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INDIA'S DIGITAL RUPEE (e₹): ARCHITECTURE, ADOPTION, ECONOMIC IMPLICATIONS, POLICY CHALLENGES AND FUTURE PROSPECTS

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Abstract:
India's Digital Rupee (e₹) is a Central Bank Digital Currency (CBDC) issued by the Reserve Bank of India (RBI). It is a digital form of money issued by the central bank. This study presents an India-specific analysis of e₹ with a focus on its architecture, adoption, economic effects, policy challenges and prospects. The research design is descriptive and analytical. It uses secondary evidence from publications of the Reserve Bank of India (RBI), the Bank for International Settlements (BIS) and peer-reviewed literature. The study mainly uses sources published during the period 2021–2026. The analysis distinguishes e₹ from UPI and commercial bank deposits and examines adoption, programmability, offline capability, wholesale settlement, financial inclusion, privacy, cybersecurity and bank disintermediation. The analysis indicates that the distinctive value of e₹ may depend less on the replication of established retail payment functions and more on specialised applications such as programmability, offline payments, institutional settlement and settlement in central bank money. The literature identifies perceived usefulness, trust, awareness, interoperability, perceived risk and user value as important factors that influence e₹ adoption. The study presents an integrated framework for CBDC architecture, adoption, use cases, economic outcomes, policy risks and technology risks. It also considers sustainable development. The study concludes that sustainable e₹ development requires interoperability, privacy protection, cybersecurity and financial stability. It also requires easy access, reliable system operation and evidence-based testing.

Keywords: Digital Rupee (e₹), Central Bank Digital Currency, CBDC, UPI, Digital Payments, Financial Inclusion

1. Introduction

1.1 Background and Context

The rapid digitisation of financial services has transformed the ways in which money is accessed, transferred and used. India has developed a large digital payment ecosystem supported by bank account access, mobile technology, interoperable payment infrastructure and the expansion of the Unified Payments Interface (UPI). Alongside this transformation, central banks have examined Central Bank Digital Currencies (CBDCs) as digital forms of sovereign money. India's Digital Rupee or e₹, represents the Reserve

Bank of India's approach to this changing monetary and technological environment. The RBI defines the Digital Rupee as the digital form of India's currency and legal tender issued by the central bank. In the retail segment, e₹ can be used for person-to-person (P2P) and person-to-merchant (P2M) transactions through wallets offered by participating intermediaries. The retail pilot began on 1 December 2022, while the wholesale pilot began on 1 November 2022. The pilot approach has been designed to test technology, architecture, scalability, applications, user experience and acceptance rather than to imply immediate nationwide replacement of existing forms of money or payment infrastructure (Reserve Bank of India, 2022). The conceptual distinction between e₹ and UPI is central to the analysis. e₹ is a form of central bank money, whereas UPI is payment infrastructure through which funds can be transferred. The RBI also allows CBDC users to scan compatible UPI QR codes through e₹ applications. This shows that e₹ and UPI can work together through interoperability rather than serve as identical payment instruments (Reserve Bank of India, 2025a). The key question is not whether India needs another digital payment system. The key question is what additional economic and monetary functions sovereign digital money can provide.

CBDC design can affect more than payment convenience. It can change how people and businesses hold their money. It can also affect bank deposits, bank funding and the flow of credit. In addition, it may affect payment efficiency, privacy, financial stability and the way monetary policy works. The RBI's Concept Note identifies monetary policy, liquidity management, financial stability, legal issues, AML/CFT, privacy and balance-sheet implications as relevant policy dimensions (Reserve Bank of India, 2022). Against this background, India's Digital Rupee requires analysis beyond its technological architecture and payment functionality. Its significance extends to user adoption, financial inclusion, payment efficiency, bank intermediation, monetary sovereignty, privacy, cybersecurity and financial stability.

1.2 Research Problem and Gap

CBDC research often asks whether digital sovereign money can replace cash or compete with existing payment systems. This view may overlook the difference between money and payment systems. In India, the more important question is what additional functions e₹ can offer when convenient digital payment options already exist. Existing studies discuss CBDC architecture, adoption, monetary policy, financial stability, privacy, data governance and payment innovation from different viewpoints. However, the literature remains divided, with limited integrated analysis of these areas in the Indian context (Genc & Takagi, 2024; Singh & Yadav, 2025). Limited attention has also been given to the link between CBDC design, adoption, use cases, economic outcomes, policy risks and technology risks. This study addresses this gap through an integrated framework. The framework connects CBDC architecture, adoption and use cases, economic outcomes, policy and technology risks, and sustainable CBDC development.

1.3 Objectives of the Study

1. Examine the evolution and architecture of India's Digital Rupee.
2. Distinguish e₹ from UPI and commercial bank money.
3. Assess adoption patterns, user-related factors and emerging use cases.
4. Analyse potential economic implications for financial inclusion, payment efficiency, monetary policy and banking intermediation.
5. Examine technological, regulatory, privacy, cybersecurity and operational challenges.

6. Develop an integrated framework linking architecture, adoption, economic outcomes, risks and safeguards.
7. Identify prospects and policy priorities for sustainable CBDC development.

1.4 Research Design and Methodology

The study uses a descriptive and analytical research design based entirely on secondary sources. The main sources include RBI Concept Notes, Digital Rupee FAQs, Annual Reports, the Report on Currency and Finance, RBI policy documents, BIS research and peer-reviewed academic studies. The study mainly uses research papers and official documents published during 2021–2026. Earlier sources are also used when necessary to explain the basic concepts and design of CBDC. RBI and BIS documents provide information about CBDC structure, pilot projects and policy issues. Peer-reviewed studies provide information about adoption, trust, perceived benefits, risks and different views on CBDC design. The study selects relevant information based on its research objectives. The information is then reviewed and arranged into four main areas: CBDC architecture; adoption and use cases; economic outcomes; and policy and technology risks. The analysis focuses on concepts and policy issues. It compares the main features of CBDC, reviews findings from previous studies and considers evidence from pilot projects. It identifies possible relationships but does not measure direct cause and effect. The study does not use a primary survey, statistical model or cause-and-effect test. Therefore, the economic effects of e₹ are treated as possible or conditional effects. These effects may depend on CBDC design, the level of adoption, user behaviour, market conditions and government safeguards.

2. Literature Review and Integrated Conceptual Framework

2.1 CNDC Architecture and The Two-Tier Model

Architecture determines how claims on the central bank are created, distributed, stored and transferred. *Auer and Böhme (2021)* argue for minimally invasive arrangements in which private-sector intermediaries continue to provide customer-facing functions while users hold claims on the central bank. This architecture is relevant to India because the RBI issues e₹ while participating intermediaries facilitate user access and wallet services. The model therefore seeks to preserve the two-tier financial structure rather than transform the central bank into a direct retail bank.

The architecture also produces an important institutional distinction between e₹ and commercial bank deposits. A bank deposit is a liability of the commercial bank, whereas e₹ is a liability of the RBI. This difference affects the credit and liquidity characteristics of the two forms of money and is central to the analysis of possible deposit substitution.

2.2 Adoption, Trust and User Behaviour

Technological availability does not automatically produce sustained adoption. *Gupta et al. (2023)* find that perceived risks and benefits, together with trust, are associated with willingness to adopt the digital rupee and that trust partially mediates the relationship between perceived risk and adoption. *Balasubramanian and Thirumaran (2025)* identify government support, trialability and similarity as adoption enablers, while usage, value and risk barriers can inhibit adoption. *Nayak and Kumar (2025)* study awareness, accessibility, transparency, security, efficiency and satisfaction. Their findings show that CBDC adoption should be assessed through actual use and user experience, not only through registration numbers. Recent studies from India show that the regulatory

environment, ease of use, merchant acceptance and social influence can affect people's intention to use CBDC. These factors may influence adoption through users' attitudes and trust in the central bank. *(Keshav & Sinha, 2026).* Privacy sensitivity and digital financial literacy have also emerged as relevant dimensions (Singh et al., 2026).

2.3 Bank Disintermediation and Financial Stability

CBDC can compete with bank deposits because both can function as liquid stores of value. If households or businesses move a large amount of money from bank deposits to CBDC, banks may face higher funding costs and changes in their available funds. The financial-stability question becomes more acute during periods of banking stress. *Bidder et al. (2025)* show that disintermediation may be slower under normal conditions but faster during banking stress. This highlights the importance of suitable holding limits for CBDC. International evidence should not be transferred mechanically to India because institutional structures, deposit insurance, banking conditions, CBDC design and adoption patterns differ across jurisdictions.

2.4 Privacy, Cybersecurity and Data Governance

Digital transactions create records. This raises questions about privacy, legal access to information, how long data should be kept, data sharing and the need to collect only necessary data. The RBI Concept Note identifies privacy and AML/CFT as relevant CBDC considerations (Reserve Bank of India, 2022). Recent systematic evidence also identifies privacy as a central design issue across direct, hybrid and intermediated CBDC architectures (Kaur, 2024; Said & Lánský, 2026). Cybersecurity is equally important because CBDC would form part of critical financial infrastructure.

2.5 Programmability, Offline Functionality and New Use Cases

Programmability is one of the distinctive features explored in India's CBDC pilots. RBI FAQs explain programmability as the ability to set purposes or conditions for the use of CBDC funds. These conditions may include an expiry date, geographical location, merchant category or merchant virtual payment address (Reserve Bank of India, 2025a). Offline functionality is another possible use of CBDC. The RBI has tested solutions based on telecom connectivity and NFC technology. This feature may help improve access and system reliability. However, it also creates technical problems related to user verification, data matching, transaction limits and double spending. Wholesale CBDC can also support financial institutions through government securities settlement and other financial market activities (Reserve Bank of India, 2024; Reserve Bank of India, 2025b).

2.6 Literature Gap and Contribution

Recent literature shows that CBDC research has expanded across architecture, adoption, privacy, financial stability, technology and institutional governance. *Dionysopoulos et al. (2024) and Prodan et al. (2024)* highlight the multidisciplinary nature of CBDC research, while *Kaur (2024)* identifies continuing privacy and data-governance concerns. Adoption studies emphasise trust, perceived benefits, financial inclusion, merchant acceptance and user behaviour (Osakwe et al., 2025; Singh & Yadav, 2025). Recent evidence also highlights bank intermediation, financial stability, institutional design, privacy sensitivity and digital financial literacy (Bolcan, 2026; Huang & Breidbach, 2026; Singh et al., 2026).

Indian evidence provides additional insights. *Balasubramanian and Thirumaran (2025)* identify government support, trialability, value and perceived risk as relevant adoption factors, while Keshav and Sinha (2026), based on 630 responses, associate regulatory environment, merchant acceptance, effort expectancy and social influence with CBDC adoption intention through attitude and trust. *Said and Lánský (2026)* further emphasise trade-offs among security, privacy, financial stability, adoption and institutional quality. Despite this growing evidence, these dimensions are often examined separately. The present study addresses this gap through an India-specific integrated framework. Accordingly, the principal contribution of this study is the development of an India-specific analytical framework that connects CBDC architecture with adoption and use cases, potential economic outcomes and the policy and technological safeguards required for sustainable development.

2.7 Integrated Conceptual Framework

The study proposes the following analytical sequence:



The framework contains five connected stages. First, architecture shapes functionality, accessibility, interoperability, settlement characteristics and risk. Second, these characteristics influence adoption among consumers, merchants, banks and institutions. Third, the scale and nature of adoption determine potential economic significance through payment efficiency, inclusion, settlement, deposits, liquidity and monetary transmission. Fourth, wider use can create or intensify policy and technological risks. Fifth, safeguards and governance determine whether innovation can develop while maintaining financial stability, privacy, resilience, accessibility and public trust.

Dimension	Key variables/issues	Expected analytical link
Architecture	Issuer; intermediary model; retail/wholesale design; wallet structure; interoperability	Shapes functionality, accessibility, settlement characteristics and risk
Adoption and use cases	Users; merchants; transaction frequency/value; retention; programmability; offline use	Determines practical economic relevance
Economic outcomes	Payment efficiency; inclusion; settlement; deposits; liquidity; monetary transmission	Captures potential benefits and trade-offs
Policy and technological risks	Privacy; AML/CFT; cybersecurity; double spending; disintermediation; digital inequality	Defines safeguards required for scale

Sustainable development	Interoperability; resilience; user choice; calibrated limits; governance	Links innovation with financial stability and public trust

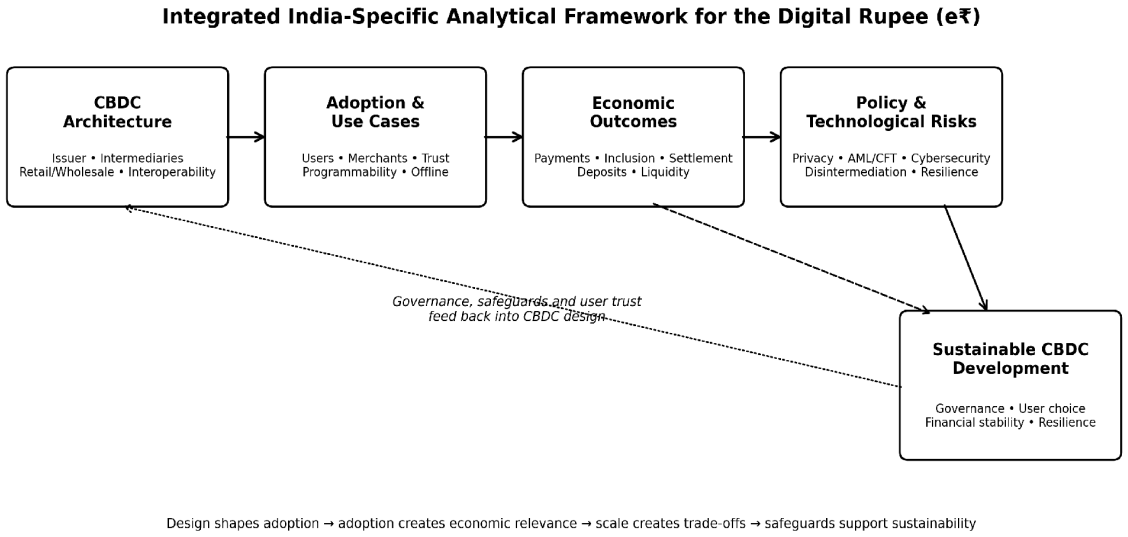


Figure 1. Integrated India-Specific Analytical Framework for the Digital Rupee (e₹)

3. Architecture, Evolution and Adoption of India's Digital Rupee

India's CBDC development entered the pilot phase in 2022. The wholesale pilot commenced on 1 November 2022, followed by the retail pilot on 1 December 2022. The retail model uses participating intermediaries to provide wallets and customer-facing services, while the RBI remains the issuer of e₹ (Reserve Bank of India, 2022). The ecosystem consists principally of e₹-R and e₹-W. Retail CBDC is intended for individuals and businesses and supports P2P and P2M transactions. Wholesale CBDC is intended for institutional participants and financial-market settlement. Subsequent pilot work has included interoperability with UPI QR infrastructure, programmability, offline transaction experiments and other specialised use cases (Reserve Bank of India, 2024, 2025a, 2025b).

3.1 e₹, UPI and Commercial-Bank Money

Basis	Digital Rupee (e₹)	UPI	Commercial-Bank Money
Nature	Digital sovereign money	Payment infrastructure/mechanism	Commercial-bank deposit
Issuer/liability	RBI	No separate monetary liability created by UPI	Commercial bank

Main function	Digital form of central-bank money and payments	Facilitates account-to-account transfers	Deposit, savings and payment functions
Storage	e₹ wallet	Usually linked to a bank/payment account	Bank account
Interest	Currently non-interest-bearing	Not applicable	Depends on deposit product
Risk character	RBI liability	Payment mechanism rather than separate money	Bank liability
Strategic role	Sovereign digital money	Interoperable payment mechanism	Core source of bank funding

3.2 Adoption Evidence

The RBI reported that by June 2024, the retail pilot had about 50 lakh users and 4.2 lakh merchants. These figures are useful as dated pilot evidence but should not be interpreted as current national penetration because they refer to a specific reporting date (Reserve Bank of India, 2024). The RBI's Annual Report reported 60 lakh users by March 2025. Subsequent government reporting stated that one crore users had been onboarded since the retail pilot began by 16 March 2026. These figures refer to cumulative onboarding rather than necessarily active users and should not be interpreted as current usage intensity or national payment-market share (Reserve Bank of India, 2025b; Ministry of Finance, Department of Economic Affairs, 2026). The appropriate analytical question is therefore not merely how many wallets have been created. Adoption should be assessed through active users, transaction frequency, transaction value, merchant acceptance, retention, repeat usage and the economic value generated by specialised use cases. A large registered user base with limited transactional activity represents a different adoption outcome from sustained use.

3.3 Emerging Applications

Programmability has been explored for targeted transfers, lending, interest subvention, employee-related payments and other purpose-specific applications. Offline functionality is being examined for low-connectivity environments. Wholesale CBDC has been used in institutional settlement. Cross-border applications and tokenisation-related use cases are also areas of continuing experimentation. These should be described as emerging or pilot-stage applications rather than established nationwide outcomes.

4. Economic Implications and Policy Challenges

India's Digital Rupee has implications beyond another digital payment instrument. Its economic significance depends on its adoption, design, functionality and integration with the financial system. While e₹ may support financial inclusion, payment efficiency, targeted payments and monetary sovereignty, it also raises concerns about bank intermediation, privacy, cybersecurity, operational resilience and digital inequality.

These effects depend on adoption levels, user behaviour, technological design and regulatory safeguards.

4.1 Financial Inclusion, Payment Efficiency and Adoption

e₹ may help improve financial inclusion by giving people access to digital money issued by the RBI. However, having digital currency alone does not ensure financial inclusion. Devices, connectivity, digital literacy, secure authentication and user confidence remain important. Offline functionality may help users facing connectivity limitations. The payment efficiency of e₹ should also be considered in relation to existing systems such as UPI, which already provides rapid and interoperable digital payments. Therefore, the distinctive economic value of e₹ may arise more from programmability, offline transactions, sovereign settlement and institutional applications than from ordinary retail payment speed. Adoption depends on perceived usefulness, trust, security, awareness, merchant acceptance and ease of use. Recent Indian studies also identify regulatory environment, social influence, attitude, privacy sensitivity, digital financial literacy and perceptions of anonymity as relevant factors (Balasubramanian & Thirumaran, 2025; Keshav & Sinha, 2026; Singh et al., 2026). Adoption should therefore be assessed through active use, transaction frequency, value, merchant acceptance and repeat usage rather than registered users alone.

4.2 Monetary Policy, Monetary Sovereignty and Financial Stability

e₹ is a direct liability of the RBI, unlike commercial bank deposits. Significant movement of liquid balances from bank deposits to CBDC could affect bank funding and liquidity. However, the magnitude of these effects depends on design features such as holding limits, remuneration, convertibility and intermediary arrangements. Since the current e₹ does not pay interest and most evidence comes from pilot projects, its major effects on the wider economy cannot yet be clearly established. Digital money issued by the central bank may also support monetary sovereignty. It can give people continued access to central bank money as digital payments become more common. This does not necessarily imply replacement of cash or bank deposits; e₹ may coexist with existing monetary arrangements. Financial stability is particularly relevant during periods of financial stress, when conversion from bank deposits to central bank money could potentially accelerate. BIS research distinguishes gradual deposit substitution under normal conditions from potentially faster disintermediation during banking stress (Bidder et al., 2025). Holding limits, tiered access and intermediary-based distribution can influence these effects. Continued monitoring of deposits, funding costs, liquidity and CBDC balances is therefore important.

4.3 Programmability, Targeted Payments and Offline Functionality

Programmability is a potentially distinctive feature of CBDC. The RBI has identified parameters such as purpose, expiry date, geographical location, merchant category and merchant virtual payment address (Reserve Bank of India, 2025a). This feature may help target payments better, reduce administrative costs and support payments for specific purposes. These may include selected government transfers, agricultural support and loans. However, restrictions embedded in programmable money raise governance concerns. Their use therefore requires necessity, proportionality, transparency, accountability and safeguards for legitimate user choice. Offline functionality may improve accessibility and resilience where connectivity is limited. The RBI has explored approaches including NFC-based solutions (Reserve Bank of India,

2025a). However, offline transactions create risks related to synchronisation, authentication and double spending. Transaction limits, secure devices and reconciliation mechanisms are therefore important. These features remain areas of experimentation rather than established nationwide economic outcomes.

4.4 Privacy, AML/CFT and Data Governance

CBDC transactions can generate detailed information about users, transaction values and transaction patterns, creating concerns about confidentiality, data retention, lawful access and information sharing. The RBI Concept Note identifies privacy and AML/CFT requirements as important aspects of CBDC design (Reserve Bank of India, 2022). Privacy protection must be balanced with mechanisms to address money laundering, terrorist financing and other illicit activities. Recent literature identifies privacy as an important issue across CBDC architectures, while adoption research indicates that privacy sensitivity and perceptions of anonymity may influence user evaluation (Kaur, 2024; Said & Lánský, 2026; Singh et al., 2026). A sustainable framework should therefore establish clear rules on data collection, access, retention and information sharing. Data minimisation, institutional oversight and remedies for misuse can strengthen public confidence while supporting legitimate regulatory requirements.

4.5 Cybersecurity and Operational Resilience

CBDC would form part of critical financial infrastructure and therefore requires strong cybersecurity and operational resilience. Risks may arise from wallet compromise, identity theft, malware, infrastructure attacks, authentication failures and system outages. Security must cover not only RBI infrastructure but also intermediaries, applications, devices and communication networks. Identity management, authentication, transaction integrity, data protection, fraud detection, independent security assessment, incident response and recovery arrangements are important safeguards. Offline functionality adds further risks related to device security, synchronisation and double spending and therefore requires appropriate controls. Cybersecurity also influences public trust and sustained adoption. Users may be reluctant to use e₹ if they perceive significant risks of fraud, theft or system failure. Overall, the economic implications of e₹ are interconnected: adoption affects its economic value; CBDC holdings may influence financial intermediation; programmability and offline functionality create opportunities alongside governance and technical risks; and privacy and cybersecurity influence trust and resilience. The Digital Rupee should therefore be evaluated as an integrated monetary, technological and institutional system.

5. Future Prospects, Key Findings and Policy Recommendations

5.1 Future Prospects

Four areas merit continued analytical attention. First, programmable CBDC may support selected government and institutional payments where purpose-specific functionality creates additional value (Reserve Bank of India, 2025a). Second, offline CBDC may improve resilience and accessibility if technical safeguards are effective (Reserve Bank of India, 2025a). Third, cross-border CBDC applications may improve settlement efficiency, but they require interoperability across jurisdictions, foreign-exchange arrangements, legal coordination, AML/CFT compliance and data governance (Auer et al., 2022; Reserve Bank of India, 2025b). Fourth, CBDC combined with tokenised

financial assets may support more efficient wholesale settlement and delivery-versus-payment processes (Reserve Bank of India, 2024, 2025b). These prospects should be understood as areas for experimentation rather than established outcomes.

5.2 Key Findings

- e₹ is fundamentally different from UPI because e₹ represents sovereign digital money, whereas UPI is payment infrastructure.
- India's intermediary-based architecture seeks to preserve the two-tier financial system while providing digital access to central-bank money.
- Available adoption figures are pilot-stage and time-specific; meaningful adoption assessment requires active-use and transaction-based indicators.
- Programmability, offline functionality, wholesale settlement and selected cross-border applications represent potential sources of distinctive CBDC value.
- CBDC can create trade-offs involving bank funding, financial stability, privacy, cybersecurity, operational resilience and digital inclusion.
- The economic significance of e₹ depends on architecture, adoption, scale, user behaviour and the wider financial environment rather than technological availability alone.

5.3 Policy Recommendations

The future development of e₹ should focus on complementarity and interoperability with cash, bank deposits, UPI and other payment systems. Interoperability can reduce duplication, lower switching costs and support wider CBDC use. Cross-border applications should also consider foreign exchange arrangements, legal frameworks, AML/CFT requirements, data governance and technical standards. Financial stability should remain an important consideration as CBDC adoption expands. Holding limits and intermediary arrangements should be calibrated according to evidence from pilot programmes and banking conditions. Regular assessment of deposit substitution, bank liquidity and funding conditions can help identify potential financial-stability risks. Privacy, cybersecurity and operational resilience should receive continued policy attention. Clear standards for data minimisation, lawful access, retention and accountability should operate alongside necessary AML/CFT controls. Security testing, incident response, redundancy and recovery mechanisms should extend across the wider CBDC ecosystem. Finally, policy experimentation should prioritise distinctive and inclusive use cases such as programmable payments, targeted transfers, offline transactions and wholesale settlement rather than simply duplicating existing payment functions. Future pilots should evaluate active users, transaction frequency and value, merchant acceptance, retention, user satisfaction, operational incidents and effects on bank deposits and liquidity. Such evidence can support calibrated and sustainable development of the Digital Rupee.

6. Limitations, Future Research and Conclusion

6.1 Limitations

The study has four principal limitations. First, it relies on secondary evidence and therefore does not directly measure consumer, merchant, bank or institutional behaviour. Second, adoption figures are time-specific and should not be interpreted as current national penetration beyond the reporting period of the underlying source. Third, the conceptual framework identifies plausible relationships but does not estimate their magnitude or causal direction. Fourth, cross-country CBDC evidence may not transfer directly to India because institutional, regulatory, banking and payment-system conditions differ.

6.2 Directions for Future Research

Future research can address these limitations through longitudinal adoption datasets, user-level surveys, merchant-level evidence, bank funding analysis and econometric models. Research can also test how holding limits, remuneration, programmability, offline functionality, interoperability and trust affect adoption and financial-system outcomes. Further research can examine whether CBDC produces measurable efficiency gains in wholesale settlement and targeted government payments. Such studies would provide empirical tests of the relationships proposed in the present framework.

6.3 Conclusion

India's Digital Rupee represents an important development in the country's monetary and financial infrastructure. The launch of e₹-W in November 2022 and e₹-R in December 2022 established a controlled experimentation process through which the RBI could examine retail and wholesale applications, interoperability, programmability, offline functionality and institutional settlement. The analysis establishes that e₹ and UPI should not be treated as identical innovations. e₹ is digital sovereign money and a liability of the RBI, whereas UPI primarily provides payment infrastructure for transferring funds. This distinction creates a basis for coexistence and interoperability. The economic question is therefore not whether e₹ can reproduce existing digital-payment functionality, but whether it can provide distinctive monetary and institutional utility.

The evidence reviewed suggests that specialised applications may provide more distinctive value than simple duplication of ordinary retail payments. Programmable transfers, offline payments, wholesale settlement, tokenised-asset settlement and potential cross-border applications warrant continued experimentation. At the same time, wider CBDC use can affect the relationship between central-bank money and commercial-bank money and can introduce challenges related to financial stability, privacy, cybersecurity, operational resilience and digital inclusion.

The integrated framework developed in this study shows that architecture influences adoption and use cases; the scale and nature of adoption shape potential economic effects; and those effects create corresponding policy and technological requirements. CBDC should therefore be evaluated as a connected monetary, technological, institutional and regulatory system rather than as a standalone payment application. Ultimately, sustainable development of India's Digital Rupee depends on evidence-based experimentation and calibrated policy design. Interoperability, intermediary-based delivery, privacy protection, financial stability safeguards, accessibility, operational resilience and user choice should remain central evaluation criteria. The long-term significance of e₹ will depend less on technological novelty alone and more on whether

it provides meaningful economic utility while maintaining trust and stability within India's financial system.

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