



“Money in the Digital Age: A Comprehensive Analysis of UPI and Central Banking Digital Currency in India”

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Abstract

Since 2016, the Government of India has pushed for the widespread adoption of smartphone-based payment apps—advancement in technology digitalization of banking services, and change in the form of money. An example of this is the Unified Payments Interface (UPI) that is already in use and the emerging Central Banking Digital Currency (CBDC) which is under pilot study. The study has three basic goals: understanding the concepts of UPI and CBDC, analyzing their key aspects, and evaluating the associated components. The study uses a systematic review technique to synthesize current material, focusing on studies that analyze UPI's technological architecture, security aspects, and developmental advantages. Furthermore, it goes into historical monetary system movements to better understand the causes and potential benefits of CBDC adoption. The review analyses consumer resistance characteristics, such as privacy and security concerns, that influence UPI adoption and investigates the relationship between cash use and CBDC demand.

Keywords: CBDC (Central Banking Digital Currency), UPI (Unified Payment Interface)

INTRODUCTION:

Transactions began with the barter system and continued to develop with the coin era, token notes, and electronic money transfers such as RTGS and NEFT. UPI gained popularity in India as the technological revolution changed trade, commerce, and business (RBI, 2022). The Reserve Bank of India and the Indian government are currently working to improve the security and efficiency of financial transactions by implementing the CBDC.

In India, a real-time payment system called the Unified Payments Interface (UPI) enables speedy money transfers between bank accounts through mobile devices. Its simplicity makes it extensively utilized. Central banks create Central Bank Digital Currency (CBDC), a digital currency that can be used as legal tender to encourage financial inclusion, reduce expenses, enhance monetary policy and promote creativity. While CBDC provides a safe digital substitute for fiat money, UPI concentrates on retail transactions, giving central

banks more monetary power in the digital economy. For the purpose of handling digital payments and shaping the direction of finance, it is important to comprehend UPI and CBDC (Gupta et al., 2023)

Since its 2016 inception, the UPI has grown to become the most widely used and favored payment method, driving both person-to-person and person-to-merchant transactions, which now account for 75% of all digital payments. Between January 2017 and January 2023, there were 0.45 crore UPI transactions; by January 2023, there were 804 crore transactions. Since December 2022, UPI has processed 1000 crore transactions per month, demonstrating the stability of India's payment system and acceptance of consumers. A recent pan-India digital payments survey (covering 90,000 respondents) revealed that 42 percent of respondents have used digital payments (The economic times, 2023)

The Reserve Bank of India (RBI) has initiated notable Central Bank Digital Currency (CBDC) pilots, focusing on the retail (e₹-R) and wholesale (e₹-W) markets. With its November 1, 2022 launch, E₹-W seeks to increase the effectiveness of interbank market transactions. E₹-R is a closed user group that was introduced on December 1, 2022, and is provided by participating institutions via digital wallets (finace, 2023). Thirteen institutions, including State Bank of India and ICICI Bank, are part of the trial initiative, which has a gradual expansion plan. Features of E₹-R are comparable to those of actual cash, and the RBI intends to progressively broaden the test program in response to customer input. The CBDC projects, which constitute a significant development in efficiency and creativity, demonstrate the RBI's commitment to the implementation of CBDC in India.

REVIEW OF LITERATURE

Numerous aspects of Central Bank Digital Currency (CBDC) and the Unified Payment Interface (UPI) have been thoroughly investigated in a number of research. In-depth analysis of UPI's architecture, transaction protocols, and security measures was done by (George et al., 2023). They emphasized how important it is to have strong security protocols, effective money management, and a thorough understanding of client behavior in order to shape UPI's effectiveness. In order to further the conversation, (Abraham, 2020) examined how UPI advances digital sovereignty, focusing on governance design, interoperability, and data privacy issues. (Khanra et al., 2020) looked into what factors affect the use of UPI, identifying concerns about privacy, security issues, and the importance of word-of-mouth advertising.

(Neema & Neema, 2018) provided insight into how the demonetization affected the acceptance of UPI, emphasizing the need to increase outreach and boost confidence, particularly in rural areas. In his evaluation of UPI's revolutionary potential for the digital payment space, (Gochhwal, 2017) argued in favor of merchant-centric approaches and tactics that promote financial inclusion. An extensive examination of security flaws in UPI protocols was carried out by (Kumar et al., 2020), who emphasized the need for ongoing evaluations and improvements. In a similar vein, (Khiaonarong & Humphrey, 2019) investigated the relationship between the use of cash and the need for CBDC, proposing a methodical strategy for its execution predicated on current levels of cash usage. (Bordo, 2022) examined the adoption of the CBDC historically as well as the anticipated effects on monetary policy and international payment systems. (Ozili et al., 2024) noted the obstacles

preventing the adoption of the CBDC and suggested solutions, such as programs to strengthen privacy protections and improve digital literacy. (Sadiq et al., 2023) focused on blockchain technology and industry-oriented analysis while examining how digital currencies affect loan accessibility and financial stability. (Ozili, 2023) evaluated the degree of interest and advancement across African countries with respect to the issuance of CBDCs, attributing the lack of enthusiasm to infrastructure shortcomings and concerns about privacy. The effects of CBDC on financial stability were examined by (Luu et al., 2023), who found that there were benefits overall, notably for banking institutions in emerging nations. Finally, (Lee & Park, 2022) examined how the implementation of CBDCs will affect the environment, stressing the technology's eco-friendliness in comparison to cryptocurrencies and its alignment with sustainability goals.

OBJECTIVES OF THE STUDY

- To understand the concept of UPI & CBDC
- To Analyse the Key characteristics of UPI & CBDC
- To assess the factors associated with UPI and CBDC.

RESEARCH METHODOLOGY

The study uses a systematic literature review to conduct a Comprehensive Analysis of UPI and Central Banking Digital Currency in India. It has three goals: assessing UPI's essential features, investigating CBDC's concept, and comparing UPI and CBDC in the digital financial scene through understanding of the evolving digital financial ecosystem in India by reviewing academic literature, research articles, and official.

OVERVIEW OF CBDC

The digital version of legal money issued by a central bank is called CBDC. It is comparable to sovereign paper money but has a distinct format, is exchangeable for current currency, and is recognized as a safe haven for value as well as a means of payment and legal tender. On the balance sheet of a central bank, CBDCs would be listed as liabilities (RBI, 2022).

Central Bank Digital Currency (CBDC) is a digital form of sovereign currency created by central banks that is recorded as a liability on the bank's balance sheet. It must be accepted as legal tender by all entities, convertible against commercial bank money and cash, and used as a secure store of value. The CBDC aspires to reduce the cost of money issuance and transactions while also providing the public and companies with a handy, electronic form of central bank money (RBI, 2022).

Central Bank Digital Currency (CBDC) provides numerous benefits, including increased transparency, lower operational costs, expanded payment systems for a larger user base, financial inclusion, payment system innovation, settlement efficiency, and a trusted and regulated digital payment option for both domestic and cross-border transactions. These advantages emphasize CBDC's ability to transform the financial sector and provide access to secure and efficient digital payment alternatives (RBI, 2022)

There are two approaches for Central Bank Digital Currency (CBDC) issuance and management: the Direct Model (single tier) and the Indirect Model (two tiers). Under the Direct Model, the central bank manages all parts of the CBDC system autonomously. In contrast, the Indirect Model incorporates collaboration between the central bank and intermediaries, such as banks and service providers, with the central bank issuing CBDC indirectly through these intermediaries. This summary discusses the many ways central banks can use when structuring their CBDC systems (RBI, 2022).

OVERVIEW OF UPI

With rapid adoption and widespread usage, UPI has become a very popular mode of payment in India. UPI has been instrumental in accelerating the penetration of digital payments in India, making it a potential platform that can be merged with CBDC. This blend will serve as a better payment solution offering instantaneous fund transfers and accessibility.

The Unified Payments Interface (UPI) is a real-time payment system in India with key features such as interoperability across banks, real-time transactions 24/7, mobile-based accessibility, a unique UPI ID for users, integration with Immediate Payment Service (IMPS), support for QR code payments, bill splitting and request money features, two-factor authentication for security, promotion of financial inclusion, utility bill payment options, and integration with third-party UPI is well-known for its simplicity, speed, security, and broad use in digital transactions.

The main difference between UPI (Unified Payments Interface) and CBDC (Central Bank Digital Currency) lies in several key aspects:

Central Bank Digital Currency (CBDC) is a digital representation of a country's fiat currency issued and controlled by the central bank. It allows individuals and businesses to make digital payments, potentially offering greater stability and security. Currently in the experimental phase, CBDC is not widely used.

Unified Payments Interface (UPI) is a real-time payment system enabling instant money transfers between bank accounts via mobile devices. Controlled by a consortium of banks and financial institutions, UPI has gained widespread adoption, particularly in countries like India. While UPI enhances accessibility and convenience for digital payments, its decentralized control may raise concerns about stability and security.

Overall, CBDC has the potential to revolutionize monetary policy by altering how central banks manage money supply, while UPI contributes to making digital payments more accessible and convenient.

1. **Form of Payment:** UPI facilitates real-time transfers between bank accounts, while CBDC is akin to digital sovereign currency loaded into a wallet.
2. **Dependency:** UPI transactions rely on banks, NPCI, and payment service providers, whereas CBDC transactions are independent of bank accounts and involve only the sender and receiver wallets.

3. **Settlement:** UPI settlements occur instantly for end users but on a deferred net basis between banks, while there's no settlement process for CBDC as the balance is transferred directly between wallets.

4. **Anonymity:** UPI transactions are recorded by banks, making them non-anonymous, while CBDC transactions are anonymous as no transaction data is captured during wallet-to-wallet transfers.

5. **Liability:** In UPI, the liability lies with the users and bank accounts involved, whereas in CBDC, the central bank (RBI) holds the liability.

FINDINGS OF THE STUDY

Technological Architecture and Security: George et al. (2023) stressed the importance of UPI's technological architecture, transaction protocols, and security protocols. Bordo (2022) investigated the adoption of CBDC by examining historical movements in monetary systems, emphasizing implications of technical changes.

Digital Sovereignty and Governance: Abraham (2020) discussed UPI's role in achieving digital sovereignty, highlighting the need for a mature governance architecture. Ozili et al. (2024) identified barriers to CBDC adoption, including governance-related concerns and the role of government in issuing and regulating money.

Consumer Resistance and Adoption: Khanra et al. (2020) studied how consumer resistance variables influence the intention to continue using UPI. Ozili et al. (2024) identified factors hindering CBDC adoption, including consumers' lack of digital proficiency and privacy concerns.

Impact of Digital Money and Blockchain on Loan Availability: Sadiq et al.'s study looks at how digital money and blockchain affect loan availability and financial stability. The findings show the quick changes in business as a result of the acceptance of numerous digital currencies, as well as the importance of sectors adapting to blockchain technology.

Demonetization Impact: Neema & Neema (2018) examined the impact of demonetization on the acceptability of digital payments, focusing on UPI. Khiaonarong & Humphrey (2019) investigated the relationship between cash use and prospective demand for CBDC.

Advancements in Technology: Gochhwal (2017) evaluated UPI as a modern payment system, showcasing its significant development over previous systems. Sadiq et al. (2023) explored how digital money and blockchain impact financial stability, emphasizing changes in business due to digital currency acceptance.

Security Analysis: Kumar et al. (2020) delved into the security of the UPI protocol, identifying design weaknesses. Lee and Park (2022) focused on the environmental impact of CBDC adoption, considering its technological procedures and energy use.

Effects on Financial Stability: Luu et al. (2023) analyzed the effects of CBDC on financial stability, revealing positive impacts.

Financial Inclusion Initiatives: The success of CBDC adoption may be influenced by financial inclusion initiatives, ensuring access to digital currency for a broader population (RBI, 2022). UPI adoption has been driven, in part, by efforts to enhance financial inclusion, making digital payments accessible to a larger segment of the population.

Perceived Utility and Convenience: CBDC & UPI Users assess the perceived utility and convenience of CBDC, considering factors such as ease of use and benefits over traditional forms of currency (Yang et al., 2021).

Environmental Implications: CBDC: Lee and Park (2022) focuses on the environmental impact of Central Bank Digital Currency (CBDC) adoption in East Asia and the Pacific. The findings demonstrate CBDC's lower energy use compared to cryptocurrencies, emphasizing the need of taking environmental considerations into account while designing CBDCs.

Issues and challenges: UPI & CBDC Both literature strands addressed challenges and proposed solutions. UPI studies recommended interventions for privacy concerns, usage barriers, and improvements in technological infrastructure. CBDC studies proposed solutions for digital proficiency, privacy-focused CBDC, and governance-related issues.

CONCLUSION

This study focuses on the transformative impact of the Indian government's digital financial activities, as seen by the operational success of the Unified Payments Interface (UPI) and the potential introduction of the Central Banking Digital Currency. Addressing the study's three main objectives, the systematic review technique thoroughly investigates UPI's technological complexities, security features, and developmental benefits. Incorporating a historical viewpoint improves our understanding of the motivations behind CBDC uptake. The examination of consumer resistance factors and the interaction between cash use and CBDC demand yields critical insights. As a researcher, this study not only reflects the current condition of India's digital banking, but also acts as a basic reference for projecting the trajectories of UPI and prospective CBDC adoption.

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