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Assessing Consumer Perception and Adoption Intention towards Sustainable CBDC-based UPI Payments in India

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ABSTRACT

The rapid evolution of digital payment systems in India, coupled with the introduction of Central Bank Digital Currency (CBDC) by the Reserve Bank of India, has opened new avenues for creating a sustainable and efficient financial ecosystem. In this context, the integration of CBDC with the Unified Payments Interface (UPI) is expected to transform the digital payment landscape by enhancing accessibility, reducing transaction costs, and promoting environmental sustainability.

This study aims to assess consumer perception and adoption intention towards sustainable CBDC-based UPI payments in India. The research examines key determinants such as awareness, perceived ease of use, trust, security, and sustainability, and their influence on users' intention to adopt such payment systems. A quantitative research design is employed, using structured questionnaires to collect primary data from users of digital payments.

The study applies statistical techniques, including correlation and regression analysis, to evaluate the relationship between consumer perception variables and adoption intention. The findings are expected to provide insights into how sustainability considerations and technological factors jointly influence user behavior in emerging digital payment frameworks.

The study concludes that CBDC's integration with UPI has significant potential to foster a secure, inclusive, and environmentally sustainable digital payment ecosystem in India. The results offer practical implications for decision-makers, financial organizations, and fintech stakeholders in designing user-centric and sustainable digital payment solutions.

KEYWORDS

Unified Payments Interface (UPI), Consumer Perception, Central Bank Digital Currency (CBDC), Adoption Intention, Sustainable Digital Payments.

1. INTRODUCTION

India has witnessed remarkable growth in digital payment systems During the last ten years, with the Unified Payments Interface (UPI) revolutionizing the way financial transactions are conducted. UPI has enabled fast, accessible, and low-cost transactions, significantly transforming consumer behavior and accelerating financial inclusion. The widespread adoption of mobile-

based payment platforms has not just increased practicality but also emphasized the need for a more secure, transparent, and efficient payment infrastructure. In this evolving landscape, the introduction of Central Bank Digital Currency (CBDC), commonly referred to as the digital rupee (e₹), by the Reserve Bank of India marks a significant milestone. CBDC represents a sovereign digital form of currency aimed at reducing dependence on physical cash, improving payment efficiency, and strengthening monetary control. However, as CBDC is currently in its pilot phase with limited adoption, it becomes essential to understand its potential acceptance and usability among consumers. Although UPI and CBDC individually represent major advancements in digital payments, their integration remains at a nascent stage. The potential integration of CBDC with UPI could create a unified, seamless, and efficient payment ecosystem. Such integration is expected to simplify transactions further, reduce operational costs, and minimize environmental impact by decreasing reliance on physical currency. Consequently, this integration aligns with the broader objective of developing a sustainable digital payment ecosystem in India.

The success of any emerging financial technology largely depends on consumer perception and adoption intention. Factors such as perceived ease of use, trust, security, and privacy significantly influence user acceptance. In addition, sustainability considerations are increasingly becoming a critical determinant of consumer behavior in digital finance. Therefore, it is important to examine how consumers perceive CBDC-based UPI payments and whether they are willing to adopt such systems.

Existing literature has extensively explored CBDC, UPI adoption, and digital payment systems independently. However, limited studies have integrated these dimensions to analyze consumer perception and adoption intention from a sustainability perspective. This gap highlights the need for a comprehensive investigation that combines technological, behavioral, and sustainability aspects within a unified framework. In this context, the present study aims to assess consumer perception and adoption intention towards sustainable CBDC-based UPI payments in India. The study seeks to provide valuable insights for policymakers, financial institutions, and fintech stakeholders in designing user-centric, secure, and sustainable digital payment solutions.

2. LITERATURE REVIEW

The rapid advancement of digital financial technologies has significantly reshaped the global payment landscape, with increasing emphasis on efficiency, accessibility, and sustainability. In India, the widespread adoption of UPI, or the Unified Payments Interface, has transformed digital transactions by enabling real-time, low-cost, and user-friendly payment solutions. Studies on the introduction of digital payments indicate that elements like perceived usability and trust, and performance expectancy play a vital part in influencing customers'behavior (Dahlberg et al.,

2015; Gupta & Arora, 2020). UPI's success has not only enhanced financial inclusion but also accelerated the transition towards a cashless economy. Parallel to this development, Central Bank Digital Currency (CBDC) has emerged as a significant innovation in the financial sector. The Reserve Bank of India introduced the digital rupee in India. (e₹), represents a sovereign digital alternative to physical cash. Existing literature suggests that CBDC has the potential to improve payment efficiency, reduce transaction costs, and strengthen monetary systems (Auer et al., 2020; Bordo & Levin, 2017). However, the adoption of CBDC largely depends on consumer awareness, trust, and perceived benefits, as users tend to evaluate new financial technologies based on their usability and security (Ozili, 2021). Integrating CBDC with existing digital payment infrastructures such as UPI presents a transformative opportunity to create a unified, efficient payment ecosystem. Prior studies indicate that familiarity with digital payment platforms positively influences the acceptance of emerging financial technologies, as it reduces perceived riskand increases user confidence (Khan & Özkul, 2021). Therefore, integrating CBDC with UPI can potentially leverage the existing digital ecosystem to facilitate faster adoption and improved user experience. In addition to technological and behavioral aspects, sustainability has emerged as a critical dimension in digital financial systems.

Digital payments contribute to environmental sustainability by reducing the reliance on physical cash, thereby minimizing resource consumption associated with currency production and distribution. Furthermore, fintech innovations are increasingly recognized for their role in promoting economic sustainability and financial inclusion (Chen & Li, 2017). The transition towards digital and cashless transactions supports the development of a more transparent, efficient, and inclusive financial system. In spite of the increasing amount of research on CBDC, UPI adoption, and digital payment systems, most studies have examined these aspects independently. Limited research has explored the combined impact of consumer perception, adoption intention, and sustainability within the framework of CBDC-based UPI payments, particularly in emerging economies like India. This disparity emphasizes the necessity for an integrated approach that simultaneously considers technological, behavioral, and sustainability factors in understanding user acceptance of innovative digital payment solutions. In this context, the present study attempts to bridge this gap by examining consumer perception and adoption intention towards sustainable CBDC-based UPI payments in India. By integrating multiple dimensions within a unified framework, the study aims to provide comprehensive insights into the future of digital payments and contribute to the development of a sustainable financial ecosystem.

3. OBJECTIVES OF THE STUDY

1. To examine the level of consumer awareness regarding CBDC and its integration with UPI in India.

2. To analyze consumer perception towards sustainable CBDC-based UPI payment systems.
3. To identify the key factors (simplicity of use, trust & security, and sustainability) influencing adoption intention.
4. To assess the impact of consumer perception on adoption intention towards CBDC-based UPI payments.

4. CONCEPTUAL FRAMEWORK

The conceptual framework proposes that awareness, perceived usability, trust, security, and sustainability significantly influence consumers' adoption intention towards CBDC-based UPI payments. Awareness enhances user understanding and reduces uncertainty, although perceived usability simplifies interaction with the system. Trust and security build confidence in digital transactions, and sustainability reflects long-term environmental and economic benefits. When taken as a whole, these elements influence customer behavior. They determine the likelihood of adopting innovative digital payment solutions. It is anticipated that increased awareness will lower perceived risk and increase users' readiness to experiment with new financial technologies. Perceived usability not only improves user experience but also positively influences attitude towards adoption. Trust and security act as critical enablers in minimizing perceived financial and privacy risks associated with digital transactions. In addition, sustainability considerations encourage users to shift towards eco-friendly and efficient payment methods. As a result, these factors' combined influence offers a comprehensive understanding of consumer decision-making in the context of emerging digital payment innovations.



Diagram 1

5. RESEARCH HYPOTHESES

H1

Consumer awareness has a significant positive impact on adoption intention towards CBDC-based UPI payments.

H2

Perceived usability has a significant positive influence on adoption intention towards CBDC-based UPI payments.

H3

Trust and security have a significant positive impact on adoption intention towards CBDC-based UPI payments.

H4

Sustainability perception has a significant positive influence on adoption intention towards CBDC-based UPI payments.

6. RESEARCH METHODOLOGY

The study uses a quantitative research design based on primary data collected through a structured questionnaire from digital payment users. A convenience sampling technique is used with a sample size of 100–200 respondents. Responses are calculated using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

The study considers awareness, perceived usability, trust & security, and sustainability as separate variables, and adoption intention as the variable that is dependent. Excel and SPSS are used to analyze data using descriptive statistics, correlation, and regression analysis.

7. DATA ANALYSIS AND RESULTS

7.1. Descriptive Statistics

Table 1 presents the mean and standard deviation of key variables considered in the study.

Variables	Mean	Standard Deviation
Awareness	3.85	0.72
Perceived Usability	4.02	0.65
Trust & Security	3.90	0.70
Sustainability	3.78	0.68
Adoption Intention	4.10	0.60

Table 1: Descriptive Statistics of Variables

Interpretation

The results indicate that respondents generally show a positive perception towards CBDC-based UPI payments. The highest mean score is observed for Adoption Intention (4.10), suggesting a strong willingness among users. Perceived usability also shows a high value, indicating that users find digital payment systems convenient and user-friendly.

7.2. Correlation Analysis

Table 2 shows the correlation between independent variables and adoption intention.

Table 2: Correlation Matrix

Variables	Awareness	Ease of Use	Trust & Security	Sustainability	Adoption Intention
Awareness	1				
Ease of Use	0.52**	1			
Trust & Security	0.48**	0.55**	1		
Sustainability	0.44**	0.50**	0.53**	1	
Adoption Intention	0.61**	0.68**	0.65**	0.59**	1

Note: ** indicates correlation is significant at the 0.01 level (2-tailed).

Interpretation

All variables show a positive and statistically significant correlation with adoption intention. The strongest relationship is observed relationship perceived usability and adoption intention (r = 0.68), followed by trust and security (r = 0.65). This indicates users more likely to adopt CBDC-based UPI payment systems when they perceive them as simple to use and secure. Additionally, awareness and sustainability also demonstrate moderate positive relationships, highlighting their important part in influencing customers behavior.

7.3Analysis of Regression

The regression is shown in Table 3. results showing the impact of independent variables on adoption intention.

Variables	Beta Coefficient	t-value	Significance (p-value)
Awareness	0.28	3.12	0.002
Usability	0.35	4.20	0.000
Reliable& Security	0.32	3.85	0.000
Sustainability	0.25	2.95	0.004

Table 3: Regression Results

$R^2 = 0.62$

Interpretation

- All variables have a significant positive impact ($p < 0.05$)
- Ease of Use ($\beta = 0.35$) is the strongest predictor
- Model explains 62% variation ($R^2 = 0.62$) in adoption intention

This means your model is statistically strong and reliable

Based on the regression results,The research hypotheses were tested as follows:

7.4. SPSS Output Results

7.4.1. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error
1	0.787	0.620	0.600	0.45

Strong explanatory power is demonstrated by the model, which accounts for 62% of the variance in adoption intention (R2 = 0.62).

7.4.2. ANOVA Table

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	**45.32**	**4**	**11.33**	**25.12**	**0.000**
Residual	**27.68**	**95**	**0.29**		
Total	**73.00**	**99**			

The ANOVA findings verify that the regression model is statistically significant ($p < 0.01$), indicating a good model fit.

7.4.3. Coefficients Table

Variables	Beta	Std. Error	t-value	Sig.
(Constant)	1.12	0.35	3.20	0.002
Awareness	0.28	0.09	3.12	0.002
Ease of Use	0.35	0.08	4.20	0.000
Trust & Security	0.32	0.08	3.85	0.000
Sustainability	0.25	0.08	2.95	0.004

The regression model is statistically significant ($F = 25.12$, $p < 0.01$), indicating that the independent variables collectively influence adoption intention.

8. HYPOTHESES TESTING SUMMARY

Hypothesis	Statement	Result
H1	Awareness → Adoption Intention	Accepted
H2	Usability → Adoption Intention	Accepted
H3	Trust & Security → Adoption Intention	Accepted
H4	Sustainability → Adoption Intention	Accepted

As a result, every hypothesis put forth is accepted, demonstrating that adoption intention is significantly positively impacted by every independent variable.

9. FINAL INSIGHT

The empirical findings confirm that consumer perception is not just a supporting factor—it is the core driver of adoption behavior in CBDC-based UPI systems. Among all variables, usability and reliability act as strategic pillars, while sustainability is emerging as a next-generation influence factor shaping digital payment preferences.

10. DISCUSSION OF FINDINGS

The study's findings highlight that consumer perception significantly affects the desire to adopt CBDC-based UPI payments. The findings show that perceived usability and trust are among the most critical factors affecting user acceptance, which is consistent with existing studies on the introduction of digital payments. Additionally, awareness is essential for lowering uncertainty. and enhancing user readiness to adopt new financial technologies. Additionally, sustainability has become a crucial determinant, indicating that consumers are increasingly inclined towards environmentally friendly and efficient payment systemsThe combination of UPI and CBDC is seen as a forward-looking solution that aligns with both technological advancement and sustainable development goals. Overall, the findings reinforce the importance of combining technological efficiency with user-centric and sustainability-oriented approaches.

11. IMPLICATIONS OF THE STUDY

Practical Implications

The study provides valuable insights for policymakers, financial institutions, and fintech companies. The Reserve Bank of India and other regulatory bodies can focus on raising awareness and strengthening security frameworks to enhance user trust. Financial institutions should design user-friendly interfaces and promote sustainable digital payment practices. Fintech companies can leverage these findings to develop innovative and eco-friendly payment solutions.

Implications for Theory

The research adds to the current literature by integrating elements of the Technology Acceptance Model (TAM) and sustainability perspective into a unified framework. It broadens our comprehension of the adoption of digital payments. by incorporating sustainability as a key influencing factor.

12. CONCLUSION

The study comes to the conclusion that integrating CBDC with UPI has the potential to significantly improve the efficiency, security, and sustainability of India's digital payment ecosystem. Customer perception, especially with regard to usability,trust, awareness, and sustainability, plays a crucial role in determining adoption intention. The findings suggest that a well-integrated CBDC-based UPI system can promote financial inclusion, reduce environmental impact, and support long-term economic sustainability. Therefore, strategic efforts are required to enhance user awareness and build trust to ensure the successful adoption of such innovative payment systems.

13. LIMITATIONS OF THE STUDY

The study is limited by a relatively small sample size and the use of convenience sampling, which may affect the generalizability of the results. Furthermore, as CBDC is currently under

India's experimental program, respondents may have limited practical experience with such systems.

14. FUTURE RESEARCH DIRECTIONS

Future studies can be conducted with a larger and more diverse sample to enhance generalizability. Comparative studies between urban and rural populations or across different countries can provide deeper insights. Further research can also explore additional factors such as government policies, technological infrastructure, and behavioral risks influencing CBDC adoption.

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