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CENTRAL BANK DIGITAL CURRENCY (CBDC) – DIGITAL RUPEE (E₹): TRANSFORMING INDIA'S DIGITAL FINANCIAL ECOSYSTEM

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RESEARCH ARTICLE

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Abstract

The swift digital evolution of financial systems has heightened global interest in Central Bank Digital Currencies (CBDCs) as secure, efficient, and sovereign alternatives to traditional cash and private cryptocurrencies. India's Central Bank Digital Currency, referred to as the Digital Rupee (e₹), launched by the Reserve Bank of India (RBI), marks a significant achievement in the modernization of the nation's payment and monetary framework. This review article explores the concept, development, implementation, opportunities, challenges, and future prospects of the Digital Rupee in reshaping India's digital financial landscape. The main aim is to evaluate the role of CBDC in enhancing payment efficiency, promoting financial inclusion, lowering currency management costs, reinforcing monetary sovereignty, and aiding economic modernization. The research employs a narrative review methodology based on secondary data gathered from RBI publications, Bank for International Settlements (BIS) reports, International Monetary Fund (IMF) documents, government policy papers, and peer-reviewed academic literature published between 2018 and 2026. The results indicate that the Digital Rupee possesses significant potential to complement current payment systems, enable secure and instantaneous transactions, support offline payments, enhance cross-border remittances, and facilitate programmable financial services. Nevertheless, issues related to cybersecurity, privacy protection, technological infrastructure, financial stability, and digital literacy remain considerable challenges. The study concludes that India's phased CBDC implementation strategy provides a balanced framework for encouraging innovation while ensuring monetary and financial stability, positioning the Digital Rupee as a transformative cornerstone of the nation's future digital economy.

Keywords: *Central Bank Digital Currency, Digital Rupee, e₹, Reserve Bank of India, Financial Inclusion, Digital Payments*

Introduction

The progression of money has continually mirrored transformations in economic frameworks, technological progress, and societal demands. From barter systems and metal coins to paper currency and digital payments, every phase of monetary evolution has sought to enhance the efficiency, security, and accessibility of financial transactions. In recent times, swift technological advancements, extensive internet access, and the rise of digital financial services have hastened the shift towards cashless economies. Concurrently, the rise of cryptocurrencies and decentralized finance has posed challenges to conventional monetary systems, prompting central banks globally to investigate sovereign digital currencies. In this regard, Central Bank Digital Currency (CBDC) has surfaced as one of the most pivotal financial innovations of the twenty-first century.

A CBDC denotes a digital variant of sovereign currency that is issued and regulated by a nation's central bank. In contrast to private cryptocurrencies like Bitcoin and Ethereum, CBDCs are recognized as legal tender, supported by governmental authority, and crafted to uphold monetary stability. India's Digital Rupee (e₹), launched by the Reserve Bank of India (RBI), signifies the nation's strategic initiative to modernize its monetary and payment systems while ensuring trust, security, and regulatory supervision. The Digital Rupee merges the dependability of central bank money with the ease of digital technology, thus establishing a new facet in the evolution of money.

India boasts one of the most sophisticated digital payment ecosystems globally, bolstered by platforms such as RTGS, NEFT, IMPS, UPI, BBPS, and NETC. Government initiatives like Digital India, Jan Dhan Yojana, Aadhaar, and the rise in smartphone usage have significantly propelled financial digitization. Building upon this strong foundation, the Union Budget for 2022–23 introduced the Digital Rupee, followed by pilot projects that encompass both wholesale and retail segments of Central Bank

Digital Currency (CBDC). This review intends to analyse the development, implementation, advantages, challenges, and future outlook of the Digital Rupee within the context of India's dynamic financial ecosystem. The study emphasizes policy, operational, economic, and financial aspects while omitting intricate technical coding frameworks. The research aims to address the pivotal question: In what ways can the Digital Rupee reshape India's digital financial landscape while ensuring a balance between innovation, efficiency, financial inclusion, financial stability, and consumer protection? In light of the growing global interest in CBDCs, it is both timely and pertinent for policymakers, financial institutions, researchers, and industry stakeholders to comprehend the opportunities and implications associated with the Digital Rupee.

Figure 1. Central Bank Digital Currency (CBDC) In India– Digital Rupee (e₹). Source: Axis Bank

Methodology

This research utilizes a narrative review approach to consolidate existing insights regarding Central Bank Digital Currency and the Digital Rupee initiative in India. The review is based solely on secondary sources and seeks to deliver a thorough understanding of the changing CBDC environment through a systematic gathering and thematic examination of published literature. Relevant literature was located through searches in prominent academic and policy databases, such as Google Scholar, Scopus, Web of Science, JSTOR, SSRN, publications from the Reserve Bank of India (RBI), reports from the Bank for International Settlements (BIS), working papers from the International Monetary Fund (IMF), World Bank publications, and policy documents from the Government of India. Additional data was collected from peer-reviewed journals that concentrate on monetary economics, digital finance, financial technology, banking innovation, payment systems, and digital governance.

The search strategy incorporated keywords including "Central Bank Digital Currency," "CBDC," "Digital Rupee," "e₹," "Retail CBDC," "Wholesale CBDC," "Digital Payments in India," "Financial Inclusion," "CBDC Adoption," "Programmable Money," "Cross-Border Payments," "Monetary Policy," and "CBDC Challenges." Publications from the years 2018 to 2026 were included to guarantee relevance and encompass recent advancements. The inclusion criteria comprised peer-reviewed journal articles, reports from central banks, government publications, policy documents, conference proceedings, and empirical research that specifically addressed the implementation, adoption, design, and impact of Central Bank Digital Currencies (CBDCs). Publications that exclusively focused on private cryptocurrencies without any relevance to CBDCs were excluded from consideration. Additionally, duplicate entries, non-English publications, and studies that lacked analytical rigor were also disregarded. The literature that was selected underwent analysis through a thematic framework that included the evolution of CBDCs, payment efficiency, financial inclusion, programmability, monetary sovereignty, financial stability, technological infrastructure, and policy implications. A comparative analysis was utilized to uncover common findings, differing viewpoints, emerging trends, and gaps in research within the existing literature.

Thematic Discussion

The literature demonstrates a growing global consensus regarding the transformative role of CBDCs in modern financial systems. Scholars such as Debesh Bhowmik (2021), Nanez Alonso et al. (2021), Allen et al. (2022), and Corbet et al. (2023) describe CBDCs as the next evolutionary stage in the development of sovereign money. They argue that CBDCs combine the trust associated with central bank-issued currency with the efficiency of digital technology while maintaining monetary sovereignty and regulatory oversight. Unlike decentralized cryptocurrencies, CBDCs provide stability and legitimacy, making them suitable for large-scale public adoption.

Kumar, R. (2025) discusses the sustainability of CBDC adoption and its impact on sustainable economic growth. Debesh Bhowmik. (2021) explores pilot projects aimed at introducing central bank digital currency. Mehlkop, G et al (2023) focus on the establishment of new digital mediums of exchange. Pandey, A. K et al (2025) emphasize the importance of design features in Central Bank Digital Currency (CBDC). Kaur, H et al (2024) highlight a crucial development in the evolution of financial systems. Kaur, H et al (2025) examine the factors influencing intentions to adopt Central Bank Digital Currency (CBDC). Banerjee, S.et al (2023) underscore the potential of CBDC to enhance financial inclusion. Ghosh, D et al (2025) argue that CBDC can facilitate smoother global trade and financial integration. Garg, M et al (2025) note that the adoption of Central Bank Digital Currency (CBDC) is gaining momentum globally. Nanez Alonso et al (2021) report that several countries and currency areas are considering the implementation of CBDCs.

Sandhu K et al (2025) advocate for the use of central bank digital currency (CBDC) as a means to promote financial inclusion. Ogunmola GA et al (2024) discuss the adoption of digital currencies in India. Attarde K et al (2025) assert that the adoption of CBDCs can contribute to enhanced financial stability. Desai R (2025) assesses the readiness to adopt central bank digital currency (CBDC). Ghosh K et al (2026) explore the future of digital currency and FinTech adoption. Allen, F et al (2022) highlight the role of enhanced public confidence in promoting innovation growth within this market. Haque, M. A et al (2023) state that the adoption of e₹ necessitates adequate digital infrastructure and regulations to ensure safety, reliability, and usability. Priyadarshini, D et al (2022) identify opportunities and challenges associated with the adoption of CBDCs. Gupta, M et al (2023) analyze the factors that influence CBDC adoption and usage behavior in India.

A dominant theme in the literature concerns payment system efficiency. Studies by Liu et al. (2024), Claessens et al. (2024), Wang et al. (2025), and Ghosh et al. (2025) emphasize that CBDCs can significantly improve transaction speed, reduce settlement delays, and lower operational costs. The Digital Rupee is particularly relevant within India's highly digitized payment environment. Researchers suggest that retail CBDC can facilitate seamless peer-to-peer and merchant payments, while wholesale CBDC can improve government securities settlement and interbank transactions through faster and more secure processing mechanisms.

Samudrala, R.S et al (2021) suggest that financial inclusion can benefit from the adoption of CBDC. Mohammad Razi-ur-Rahim et al (2026) emphasize the importance of policymakers in crafting strategies for a seamless transition to CBDC adoption. Simarjeet Singh et al (2023) discuss the motivations behind the launch of central bank digital currencies in emerging markets. Babu, S et al (2021) describe digital currency as a medium of exchange and a store of value. Singh, V et al (2026) advocate for enhancing digital financial literacy and incorporating strong anonymity protections to build user trust in CBDC systems. Sethaput et al (2023) note that Blockchain or Distributed Ledger Technology (DLT) can facilitate the implementation of CBDC. Rani, M et al (2026) highlight that central bank digital currency (CBDC) is increasingly seen as an appealing alternative to traditional currencies, improving the speed and efficiency of online transactions. Thapliyal, K et al (2025) focus on CBDC adoption as a means to achieve the nation's sustainable development objectives.

Sandhu, K et al (2023) assert that CBDC aims to enhance efficiency in exchanges and promote financial inclusion. Ghosh K et al (2025) examine the factors influencing CBDC adoption at both micro and macroeconomic levels. Corbet, S et al (2024) argue that successful CBDC implementation necessitates a harmonious relationship between technological infrastructure and regulatory frameworks. Bhatnagr P et al (2025) point out that perceived value significantly impacts the utilization of digital currency. Bapat D et al (2026) discuss how central bank digital currencies (CBDC) are transforming digital finance, driven by central banks and policymakers globally. Laboure, M., H.-P et al (2021) analyze the environmental, social, and governance (ESG) implications associated with the introduction of such digital currencies. Bhaskar, R et al (2022) suggest that the development of CBDCs could lead to the establishment of a global common currency. Ozili PK (2023) explores the role of central bank digital currency (CBDC) in promoting financial inclusion and stability within the Fintech landscape..

Shroff, S.J et al (2026) assert that the adoption of digital currency represents a vital frontier for financial systems in emerging markets. Shah, M. A et al (2025) discuss opportunities and collaborative strategies for blockchain-enabled Central Bank Digital Currencies (CBDCs). Desai R et al (2026) focus on strategizing initiatives aimed at accelerating the adoption of CBDCs. Kumar, J et al (2025) define Central Bank Digital Currency (CBDC) as a type of digital currency issued by a central bank. Gupta, S et al (2023) significantly predict the willingness to adopt the digital rupee, with the exception of perceived usefulness. Razi-ur-Rahim et al (2024) explore the introduction of Central Bank Digital Currency (CBDC) among urban populations in India. Subhadarsini, A et al (2025) note that advancements in technology related to blockchain have led to the emergence of Central Bank Digital Currencies (CBDC). Bhatnagr P (2025) highlights developments in digital financial services. Ozili PK (2023) emphasizes the potential for issuing CBDCs, citing numerous benefits.

Ghosh, K et al (2025) examine potential directions for national-level policies regarding CBDCs. Palanisamy, M et al (2025) discuss the achievement of a nation's broader digital transformation goals. Vijayalakshmi, S et al (2026) indicate that there is rapid progress towards the adoption of digital currency. Hemphill, T. A. (2024) suggests that the next technological disruption in the banking and financial services sector will involve the introduction of a central bank digital currency. Liu, X et al (2024) argue that central bank digital currency (CBDC) promises a significant transformation of the payment system. Low, R. K. Y., & Marsh, T. (2025) investigate Blockchain Technology and Decentralized Applications in the context of CBDC.

Financial inclusion remains another major area of discussion. Banerjee et al. (2023), Sandhu et al. (2023; 2025), Samudrala et al. (2021), and Desai (2026) highlight the ability of CBDCs to expand access to formal financial services among underserved populations. Digital wallets, simplified onboarding procedures, and offline transaction capabilities can provide financial access to individuals living in remote and rural regions. The Digital Rupee also offers opportunities for direct benefit transfers, welfare payments, and subsidy distribution, thereby improving economic participation among marginalized communities.

Claessens, S et al (2024) discuss Central Bank Digital Currencies (CBDCs) for both retail and wholesale applications. Migozzi, J et al (2024) provide an analysis of FinTech developments in India. Basu, P. (2025) examines the implications of Central Bank Digital Currencies (CBDCs). Kim, J. J et al (2024) explore the intention to utilize CBDC for payments. Pham A et al (2025) focus on establishing foundational trust and clearly articulating user benefits. Bindseil, U et al (2025) analyze technological and preferential changes in the use of money as a payment method. Ozili PK (2024) investigates the factors influencing global interest in Central Bank Digital Currency (CBDC). Khan FN et al (2026) assess the willingness to adopt Central Bank Digital Currency.

Corbet S, et al (2023) highlight the development of Central Bank Digital Currencies as one of the most progressive movements by central banks in recent years. Gafsi, N. (2025) evaluates the impact of Central Bank Digital Currencies (CBDCs) on global financial systems. Wang, D et al (2025) discuss strategies for enhancing the adoption of CBDC-based payment systems. Desai, R (2026) addresses the advantages of CBDC in promoting financial inclusion.

The literature further emphasizes programmability as a transformative feature of CBDCs. Researchers such as Nyffenegger (2024), Shah et al. (2025), and Low and Marsh (2025) argue that programmable money can enable conditional payments, smart contracts, automated compliance, and targeted government spending. Such capabilities can improve transparency, reduce leakages, and enhance the effectiveness of public welfare programs. Programmable CBDCs may also support innovative financial products and facilitate digital transformation across multiple sectors.

Koul, S et al (2024) note that digital credit services are swiftly advancing within the realm of Internet commerce. El Kalak I et al (2026) examine the personal financial planning elements that affect the acceptance of central bank digital currencies. Wronka, C (2023) discusses digital currency that serves a variety of functions, including digital payments. Said, J. E et al (2026) assess the design trade-offs associated with retail CBDCs. Nechitailo V et al (2021) explore the potential regulations surrounding Central Bank Digital Currencies. Li, S. (2026) argues that enhancing central bank monetary discipline necessitates legal frameworks. Rossi, S. (2025) suggests that CBDCs could replace banknotes in developed economies. Nyffenegger, R (2024) investigates the fundamentals of a CBDC on blockchain for programmable payments. Ozili, P.K (2022) states that the rise of central bank digital currency (CBDC) presents an opportunity for central banks to significantly contribute to the shift towards a circular economy.

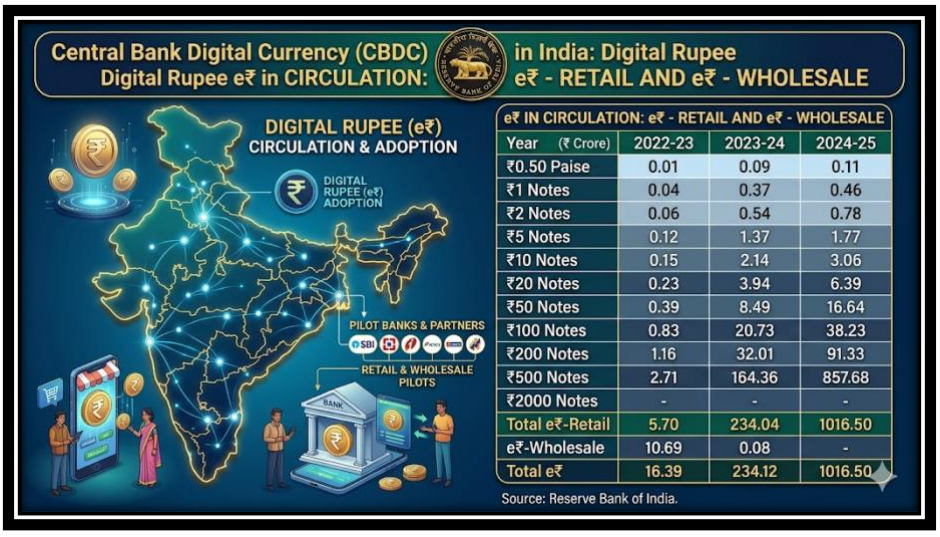
Another significant theme concerns monetary sovereignty and financial stability. Studies by Ozili (2023; 2024), Attarde et al. (2025), and Bindseil et al. (2025) suggest that CBDCs can strengthen monetary control by providing a sovereign alternative to private cryptocurrencies. However, researchers caution that excessive migration of bank deposits into CBDC wallets could affect commercial banking operations and credit creation. Consequently, most scholars advocate phased implementation accompanied by appropriate regulatory safeguards and risk management frameworks.

Balasubramanian SA et al (2025) look into the issuance of central bank digital currencies in their digital format. Shreekanth M. et al (2025) focus on digital currencies that maintain relatively stable valuations. Singh, R. (2025) discusses Central Bank Digital Currency and its role in facilitating trade settlements in INR. Walker, G. A. (2022) presents Central Bank Digital Currency (CBDC) as both a new opportunity and a new challenge. Rana, R et al (2025) propose policy initiatives aimed at improving financial inclusion and closing the digital divide. Weinberg, A.I et al (2025) conduct thorough evaluations of CBDCs. Fahad S et al (2024) analyze Central Bank Digital Currencies (CBDCs) in the context of the growing global demand for digital payments. Alamsyah A et al (2025) address issues of financial inclusion, competition, and economic growth.

Technology and governance issues are also widely discussed. Haque et al. (2023), Corbet et al. (2024), Singh et al. (2026), and Li (2026) emphasize the need for strong cybersecurity frameworks, privacy protection mechanisms, robust legal structures, and comprehensive digital infrastructure. Their findings suggest that successful CBDC adoption depends not only on technological innovation but also on user trust, regulatory clarity, and institutional readiness.

Results

The literature review presents compelling evidence that underscores the transformative potential of the Digital Rupee within India's financial landscape. Most research identifies key advantages of CBDC adoption, including enhanced payment efficiency, increased financial inclusion, greater transparency, and decreased currency management costs. Findings from various studies suggest that CBDCs can markedly enhance transaction speed, mitigate settlement risk, and reduce operational expenses when compared to traditional payment systems. Since its inception, India's Digital Rupee pilot has shown significant growth. As per RBI data, the total value of e₹ in circulation surged from ₹16.39 crore in 2022–23 to ₹234.12 crore in 2023–24, and further escalated to ₹1,016.50 crore in 2024–25. The retail sector has been the primary driver of this growth, climbing from ₹5.70 crore in 2022–23 to ₹1,016.50 crore in 2024–25. The ₹500 denomination accounted for the largest portion of circulation, increasing from ₹2.71 crore in 2022–23 to ₹857.68 crore in 2024–25.



Year (₹ Crore)	2022-23	2023-24	2024-25
₹0.50 Paise	0.01	0.09	0.11
₹1 Notes	0.04	0.37	0.46
₹2 Notes	0.06	0.54	0.78
₹5 Notes	0.12	1.37	1.77
₹10 Notes	0.15	2.14	3.06
₹20 Notes	0.23	3.94	6.39
₹50 Notes	0.39	8.49	16.64
₹100 Notes	0.83	20.73	38.23
₹200 Notes	1.16	32.01	91.33
₹500 Notes	2.71	164.36	857.68
₹2000 Notes	-	-	-
Total e₹-Retail	5.70	234.04	1016.50
e₹-Wholesale	10.69	0.08	-
Total e₹	16.39	234.12	1016.50

Figure 2. Central Bank Digital Currency (CBDC) – Digital Rupee (e₹) in India: e₹ in Circulation: e₹ - Retail and e₹ - Wholesale Source: RBI

Figure 3. India's Central Bank Digital Currency (CBDC) - The Digital Rupee (e₹) in India: Pilot Is Ongoing With 19 Banks and 2 Non-Bank Entities. Source: RBI

The current pilot ecosystem comprises 19 participating banks and two non-bank entities, reflecting extensive institutional backing. Literature evidence points to favorable user acceptance attributed to convenience, security, accessibility, and compatibility with the existing digital payment framework. In summary, the findings indicate that the Digital Rupee has the potential to serve as a complementary tool within India's wider digital financial architecture, fostering innovation, efficiency, and inclusion.

Discussion

The results indicate that the Digital Rupee has considerable potential to revolutionize India's digital financial landscape. By merging government support with digital efficiency, the Digital Rupee overcomes the challenges linked to both physical currency and private cryptocurrencies. The existing literature consistently shows that Central Bank Digital Currencies (CBDCs) can improve payment efficiency, bolster financial inclusion, lower transaction costs, and foster innovation through programmable financial services. India's phased implementation strategy has proven to be a vital factor for success. The pilot-based method enables policymakers to assess technological performance, consumer behavior, operational viability, and cybersecurity risks prior to widespread deployment. This gradual approach reduces systemic risks while facilitating ongoing learning and policy adjustments.

However, the review points out several issues. Cybersecurity threats remain a major concern due to the growing complexity of digital attacks. Privacy issues necessitate a careful balance between user confidentiality and regulatory obligations, such as compliance with anti-money laundering laws. Furthermore, the risk of financial disintermediation due to a significant shift of deposits from commercial banks to CBDC wallets requires vigilant oversight. The analysis indicates that the effective implementation of CBDCs will rely on robust governance structures, public confidence, technological robustness, regulatory collaboration, and continuous innovation. If these prerequisites are fulfilled, the Digital Rupee could serve as a fundamental element of India's future digital economy.

Challenges, Limitations and Research Gaps

The existing body of literature concerning Central Bank Digital Currencies (CBDCs) predominantly emphasizes conceptual frameworks, pilot initiatives, and theoretical implications, rather than focusing on long-term empirical results. Given that the majority of CBDC projects globally are still in their developmental or experimental phases, the available evidence regarding their macroeconomic effects, consumer behavior, and implications for financial stability is notably limited. Several significant research gaps continue to exist. Areas such as cybersecurity vulnerabilities, privacy protection mechanisms, interoperability standards, and legal frameworks necessitate further investigation. Additionally, there is a lack of comprehensive research on the adoption of CBDCs among rural populations, elderly individuals, and communities that are digitally excluded. The long-term impacts of CBDCs on commercial bank deposits, lending practices, credit creation, and the transmission of monetary policy remain ambiguous. Moreover, there is a relative scarcity of comparative studies among countries that are implementing CBDCs.

Future research endeavors should aim to include large-scale empirical studies, behavioral research, longitudinal analyses, and cross-national comparisons to yield more profound insights into the effectiveness of CBDCs, the dynamics of their adoption, and the risks associated with them.

Future Directions

The future development of the Digital Rupee is anticipated to concentrate on scalability, interoperability, programmability, and cross-border integration. Researchers are increasingly highlighting the significance of offline payment capabilities to foster financial inclusion in areas with limited internet access. Such advancements could greatly enhance the accessibility and usability of CBDCs across various demographic segments. Emerging technologies such as blockchain, distributed ledger technology, artificial intelligence, tokenization, and decentralized identity systems are projected to play crucial roles in improving CBDC functionality. Programmable welfare transfers, smart contracts, and automated compliance mechanisms may open up new avenues for effective governance and public service delivery. International cooperation among central banks is also expected to expedite cross-border CBDC interoperability, thereby lowering remittance costs and enhancing settlement efficiency. India's CBDC and Asset Tokenisation initiatives offer a valuable platform for experimentation and innovation. Future research should investigate integration models, user behavior patterns, cybersecurity architectures, and policy frameworks that can support sustainable CBDC ecosystems in increasingly digital economies.

Conclusion

The Digital Rupee (e₹) signifies a pivotal advancement in India's monetary and financial framework. As a sovereign digital currency issued by the Reserve Bank of India, it merges the reliability and stability of central bank money with the effectiveness and convenience of digital technology. The literature examined in this study reveals that Central Bank Digital Currencies (CBDCs) have considerable potential to enhance payment efficiency, lower currency management expenses, bolster financial inclusion, facilitate programmable financial services, and uphold monetary sovereignty. India's sophisticated digital payment infrastructure lays a robust groundwork for the adoption of CBDCs. The notable rise in e₹ circulation and the increasing involvement of banks and financial service providers reflect a growing confidence in the Digital Rupee ecosystem. Concurrently, issues concerning cybersecurity, privacy, infrastructure readiness, digital literacy, and implications for the financial sector necessitate ongoing policy focus. The primary research question regarding whether the Digital Rupee can revolutionize India's digital financial landscape while ensuring stability and trust can be positively addressed, assuming that suitable safeguards, technological advancements, and regulatory frameworks continue to develop. As adoption broadens and technological capabilities advance, the Digital Rupee is set to become a fundamental element of India's digital economy, fostering a more inclusive, efficient, resilient, and globally competitive financial ecosystem.

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