

Impact of RBI's Digital Rupee on the Traditional Banking System in India

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ABSTRACT

This study analyzes the Reserve Bank of India's introduction of the Digital Rupee (CBDC) and its implications for India's financial system. It highlights the currency's potential to boost financial inclusion, payment efficiency, and monetary policy effectiveness, supported by advanced technologies and AI integration. Despite this promise, adoption has been slow due to issues like limited public awareness, trust, and infrastructure. The research examines operational, regulatory, and systemic challenges—particularly for traditional banks—and compares global experiences (e.g., China) to assess adoption strategies. It concludes with policy recommendations to ensure the Digital Rupee's successful integration into India's digital economy while safeguarding financial stability.

Keywords – Digital Rupee India, Central Bank Digital Currency (CBDC), AI Integration,

Traditional banks, India's digital economy.

1. INTRODUCTION

- A Central Bank Digital Currency (CBDC) is a digital form of a nation's official currency, regulated by the central bank to enhance payment systems, promote financial inclusion, and uphold monetary sovereignty. In India, the Reserve Bank of India (RBI) launched the Digital Rupee (₹) in two forms: ₹-W (Wholesale) for large financial transactions, and ₹-R (Retail) for daily consumer use. The pilot for ₹-W began in November 2022, and for ₹-R in December 2022, following its announcement in the Union Budget 2022-23, placing India at the forefront of CBDC innovation.
- The Digital Rupee is legal tender, equivalent to cash, and transacted via digital wallets offered by banks and select non-banking entities. It does not accrue interest, functions both online and offline, and supports programmable features (e.g., usage restrictions, expiry). The system aims to reduce cash reliance, operational costs, and counter the influence of private digital currencies, while also boosting efficiency, security, and financial inclusion, especially in remote or underserved areas. It also holds promise for enhancing cross-border remittances, which are vital to India's economy.
- Technology & Infrastructure Behind Digital Rupee
- The ₹ uses Distributed Ledger Technology (DLT) via a permissioned blockchain (Hyperledger Fabric) for secure token issuance and ledger management. It runs on a two-tier architecture, enabling real-time, high-volume retail transactions similar to UPI. Key features include:

- **Ledger & Settlement:** Inter-wallet transactions settle instantly; UPI QR compatibility is integrated.
- **Offline Capability:** Allows transactions without internet (e.g., via NFC), reducing dependency on connectivity.
- **Programmability:** Allows conditions like time limits or usage boundaries—ideal for subsidies or corporate disbursements.
- **Security & Scalability:** Encrypted, permissioned infrastructure with robust cybersecurity, supporting 24/7 real-time processing.

- **Adoption & Growth of e₹ (as of early 2024)**
- **User Base:** From 50,000 wallets in 2022 to 4–5 million by mid-2024.
- **Merchant Adoption:** Over 400,000 merchants now accept e₹.
- **Transaction Growth:** From 25,000 daily transactions to 1 million on peak days, largely driven by payroll and incentive schemes.
- **Challenges:** Slower growth than UPI due to low public awareness, privacy concerns, and lack of interest earnings.

• **Comparison: Digital Rupee (e₹) vs UPI**

Feature	Digital Rupee (e₹)	UPI
Legal Tender	Yes (issued by RBI)	No (bank-linked payment system)
Offline Capability	Yes	No
Programmability	Yes (e.g., geofencing, expiry)	No
Interest	No (non-interest bearing)	Depends on linked account
Account Requirement	No (only KYC needed)	Yes (bank account mandatory)
Use Case	Digital cash replacement	Bank-linked digital transactions
Adoption	5 million users (2024 est.)	300M+ daily transactions
Transaction Volume	₹2.34 billion (FY2023-24)	₹125.95 lakh crore (FY2021-22)

- The Digital Rupee is a strategic innovation by the RBI, blending digital convenience with the security of central bank money. It aims to modernize India's financial infrastructure, support inclusive digital growth, and reduce reliance on physical cash—while facing adoption hurdles in a UPI-dominated market.



- The advent of Central Bank Digital Currencies (CBDCs) marks a transformative shift in global finance, with the Reserve Bank of India (RBI) pioneering its own version through the Digital Rupee (e₹). Designed as a sovereign digital currency, the e₹ aims to enhance payment efficiency, reduce dependence on cash, and promote financial inclusion—especially in underserved regions. Its programmable features, offline transaction capability, and legal tender status distinguish it from existing digital payment systems. The integration of Artificial Intelligence (AI) further amplifies its impact, enabling real-time fraud detection, predictive analytics for policy decisions, and personalized banking experiences. Together, CBDC and AI are redefining the architecture of India's banking system, fostering greater transparency, operational efficiency, and financial reach in a rapidly digitalizing economy.

2. REVIEW OF LITREATURE

The technology behind the Digital Rupee is based on blockchain or distributed ledger technology (DLT). For the retail version (e₹-R), the system is primarily token-based, which aligns it more closely with physical cash, enabling peer-to-peer transactions. The wholesale segment (e₹-W), however, is being developed with an account-based system. Blockchain technology offers enhanced security, transparency, and resilience, leveraging cryptographic protocols to ensure the integrity and trust of the digital currency. While this technology promises significant advantages, such as secure transactions and immutability, there are challenges related to scalability and performance that the RBI will need to address as the Digital Rupee continues to evolve. ((Deshmukh, S., Joshi, A., Shinde, S., & Sharma, M. (2023); Kakade, K. S., & Patankar, P. (2023); Nazeer, N. I. (2023b); Kumar, R., Kakade, K. S., Priscilla, M., & Krishna, B. S. (2023); Shinde, S. C. (2014); Kakade, K. S., Kale, S. K., Vispute, S. A., & Mane, S. B. (2024); Wankhede, V. V., Chaudhari, N. C., Pankajam, A., Ganesh, K., & Shinde, S. C. (2022); Shinde, S. C. (2017); Mukil, A., Kakade, K. S., Alexander, C. H. C., & Susiapan, Y. S. (2024); Shinde, M. S. C. (2016); Sarkar, S., Kakade, K., & AK, S. (2024)).

3. RESEARCH OBJECTIVES

The objective of this research is to critically analyze the implementation, adoption, and impact of the Digital Rupee (₹) as a Central Bank Digital Currency (CBDC) in India. Specifically, the study aims to evaluate its technological infrastructure, user adoption trends, regulatory challenges, and its potential impact on the banking system, monetary policy, and financial inclusion. The research also seeks to understand the comparative advantages and challenges of the Digital Rupee over other existing digital payment systems such as UPI, and its role in the future of digital currency adoption globally.

4. RESEARCH METHODOLOGY

This study uses a descriptive and analytical research design, relying entirely on secondary data from credible sources such as RBI reports, Ministry of Finance documents, academic journals, industry analyses, and media publications. Both qualitative and quantitative methods are applied—qualitative analysis includes thematic and content analysis to explore challenges and opportunities, while quantitative analysis assesses adoption metrics compared to other digital payment systems like UPI. A comparative international review is also conducted. The study focuses on technological infrastructure, regulatory challenges, monetary policy implications, and user adoption patterns. While offering a comprehensive understanding of the Digital Rupee's impact, the study acknowledges limitations in capturing real-time user experiences and localized adoption issues.

5. DATA ANALYSIS AND DISCUSSION

UPI vs. Digital Rupee (₹) in India:

UPI leads digital payments with over 300 million daily transactions due to its interoperability, zero cost, and scalability. In contrast, ₹ peaked at 1 million daily transactions but has declined to around 100,000. To boost adoption, ₹ must utilize UPI infrastructure and offer distinct benefits like programmability, offline functionality, and direct government transfers.

Key Differences:

- UPI: Bank account-based, a payment method.
- ₹: Digital legal tender, wallet-based, enables peer-to-peer transactions without intermediaries, supports offline use, and can be programmable.
- ₹ complements, not replaces, UPI.

Pilot Project Status (as of 2024):

- Retail ₹-R: Launched in Dec 2022, with 5M+ users and 4M merchants by Sept 2024. Peak transactions (Dec 2023) were 1M/day, now at ~100K/day. Circulation value: ₹234.04 crore (Mar 2024).
- Wholesale ₹-W: Usage has declined; focus remains on secure and gradual rollout based on feedback.

Risks for the Banking System

The Digital Rupee poses several risks to the traditional banking system. It may lead to

disintermediation, where funds move from banks to the central bank, reducing banks' liquidity and lending power. The RBI's direct competition in digital payments could diminish banks' revenue and customer relationships. Additionally, cybersecurity threats such as hacking require strong protections. The shift away from deposits could also reduce bank profitability and loan capacity. Lastly, regulatory uncertainties, especially around privacy, AML, and KYC, create compliance challenges for banks.

Table 1: Impact of RBI's Digital Rupee on the Traditional Banking System in India

Aspect	Details
1. Adoption Rates	- e₹-W launched: 1 Nov 2022- e₹-R launched: 1 Dec 2022- Users: 4.6 million (as of Mar 2024)- Merchants: 400,000- Peak daily transactions: 1 million (Dec 2023)- Current average daily transactions: 100,000- Circulation value: ₹323.5 crore- Total physical currency in circulation: ₹35.4 lakh crore
2. Risks to Traditional Banking	- Risk of deposit disintermediation- 1% shifts in deposits = ₹1.5 lakh crore loss to banks- Threat to credit creation due to reduced bank liquidity- Reduced money multiplier effect
3. Operational Challenges	- Core banking and cybersecurity infrastructure upgrades required- No full interoperability with UPI yet- RBI to allow fintech's like Paytm & PhonePe to participate by end of 2025- Only 28% of registered merchants have used e₹ for at least one transaction
4. Effects on Monetary Policy	- e₹ enables programmable monetary tools and real-time monitoring- Current version of e₹ is non-interest-bearing- Potential for interest-bearing e₹ to improve policy transmission- Could accelerate bank runs during economic crises
5. Financial Inclusion	- Internet penetration: 47% (overall), 38% (rural)- Awareness: Only 31% of rural/semi-urban respondents knew of e₹ (RBI survey, 2024)- G2P use cases: Trials in Maharashtra & Karnataka for MGNREGA and subsidies
Summary	- e₹ holds long-term potential but adoption is limited- Traditional banks face deposit and credit risks- Key needs: system upgrades, fintech integration, awareness programs, and rural reach expansion

Source - <https://www.rbi.org.in>

The Digital Rupee (e₹), launched in 2022, has seen moderate adoption with over 5 million users, but still lags behind UPI in transaction volume and public awareness. Major operational challenges for banks include the need for technology upgrades, privacy vs. compliance with AML/KYC laws, and high implementation costs—estimated at USD 2 billion for large economies like India. Ensuring interoperability with UPI, NEFT, and RTGS is critical for smooth integration. The e₹ offers opportunities to improve monetary policy, enabling direct control via interest-bearing CBDCs and potential use of negative interest rates. However, it may disrupt liquidity management, reducing banks' traditional roles. The Digital Rupee also provides real-time data that can help the RBI make timely policy decisions.

In terms of financial inclusion, e₹ can reach 190 million unbanked Indians, streamline direct benefit transfers (DBT), and offer offline capabilities in rural areas. It also enables targeted financial services for farmers and small businesses. Globally, over 100 countries are exploring CBDCs. China leads with 260 million e-CNY users, offering key lessons for India. India's e₹ could transform cross-border payments, especially through trials like India-UAE remittance integration. With strategic implementation and focus on inclusion, interoperability, and regulation, the Digital Rupee has the potential to reshape India's financial ecosystem and establish global leadership in digital finance.

The Digital Rupee (e₹), issued by the RBI, utilizes Distributed Ledger Technology (DLT) to enhance security, transparency, and efficiency. It exists in two forms: Retail (e₹-R), a token-based system enabling peer-to-peer transactions like cash, and Wholesale (e₹-W), an account-based system used for interbank settlements. Blockchain's cryptographic protocols ensure secure, tamper-proof transactions, while its decentralized structure reduces system failures.

Despite these benefits, e₹ adoption faces hurdles like scalability, integration with systems like UPI, and limited rural internet access. As of April 2024, India had 886 million internet users, 55% in rural areas, but 41% of the rural population still lacked connectivity. By September 2024, 5 million users and 4 million merchants had joined the e₹ platform. However, daily transactions fell from 1 million in December 2023 to 100,000 by June 2024, post the expiration of initial incentives.

Adoption is hindered by limited awareness—only 36% urban and 19% rural populations are familiar with e₹. To boost usage, strategies include public education, especially in regional languages, emphasizing security benefits, and integrating e₹ with popular platforms like UPI (which processes over 11.4 billion monthly transactions worth INR 17.16 lakh crore). Financial incentives like cashback could further encourage adoption, as 75% of UPI users engaged due to such rewards.

Compared to UPI's 300 million daily transactions, e₹'s volume remains low. However, e₹ offers distinct advantages: it doesn't require a bank account, supports offline transactions, and enables programmable usage—ideal for targeted subsidies and rural applications. This makes e₹ especially relevant for India's 190 million unbanked adults, reinforcing the need for sustained efforts to build trust, infrastructure, and ecosystem interoperability.

TABLE 2 - Comparison with Existing Digital Payment Systems like UPI & RBI Digital Rupee (e₹)

Feature	Digital Rupee (e₹)	UPI
Nature	Digital form of sovereign currency	Payment interface for bank account transfers
Account Requirement	Not mandatory (wallet-based)	Mandatory (linked bank account)
Offline Capability	Yes (in development)	No
Programmability	Yes (conditional payments possible)	No
Legal Tender Status	Yes	No
Transaction Speed	Instantaneous	Real-time

Interoperability

Limited (expanding)

High (widely accepted)

Adoption:

The Digital Rupee pilot, launched in late 2022, reached over 5 million users and 4 million merchants by September 2024 across 13 cities. However, adoption remains low compared to UPI, which processed 11.4 billion transactions worth ₹17.16 lakh crore in October 2024. Daily e₹ transactions peaked at 1 million in December 2023 but dropped to 100,000 by June 2024, as early incentives wore off. Awareness is limited—only 36% urban and 19% rural users understand how to use it. Key adoption factors include ease of use, trust in RBI, 84% mobile penetration, and use cases like digital subsidies, metro transit, and contactless payments.

Risks to the Banking System:

The adoption of the Digital Rupee introduces systemic risks for traditional banks. An IMF report (2023) warns of a potential 20–30% drop in bank deposits under aggressive CBDC adoption, reducing banks' lending capacity. With retail e₹-R allowing users to hold funds directly with the RBI, banks may be bypassed, increasing the risk of digital bank runs during crises. Banks also face competition from the RBI in payment services and infrastructure, threatening fee-based revenues. Additionally, cybersecurity becomes critical, as over 1.4 million financial-sector incidents were reported in 2023 (CERT-In).

Operational Challenges for Banks:

Implementing the Digital Rupee will require banks to make substantial upgrades, including DLT-ready systems, staff training, and mobile app development. According to a 2024 FICCI survey, 72% of Indian banks cite tech costs as the main barrier. Ensuring interoperability with systems like UPI, NEFT, and Bharat BillPay adds complexity. Banks also face regulatory challenges balancing privacy with AML and KYC compliance. Additionally, onboarding merchants—costing INR 750–1,000 each—adds to the financial burden due to training and system integration requirements.

Impact on Monetary Policy:

The Digital Rupee can strengthen India's monetary policy by enabling real-time data access, improving liquidity control, inflation targeting, and responsiveness to economic shocks. It can also reduce fiscal leakages—currently 20–25% of welfare disbursements—through direct, programmable transfers for specific uses like subsidies. Replacing unregulated crypto use (worth USD 5.5 billion annually) with the Digital Rupee would enhance currency sovereignty and improve monetary transmission.

Impact on Financial Inclusion:

India has around 190 million unbanked adults, and the Digital Rupee could help bridge this gap through mobile-first access, QR-code payments, and offline functionality. Offline wallets tested in remote regions like the Andaman & Nicobar Islands and Ladakh enable usage without constant internet. Additionally, e₹ can enhance efficiency in government-to-person (G2P) transfers for over 800 million beneficiaries of schemes like PMGKY and PM-Kisan. By lowering transaction and access costs—currently up to ₹50–100/month for rural users—the Digital Rupee could significantly boost financial inclusion.

Global Comparison:

Over 130 countries, covering 98% of global GDP, are exploring CBDCs, with 11 having launched them. China's e-CNY has seen limited adoption despite 260 million wallets, partly due to competition from dominant private payment apps. Similarly, in India, existing platforms like UPI pose adoption challenges for the Digital Rupee. However, a key opportunity lies in enhancing cross-border remittances—worth USD 115.3 billion in 2023—by using blockchain to reduce average fees (4.7%) and speed up processing from days to seconds.

6. CONCLUSION & RECOMMENDATIONS

❖ Recommendations For Banks, Regulators, and Policymakers:

The Digital Rupee (₹) is a major advancement in India's digital financial landscape, utilizing Distributed Ledger Technology (DLT) to improve security, transparency, and efficiency. As of September 2024, over 5 million users and 4 million merchants have adopted it, though its usage still trails behind UPI, which handles over 300 million transactions daily. Key challenges to broader adoption include limited public awareness, infrastructure gaps, and lack of interoperability with current systems.

Globally, India's ₹ aligns with trends in Central Bank Digital Currencies (CBDCs), with over 100 countries exploring CBDCs and 60 in advanced stages. Successful examples include China's Digital Yuan and the Bahamas' Sand Dollar. India is also conducting cross-border trials with the UAE, tapping into its \$115.3 billion remittance market.

The ₹ has potential to promote financial inclusion for India's 190 million unbanked adults by enabling offline usage and improved access to banking. For successful implementation, key steps include:

1. **Public education campaigns to raise awareness, particularly in rural areas.**
2. **Interoperability with existing systems like UPI and NEFT.**
3. **Strong cybersecurity and privacy frameworks, including regular audits.**
4. **Incentives for banks and intermediaries to adopt and promote ₹ use.**

By addressing these issues and learning from global experiences, the Digital Rupee can modernize India's financial infrastructure and strengthen its position in the global digital economy.

Focus on Infrastructure Development

Limited internet access—only 38% of rural households—poses a challenge to Digital Rupee adoption in India. To address this, banks and policymakers must enhance rural digital infrastructure, provide affordable smartphones and connectivity, and learn from countries with faster CBDC uptake due to strong digital systems. Initiatives like incentivizing mobile providers and setting up ₹ kiosks in rural areas can further boost accessibility.

Implement a Phased Rollout and Continuous Feedback Loop

A phased rollout of the Digital Rupee is crucial to ensure a smooth transition and minimize disruptions. The RBI should start with pilot programs in select regions, similar to China's gradual approach with the Digital Yuan. Gathering feedback from users, merchants, and

intermediaries during early stages will help refine the system and address issues before nationwide implementation.

Promote Cross-Border Payment Integration

The Digital Rupee holds strong potential to improve cross-border payments, a critical need given India received USD 115.3 billion in remittances in 2023. By collaborating with countries like the UAE and expanding to BRICS nations, India can make international transfers more efficient and affordable. CBDCs could help cut global remittance costs, which currently average 6.3%, according to the World Bank.

To enhance financial inclusion in India, where 190 million adults remain unbanked, the Digital Rupee (CBDC) should focus on serving remote and underserved areas through features like offline functionality and user-friendly, low-cost solutions. Drawing lessons from Nigeria's eNaira, efforts must ensure the CBDC is accessible and inclusive. Successful implementation requires a comprehensive strategy involving public awareness, integration with current payment systems, robust security, and infrastructure development. Collaboration among banks, regulators, and policymakers is essential. By adopting global best practices, India can lead in CBDC adoption and build a secure, inclusive financial ecosystem.

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