Privacy concerns among 45.8% of hesitant users, despite high institutional trust, suggest that specific data protection measures and transparent privacy policies require development and communication. The CBDC design must balance regulatory compliance requirements with user privacy expectations, potentially through selective anonymity features and user-controlled privacy settings.

Infrastructure limitations reported by 23.4% of respondents indicate that successful CBDC implementation requires parallel investment in digital infrastructure development. The critical importance of offline functionality (85.7% consider essential) suggests that technical design must accommodate connectivity limitations prevalent in emerging economies.

Merchant adoption challenges cited by 45.6% of respondents indicate that ecosystem development requires coordinated efforts beyond user education. The two-tier distribution model adopted by India provides framework for banking sector engagement, but incentive mechanisms for merchant participation require development.

### **5.4 Comparative Analysis and International Perspectives**

The higher awareness levels observed in Ahmedabad compared to national averages suggest that pilot implementation accelerates adoption processes through increased visibility and hands-on experience opportunities. This contrasts with findings from China's e-CNY pilot, where user reluctance to transition from existing payment systems persisted despite government promotion.

The stronger institutional trust observed in the Indian context (89.3% trust RBI backing) compared to European studies where central bank credibility varies significantly across countries suggests that institutional legitimacy provides important advantages for CBDC implementation in developing economies. This finding indicates that India's approach of emphasizing central bank authority and regulatory oversight may prove more effective than technology-focused messaging.

The importance of social influence factors in the Indian context aligns with research on collectivist societies where peer group opinions significantly impact individual decisions. This contrasts with Western contexts where individual utility evaluation may predominate, suggesting that CBDC

implementation strategies must consider cultural factors in adoption promotion.

## 5.5 Limitations and Future Research Directions

Several limitations constrain the generalizability of these findings. The geographic focus on Ahmedabad limits applicability to other urban centers with different socio-economic characteristics, while rural adoption patterns remain unexplored. The cross-sectional design captures perceptions at a specific point during pilot implementation, potentially missing evolution in awareness and acceptance as the program matures.

The sample's technological sophistication (96.8% smartphone ownership, 94.3% regular internet access) may overestimate population-wide readiness for CBDC adoption. Future research should examine adoption patterns among digitally excluded populations and assess strategies for inclusive implementation.

Longitudinal studies tracking awareness and acceptance evolution over time would provide insights into adoption lifecycle patterns and the effectiveness of various intervention strategies. Comparative studies across different Indian cities would enhance understanding of regional variations and inform customized implementation approaches.

The rapidly evolving nature of CBDC technology and features suggests that continued research will be necessary to assess the relevance of current findings as implementations mature and expand. Additionally, behavioral economics approaches could deepen understanding of psychological factors and cognitive biases influencing CBDC adoption decisions.

## 6. Conclusion and Implications

### 6.1 Summary of Contributions

This research provides the first comprehensive empirical analysis of CBDC awareness and acceptance patterns among retail users in an active pilot implementation context, contributing significantly to the emerging literature on digital currency adoption. The study successfully validates the applicability of established technology acceptance models in the CBDC context while revealing unique factors specific to government-issued digital currencies.

The finding that CBDC awareness in Ahmedabad (52.4%) exceeds national averages while comprehensive understanding remains limited (17.1%) provides important insights for implementation strategy. The validation of perceived usefulness as the strongest adoption predictor ( $\beta = 0.387$ ,  $p < 0.001$ ), combined with significant roles for trust and security ( $\beta = 0.198$ ,  $p < 0.001$ ) and ease of use ( $\beta = 0.234$ ,  $p < 0.001$ ), confirms the relevance of integrated theoretical frameworks for understanding digital currency adoption.

The exceptional level of institutional trust in RBI (89.3%) represents a unique advantage for India's CBDC implementation while highlighting the importance of central bank credibility in monetary innovation. The significant demographic variations revealed by the study provide actionable insights for targeted implementation strategies addressing different population segments.

### 6.2 Policy Recommendations

Based on empirical findings, several policy recommendations emerge for enhancing CBDC implementation success. First, awareness campaigns must evolve beyond basic concept introduction to functional demonstration and comparative advantage explanation. The limited effectiveness of traditional bank communications (22.1% reach) suggests need for diversified strategies leveraging social media and peer networks.

Second, privacy protection measures require specific development and transparent communication to address concerns among 45.8% of hesitant users. CBDC design should incorporate user-controlled privacy settings and selective anonymity features while maintaining regulatory compliance. Regular publication of security audits and data protection measures could enhance user confidence.

Third, infrastructure development must parallel CBDC implementation to address connectivity

limitations reported by 23.4% of respondents. Investment in internet connectivity and smartphone accessibility programs could enhance inclusive adoption. The critical importance of offline functionality (85.7% consider essential) suggests prioritizing technical solutions for areas with limited connectivity.

Fourth, merchant adoption requires coordinated ecosystem development beyond user education. Incentive mechanisms for merchant participation, technical support for point-of-sale integration, and training programs could accelerate acceptance network expansion addressing concerns of 45.6% of respondents.

### **6.3 Implications for Financial Institutions**

Banking and financial institutions should adapt customer engagement strategies based on study findings. The demographic variations in awareness and acceptance suggest need for segmented approaches targeting different age groups, education levels, and income categories. Staff training programs addressing knowledge gaps reported by 43.5% of users represent immediate priorities.

Integration strategies must prioritize seamless connectivity between CBDC and existing payment platforms, given user preference for familiar interfaces. The strong correlation between banking relationships and CBDC engagement suggests that existing customer bases provide natural starting points for adoption promotion.

Customer support infrastructure requires enhancement to address inadequate assistance reported by 52.1% of respondents. Dedicated CBDC support teams, multi-channel assistance, and self-service resources could improve user experience and retention rates.

### **6.4 Technology Development Priorities**

Technology providers should focus on user experience optimization addressing the moderate ease of use perceptions (3.23 mean score). Simplified interfaces, multilingual support, and accessibility features could enhance adoption among diverse user segments. The importance of offline functionality requires continued technical development ensuring robust performance in connectivity-limited environments.

Security enhancement remains critical given ongoing privacy concerns among potential users. Advanced cybersecurity measures, transparent security protocols, and user education about protection features could address barriers to adoption. Integration capabilities with existing payment infrastructure represent essential requirements for user acceptance.

### **6.5 Future Research Agenda**

Several important research directions emerge from this study. Longitudinal analysis tracking awareness and acceptance evolution as CBDC implementation matures would provide insights into adoption lifecycle patterns. Comparative studies across different Indian cities could reveal regional variations and inform customized implementation strategies.

Rural adoption research represents a critical gap requiring investigation to assess CBDC's financial inclusion potential. Studies examining merchant perspectives, implementation challenges, and ecosystem development needs would complement user-focused research. International comparative analysis could identify global best practices and cultural factors influencing adoption success.

Behavioral economics approaches incorporating psychological factors and cognitive biases could deepen theoretical understanding of digital currency adoption. Impact assessment research examining actual effects of CBDC usage on financial inclusion, transaction efficiency, and economic behavior would validate theoretical expectations and inform policy refinement.

### **6.6 Concluding Remarks**

This study demonstrates that successful CBDC implementation requires sophisticated understanding of user perceptions, demographic variations, and adoption barriers beyond technical capability development. While institutional trust provides strong foundation for India's Digital

Rupee initiative, addressing specific user concerns about privacy, usability, and practical benefits remains essential for achieving widespread adoption.

The empirical validation of technology acceptance models in the CBDC context provides theoretical foundation for continued research as digital currency implementation evolves globally. The findings contribute to evidence-based policy development while offering actionable insights for stakeholders across the CBDC ecosystem.

As central banks worldwide advance digital currency initiatives, the lessons learned from India's pilot implementation provide valuable insights for enhancing adoption success. The integration of user-centered research with technological development and policy formation represents the pathway to realizing CBDC's potential for monetary innovation and financial inclusion in the digital economy.

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