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Digital Currency and the Indian Economy: A Comprehensive Review

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Abstract

Digital currency has emerged as a transformative force in modern financial systems, especially within developing economies like India. This review investigates the evolution, design, and policy implications of India's Central Bank Digital Currency (CBDC), the Digital Rupee (₹), introduced by the Reserve Bank of India (RBI). It explores the rationale for its development amidst a growing digital payments ecosystem, assessing its intended role in complementing cash and improving the efficiency of existing payment infrastructures. The paper evaluates key applications of the Digital Rupee including retail transactions, government transfers, interbank settlements, and potential cross-border use. The analysis highlights significant benefits such as promoting financial inclusion, reducing cash-handling costs, enhancing transparency in public welfare delivery, enabling programmable payments, and strengthening monetary sovereignty by offering a stable alternative to cryptocurrencies. However, the adoption of CBDCs also raises critical concerns around cybersecurity, privacy, regulatory readiness, digital infrastructure disparities, and potential disruption to traditional banking intermediation. India's phased rollout and two-tier operational model are reviewed alongside international experiences, including those of China, Sweden, the Bahamas, and Nigeria, to identify global best practices and contextual challenges. Ultimately, this paper argues that the success of the Digital Rupee will depend on coordinated policy formulation, public trust, robust technological architecture, and inclusive access. If implemented strategically, digital currency in India holds the potential to transform the country's financial ecosystem, drive innovation in digital governance, and position India as a leader in the future of money.

Keywords: Digital currency, CBDC, Digital Rupee, RBI, Indian economy, financial inclusion, blockchain, digital payments

Introduction

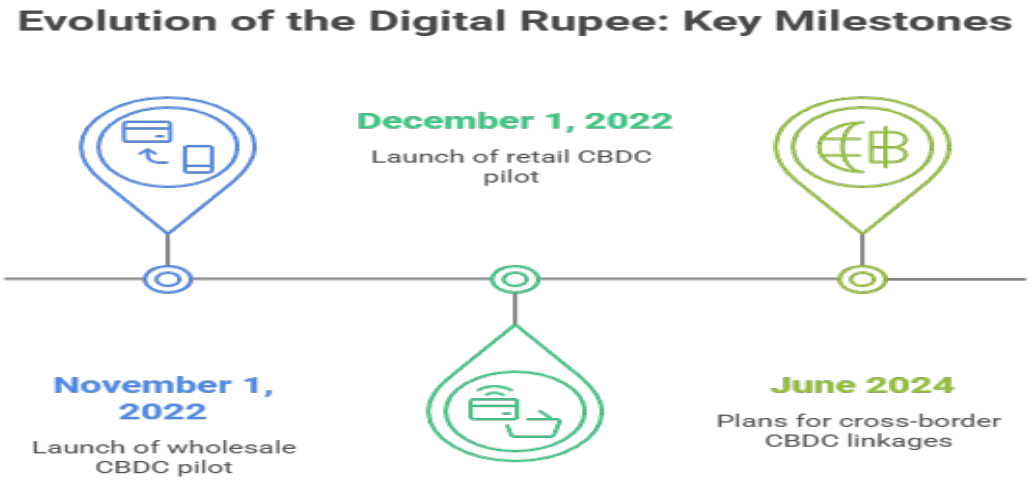
"Digital currency" refers to any form of currency that exists only in electronic form. This includes cryptocurrencies (like Bitcoin and Ethereum, which are decentralized and based on blockchain technology) and central bank digital currencies (CBDCs) (government-backed digital fiat). For example, Podder (2023) defines a cryptocurrency as "a digital currency based on a decentralized online platform called blockchain" enabling anonymous, peer-to-peer transactions. In contrast, a CBDC is "money in digital form and legal tender issued by a central bank"[2]. In India, the digital rupee (e₹) is being developed as a token-based CBDC that is a digital form of the Indian Rupee (₹) and carries the same RBI guarantee, finality, and usage as physical cash ("Central Bank Digital Currency in India," 2023)h. Broadly, digital currencies aim to leverage technology to make payments faster, cheaper, and more inclusive, while stablecoins (digital tokens pegged to fiat) also

seek to combine crypto features with price stability. (For example, BIS researchers note that stablecoins are designed to "maintain a stable value" relative to a fiat peg).

The idea of digital currency arises from global trends in payments and technology. Over time, new forms of money have been introduced (from commodity money to fiat notes, to electronic payment systems). Today, advanced economies and emerging markets alike are exploring digital currencies as a next step in the evolution of money. In India's context, digitalization of finance has already progressed via mobile banking, UPI, and electronic transfers. The Reserve Bank of India (RBI) has become interested in issuing its own digital currency (the e₹) to extend the digitalization of India's public infrastructure("Unveiling the Significance of RBI's Digital Currency," 2024)This review paper first defines digital currency types, then surveys India's digital currency history and use cases, examines the RBI's Digital Rupee initiative and regulatory framework, discusses benefits and challenges of adoption in India, compares with other countries' CBDC efforts, and outlines future prospects and policy recommendations.

Historical Development of Digital Currency in India

India's payments system has rapidly digitized in the past decade. Key milestones include the introduction of Real-Time Gross Settlement (RTGS) and National Electronic Funds Transfer (NEFT) in the early 2000s, followed by Unified Payments Interface (UPI) in 2016. UPI's success (over 5.8 billion transactions per month by mid-2022) reflects India's shift toward electronic payments. The 2016 demonetization (withdrawal of large-denomination banknotes) also accelerated adoption of digital payments. As an IMF review notes, demonetization "boosted demand" for non-cash transactions and combined with smartphone proliferation to make India a payments innovator (for example, UPI quickly became a model for other nation. Parallel to private payment apps, the RBI and government explored blockchain and fintech. For instance, in 2018 the NITI Aayog proposed a blockchain strategy and committees studied fintech regulation.



By 2021–2022, cryptocurrencies had become a public issue in India (the government banned banks from servicing crypto exchanges in 2018, but the Supreme Court lifted that ban in 2020). Concerned about cryptocurrency risks, the Government of India instituted a 30% tax on crypto gains and announced the launch of a digital rupee in the 2022–23 Budget(Haque & Shoaib, 2023). The RBI responded by quickly developing a CBDC pilot: in November 2022 it ran its first wholesale CBDC pilot for interbank settlement, and on December 1, 2022 it launched a retail CBDC pilot for general use. These pilots are part of RBI's deliberate, phased strategy. As RBI has reported, "Creation and issuance of retail

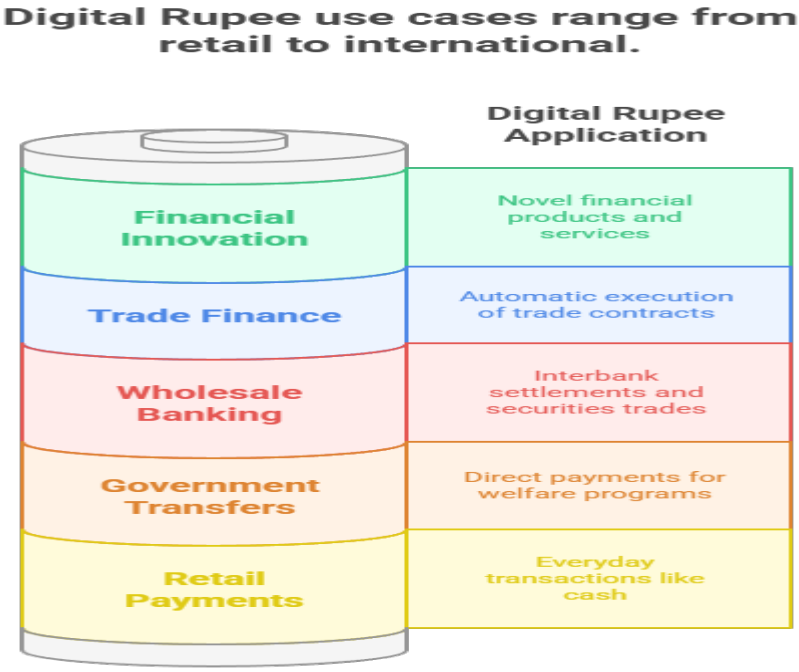
e₹…is live in pilot mode with effect from December 1, 2022(Reserve Bank of India, n.d.)". Thus India joined other countries (e.g. China, Bahamas, Eastern Caribbean) piloting CBDCs, but did so in a controlled and gradual way.

Applications and Use Cases

Retail Payments and Merchant Transactions

One of the primary use cases envisioned for the digital rupee is everyday retail payments. Like cash, e₹ is meant to be a universally accepted legal tender. Users hold e₹ in digital wallets on their smartphones (offered by banks and fintechs). The RBI FAQ explains that e₹ "can be used to receive/send money, and/or make payment for transactions, just like any physical ₹ note". In practice, a person can open an e₹ wallet via a mobile app and use it for peer-to-peer (P2P) transfers to friends or for person-to-merchant (P2M) payments at shops. At point-of-sale, a consumer can scan a CBDC QR code (generated by the merchant) or even the merchant's existing UPI QR code; the e₹ transaction then settles immediately between e₹ wallets (Reserve Bank of India, n.d.).

Crucially, e₹ is designed to work 24×7, even outside banking hours. It also aims to enable offline transfers in areas with poor internet (the RBI is testing NFC-based solutions for offline e₹ payment). In effect, e₹ combines digital convenience (instant, fee-free transfers) with cash-like features (no minimum balance, anonymity up to Rs 50,000 per day, portability). This could make retail payments faster and cheaper. For example, Haque & Shoaib (2023) note that e₹ could "make conducting business easier while enhancing the security and resilience of the overall payments system"(Haque & Shoaib, 2023). Sanskriti & Saleem (2024) similarly describe the e₹ as aiming to "revolutionize [India's] payment system by reducing…dependency on physical cash and promoting digital transactions". By reducing costs of printing and handling cash, e₹ has the potential to lower transaction costs for businesses and consumers.



Government Transfers and Welfare Programs

Digital currency could streamline government-to-person payments. In India, direct benefit transfers (DBT) for subsidies and pensions currently route funds into bank accounts or pre-paid cards. With e₹, the government could credit e₹ wallets of beneficiaries instantly and digitally. This offers more transparency and

speed. For example, an e₹-based welfare payment could be sent directly to a poor household's e-wallet (secured by Aadhaar authentication) instead of a bank account, reducing leakage and turnaround time. e₹'s audit trail could also allow real-time tracking of fund usage and program performance. Although no official pilot has yet targeted DBT, observers have noted that CBDC can improve fiscal transfers. Eichengreen et al. (2022) list "enhancing financial inclusion" and giving "government…control of the payments system" as advantages of India issuing a CBDC (Eichengreen et al., 2022). In practice, India's large unbanked population (especially in rural areas) could gain easier access to formal payments if e₹ wallets are made widely available and interoperable with India's existing digital ID (Aadhaar) and payment rails (UPI).

Wholesale Banking and Interbank Settlements

A second use-case is wholesale CBDC for the financial sector. In India's pilot, wholesale CBDC (W-CBDC) is used by banks to settle large-value transactions and government securities trades. On Nov 1, 2022 the RBI issued e₹ tokens for settlement of interbank obligations and Government of India bonds. For example, banks in the pilot could deposit rupee funds in a special W-CBDC wallet, then use e₹ tokens to instantaneously pay each other for bond purchases, instead of moving funds through netting systems. This promises real-time gross settlement without counterparty risk. Governor Das has noted that CBDC can "enhance efficiency in the financial market" by providing atomic settlement.

Moreover, wholesale CBDC can facilitate cross-border transactions. The RBI is exploring connecting the digital rupee with other countries' CBDCs. For instance, RBI's 2024 Annual Report states that collaborative projects will test CBDC-based cross-border payment systems to reduce settlement time and costs. As Kumar & Ahuja (2024) observe, the digital rupee is intended "to facilitate cross-border transactions by accelerating settlement times and removing drawbacks of traditional payment systems" ("Unveiling the Significance of RBI's Digital Currency," 2024). If realized, this could benefit Indian trade and remittances by enabling near-instant settlement of export/import invoices and remittance flows without multiple correspondent banks.

Trade and International Finance

In addition to cross-border payments, e₹ could support trade finance and international settlements. A programmable digital rupee could allow automatic execution of trade contracts (e.g. payment to exporters released when shipping documents are confirmed). It might also allow India to invoice trade in its own currency more easily. While still speculative, some commentators argue that CBDC could reduce dollar dependence in trade. Eichengreen et al. (2022) suggest one benefit is to "reduce dependence on the dollar-dominated global payments system". More concretely, if multiple countries use interoperable CBDCs, trade settlement could occur directly in e₹ between cooperating central banks, bypassing intermediary banks. However, these applications are in very early stages globally. India's pilots so far have focused on domestic aspects, though RBI's interest in cross-border pilots signals that use cases in trade finance are being considered (RBI to Scale Up Digital Rupee Trials, Considers Cross-Border CBDC Applications, n.d.).

Financial Sector Innovation

Beyond payments, the digital rupee opens new possibilities within banking and fintech. For banks, e₹ wallets are a new product, possibly generating revenue via value-added services even though RBI charges no fees for basic transfers. Fintech companies (e.g. Mobikwik, Cred, PhonePe) have partnered with RBI in 2022–2023 to offer e₹ wallets and services, suggesting a hybrid model where regulated nonbanks help distribute CBDC. This two-tier structure keeps private-sector innovation while RBI retains control of the base currency. Analysts note that e₹'s programmability could enable novel financial products: for example, e₹ tokens could be "smart contracts" that carry conditions (budgets that release money periodically, or identity-checked transfers). However, such advanced use cases have not yet been fully deployed. The current pilots

mainly test basic P2P/P2M functionality and infrastructure

The RBI Digital Rupee Initiative

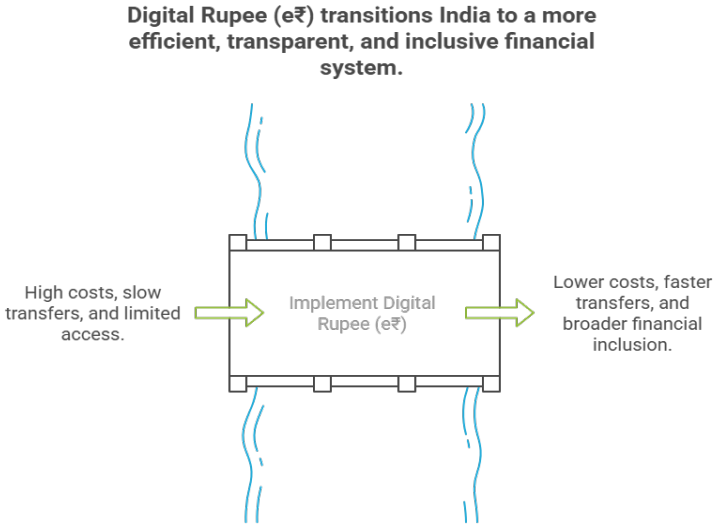
India's central bank has approached the e₹ cautiously. The RBI consulted with banks and IT firms before designing the system. It chose a two-tier model: RBI issues e₹ tokens to participating banks/non-banks, which then distribute them to end users via digital wallets. This allows the private sector to handle user onboarding and compliance (KYC/AML), while RBI handles monetary issuance. The RBI has repeatedly emphasized that e₹ holds the same denomination and guarantee as cash(Reserve Bank of India, n.d.); the only difference is the ledger is electronic. Indeed, "e₹ is legal tender" and guaranteed by the central government. Technically, RBI selected a permissioned blockchain (Hyperledger Fabric) as the ledger for retail e₹, whereas wholesale e₹ uses a different internal system, in order to test multiple architectures.

The rollout has been phased. As noted, RBI launched the wholesale pilot on Nov 1, 2022 for select banks to test bond settlements, followed by the retail pilot on Dec 1, 2022 for a few banks/nonbanks and customers. The pilots remain limited in geography and scope; as of mid-2024, about 6 major banks and several fintech's (Mobikwik, Cred, etc.) are involved (RBI to Scale Up Digital Rupee Trials, Considers Cross-Border CBDC Applications, n.d.). The retail pilot users can transfer e₹ to each other (P2P) and pay approved merchants (P2M) by scanning QR codes(Haque & Shoaib, 2023). Transactions can be settled 24/7 outside banking hours. The RBI has also introduced an "offline" payment mode in the pilot, using NFC/USSD solutions, to ensure people in areas with poor connectivity can use e₹.

Regulatory framework: The e₹ is backed by existing laws on currency. RBI has clarified that e₹ will not earn interest and will be subject to the same anti-money laundering (AML) and KYC rules as other digital transactions. Importantly, RBI ensures user privacy up to a point: retail e₹ transactions under Rs 50,000 remain mostly anonymous (just like cash), with no need to identify sender/receiver. Larger transfers may require reporting. Thus, e₹ aims to balance traceability (for law enforcement) with privacy (to maintain some cash-like anonymity).

RBI has also engaged on the legal side. In Parliament, the government passed the **Digital Rupee Bill (2022)** to formally authorize RBI-issued digital currency (treating e₹ as "digital banknotes" under Section 26 of the RBI Act). Meanwhile, RBI's ongoing discussions with other regulators (Finance Ministry, market regulators) ensure that CBDC coexists with systems like UPI, RTGS, and cryptocurrency oversight. The CBDC pilot is carefully coordinated with existing payment infrastructure: as one FAQ notes, e₹ can even scan UPI QR codes and settle via the normal UPI switch.

According to the RBI's Annual Reports (2023-24), going forward the central bank plans to scale up the pilots. The RBI commits to expanding the retail pilot to cover more banks and merchants, and extending the wholesale pilot to more government securities and interbank flows (RBI to Scale Up Digital Rupee Trials, Considers Cross-Border CBDC Applications, n.d.). Crucially, RBI is also exploring cross-border CBDC linkages. As of June 2024, the RBI is in discussions with some foreign central banks on pilot projects for CBDC payments, seeking to build an international "CBDC bridge".



Benefits of Digital Currency Adoption in India

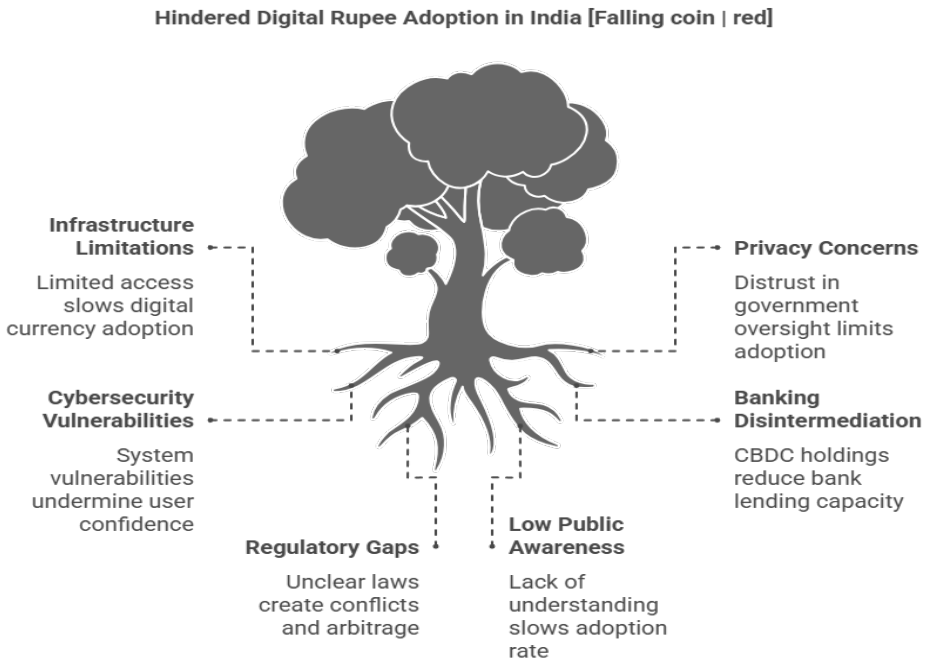
Proponents of the digital rupee cite multiple benefits:

- **Financial Inclusion:** A CBDC can bring unbanked and underbanked people into the digital economy. Since e₹ wallets can be opened without a brick-and-mortar bank branch, they can reach remote users. Haque & Shoaib (2023) and Sanskriti & Saleem (2024) both note that e₹ could help "extend financial services to unbanked societies" by accessible mobile wallets. Podder (2023) emphasizes that CBDCs "promote financial inclusion". In India, where about 10% of adults lack a formal account, a user-friendly e₹ system (integrated with Aadhaar for identity) could be a powerful inclusion tool.
- **Reduced Cash Handling Costs:** Physical currency is expensive to print, transport, and secure. India's currency-to-GDP ratio (~17% before Covid, per some estimates) is relatively high (Malhotra, n.d.), so moving value digitally could save significant seigniorage. As Sanskriti & Saleem note, a major advantage of e₹ is "reducing…dependency on physical cash" and its associated costs(Sanskriti & Saleem, 2024). Lower cash usage also cuts shadow economy activity (black money), since all digital transactions leave audit trails.
- **Efficiency and Transparency:** Digital transactions are faster and more traceable. An RBI-issued currency ensures all payments clear instantly, avoiding counterparty risk. Katz & Team (2024) highlight that digital currency can "reshape how money will circulate" by speeding up payments and settling instantly (Haque & Shoaib, 2023). Transparency into the money supply and flows is much higher with CBDC than cash, aiding central planning and fraud prevention.
- **Monetary Policy and Stability:** CBDC gives the central bank a new tool in its toolkit. For example, with digital currency the RBI could implement more effective negative interest rates (by charging small fees on e₹ wallets if needed), or use programmable money to deliver stimulus directly. CBDC also protects the central bank's monopoly on currency in the face of private digital coins. Eichengreen et al. (2022) argue that CBDC helps the government "retain control of the payments system"(Eichengreen et al., 2022). Podder (2023) similarly sees CBDC as necessary to ensure fiat currency's stability amid the rise of crypto.
- **Innovation Platform:** A CBDC can foster fintech innovation. By laying a digital payment rail across the country, RBI's e₹ may spark new products (interest-bearing wallets, micro-lending apps) and encourage banks and startups to invest in digital finance. For instance, some pilots have programmed e₹ tokens

for specific uses (subsidies that release monthly). In theory, smart-contract capabilities of CBDC could bring efficiencies to trade finance, escrow, and insurance claims (though these are future prospects).

Challenges and Risks in India

Despite the transformative potential of digital currency, its successful implementation in India faces several significant challenges. India's demographic diversity, digital infrastructure disparities, and regulatory complexity demand a cautious and inclusive approach. To ensure the Digital Rupee achieves its intended benefits—financial inclusion, reduced transaction costs, and secure digital transactions—the Reserve Bank of India (RBI) and stakeholders must navigate multiple economic, technological, and legal hurdles. The following are the most critical challenges and risks that India must address to ensure the long-term viability and public acceptance of the Digital Rupee:



- **Technology and Infrastructure:** India's diverse population includes many with limited internet or smartphone access. Ensuring robust ICT infrastructure nationwide is essential. Sanskriti & Saleem (2024) warn that digital rupee implementation "requires robust technology" and cybersecurity frameworks (Sanskriti & Saleem, 2024). RBI's offline payment efforts reflect recognition of the "digital divide." Moreover, scaling the blockchain to handle millions of transactions (especially given UPI's already huge load) will test system performance and resilience.
- **Privacy and Trust:** A fully traceable CBDC could raise privacy concerns. While e₹ allows some anonymity for small payments, larger transactions can be monitored. Users may distrust the government's oversight of their spending. Podder (2023) explicitly notes that unlike crypto, CBDC "is centralized" with "no scope for anonymizing transactions"(Podder, 2023). Designing a balance between surveillance for AML and user privacy is a major challenge. Public trust is also needed to adopt e₹ wallets; concerns about data breaches or misuse could slow adoption.
- **Cybersecurity and Operational Risk:** A digital currency becomes a new target for hackers. Any vulnerability in the e₹ system could undermine confidence. RBI must ensure extreme cybersecurity. Sanskriti & Saleem (2024) emphasize "cybersecurity threats" as a key risk that must be addressed (Sanskriti & Saleem,

2024). Furthermore, technical bugs or outages in the CBDC infrastructure could disrupt payments on a large scale, more so than an isolated failure of one private app.

- **Banking Disintermediation:** A prominent worry is that people might withdraw deposits to hold CBDC instead, reducing bank lending. If e₹ can be stored in a non-interest-bearing wallet (as currently designed), savers may prefer cash-like security over bank deposits, especially in crises. This could shrink the banking sector and impair credit availability. RBI will need to closely monitor liquidity flows and possibly adjust regulations (for example, by limiting wallet sizes or offering incentives to banks).
- **Regulatory and Legal Issues:** The legal framework for CBDC use, taxation, and cross-border flow is still evolving. Laws may need updating (the Digital Rupee Bill in Parliament was one step). Coordination among regulators (finance ministry, IT ministry, global partners) is required to prevent arbitrage or conflicts. Podder (2023) and others stress the need for "adequate regulatory measures" and international harmonization in crypto/CBDC rules(Podder, 2023).
- **Public Awareness and Adoption:** Even if technically sound, e₹ must achieve critical mass. As Ogunmola & Das (2024) find, Indian consumers' adoption intentions depend on perceived usefulness, ease of use, trust, and cost of the digital rupee (Ogunmola & Das, 2024). Their survey shows that if e₹ wallets are seen as convenient and secure, and if people understand them, adoption will rise. Conversely, if e₹ is seen as costly or confusing, uptake will lag(Ogunmola & Das, 2024). Thus, widespread education campaigns and user-friendly app design are crucial.

Comparative Perspectives

India's CBDC initiative can be compared with those of other countries. As of 2024, over 90% of central banks worldwide are exploring CBDCs. Major peers to consider include:

- **China (Digital Yuan):** China's digital currency (e-CNY/DCEP) is the most advanced. Pilots since 2020 have amassed hundreds of millions of users (by end-2021, over 261 million individual e-CNY wallets had been opened with CNY 87.6 billion transact
- The PBoC integrated e-CNY into existing apps (e.g. WeChatPay) and used it for government subsidies and salaries. Lessons for India include the need for mass adoption and offline capability. Unlike China's top-down blitz, India's approach is more gradual. Also, China's e-CNY retains more privacy for small payments (though all are traceable by PBoC). India can learn from China's scale but must balance RBI-control and user trust differently.
- **Bahamas (Sand Dollar) and East Caribbean (D Cash):** The Bahamas launched the Sand Dollar (first retail CBDC) in 2020, with government subsidies to encourage use. The Eastern Caribbean Currency Union has D Cash since 2021. Both are small economies; their adoption teaches that beyond publicity, users need incentives (lower fees) to switch. India's vast size and fragmented population present a tougher inclusion challenge than island nations.
- **Sweden (e-Krona) and EU (digital euro):** These advanced economies emphasize privacy and do cautious trials. The ECB is studying a digital euro but has not committed to launch, partly due to concerns about banking impacts. Sweden's e-Krona pilot aims for offline solutions. India can observe how these economies handle regulation and privacy in planning its own frameworks.
- **Nigeria (e-Naira):** Nigeria launched Africa's first CBDC in 2021. However, e-Naira struggled with low uptake and technical issues (only a tiny fraction of digital wallets became active users). The Nigerian experience warns India that citizen acceptance is not guaranteed and that robust tech (avoid multiple OTPs, ensure uptime) is vital.

Comparative insights suggest that while India's economy and digital infrastructure are unique, it can learn from others: strong public–private partnerships (as in China), built-in offline features (Bahamas, Sweden), and careful customer outreach (avoiding the e-Naira's pitfalls). The RBI has noted these global experiments and is collaborating with international bodies (IMF, BIS) to refine India's CBDC design.

Conclusion Future Prospects and Policy Recommendations

Digital currency is poised to play a significant role in India's economy. We have surveyed the forms of digital currency (cryptocurrencies vs CBDCs), traced India's journey from demonetization to UPI to the launch of the Digital Rupee, and reviewed use cases in retail payments, government transfers, banking, and trade. The RBI's Digital Rupee initiative, launched in late 2022, represents a cautious but ambitious effort to digitize the nation's cash. It promises benefits in inclusion, efficiency, and policy effectiveness, but also raises challenges in technology, privacy, and financial stability. Comparative experience suggests that success will depend on careful implementation and public trust. Going forward, India must continue to refine its CBDC design, expand the pilot safely, and align it with broader digital infrastructure. With supportive policy and regulation, the Digital Rupee could indeed become a new pillar of India's payment ecosystem and potentially reshape its financial system in the years ahead.

Going forward, India's digital currency could evolve in several ways:

- **Scaling Up the Pilot:** RBI will likely expand the retail pilot to more banks, fintech's, and merchant categories, perhaps aiming for nationwide roll-out by 2026. It may introduce e₹ in different forms (e.g. agent banking for rural areas) based on pilot feedback. Ensuring interoperability with UPI and card networks will be key, so users don't have to choose one over the other.
- **Monetization and Business Models:** Currently, RBI provides e₹ free of charge. To sustain the system, policymakers may consider modest fees on large transactions or value-added services. Banks and fintech's may be allowed to charge for premium wallet features. At the same time, for the economy to benefit, basic P2P transfers and small payments should remain inexpensive.
- **Regulatory Framework:** The legal basis for e₹ should be firmed up. Parliament's Digital Rupee Act is a start. RBI, Finance Ministry, and financial regulators (SEBI, IRDAI) should collaborate to update AML/CFT rules, cybersecurity standards, and data-protection laws relevant to CBDC. Internationally, India should engage with standard-setting bodies on CBDC interoperability and regulation to facilitate cross-border use.
- **Technological Innovation:** The RBI should continue to invest in the CBDC infrastructure (scalability, quantum-resistant encryption, offline transactions) and support R&D. Encouraging open innovation through hackathons or sandboxes could yield new e₹ use cases (micro-insurance, programmable subsidies, etc.).
- **Financial Ecosystem Impact:** Policymakers must monitor the macroeconomic effects. If e₹ disintermediates banks, RBI may adjust reserve requirements or issue interest-bearing CBDC accounts. If CBDC usage grows faster than expected, fiscal policy may need revision (e.g. managing seigniorage gains). On the positive side, a successful CBDC could reduce remittance costs (benefiting migrant workers) and increase formalization of the economy.
- **Public Education and Inclusion:** A large-scale campaign to educate citizens about e₹ – its safety, benefits, and usage – is essential. Partnerships with state governments could spread awareness in local languages. RBI and banks should ensure the e₹ wallet UX is simple, and consider USSD/sms-based access for those without smartphones. To bridge the digital divide, part of India's Digital India strategy (improving connectivity and

digital literacy) will complement CBDC adoption.

If implemented thoughtfully, the Digital Rupee could substantially change India's financial landscape. By embedding the Rupee into a fully digital Public Infrastructure, India could further its goals of inclusive finance and efficient government. However, care must be taken to not exacerbate inequality or privacy loss. The balance between innovation and stability will determine the economic impact of India's digital currency.

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