



Evolution, sovereignty and regulation: the global and the Indian story of CBDC

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Abstract

Central Bank Digital Currencies (CBDCs) are no more conceptual offerings. They have moved to be an integral part of the monetary systems of countries. Central Banks have moved ahead from experimenting to giving structure to it technically as well building guidance and regulations around it. This chapter traces the global evolution of CBDCs covering the initial experiments in the 1990s, covering the juxtaposition against cryptocurrencies, to the present stage of implementations woven by due regulations. It covers various international experiments from the Bahamas, to the US of A, China and EU. It also evaluates the responses and the guidance of the large relevant Institutions like the IMF and BIS covering multiple aspects like transparency, confidence levels of users, inclusivity, financial inclusion, possible concerns and sovereignty.

Keeping the international developments in the background, the paper peeks into India's journey in sufficient details. It analyses the journey of e₹ through the Institutional as well as Consumer's lens. The authors also compare the same in the context of the existing payment mechanism systems prevalent in India.

The chapter makes in-depth pursuit of the evolving regulatory aspects and federal jurisdictions. In all, the chapter contributes to the growing literature on digital public infrastructure by positioning CBDCs as a foundational transformation in the future of money and payments systems.

Introduction

Rapid digitization and heavy automation in the payment ecosystems across many countries are dictating the inclusion aspects and improvisation of the resilience-quotient. In this background, Central Banks across the globe are seeing Central Bank Digital Currencies (CBDCs) as another

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option of digitization. Over the years, we have seen the discussion on CBDCs have moved from academic discourses to implementation (pilots in many places). While the over-arching designs of the ecosystems have been sounded by the larger financial institutions (read multilateral also), governments have partnered with their respective central banks to codify the system into workable aspects. They have been working for upgrading themselves on the lines of financial inclusion, democratization, reducing settlement risks and reducing the risks typically associated with settlements and private currencies.

India's tryst with CBDC has been a topic of study because of the existing robust digital payment system i.e. UPI. Along with the challenges of stability, digitization and inclusion, the central bank i.e. RBI also had to look at interoperability. Regulatory concerns have been considered seriously by the central bank particularly because of the growing trade relations with other countries and the emergence of India as a major power across the globe.

The Evolution of CBDCs Across the Globe

a. The early concept (Pre – 2010 s)

Long ago the term “Bitcoin” was widely used and Central Banks were thinking about the digital currency. In the year 1993, Finland initiated the smart card with the name “Avant” which was the first form of a CBDC. Regardless for a long time, many countries did not feel that there is a need of digital currency as tangible money and credit cards were functioning adequately.

b. The Crypto Wake-Up Call (2010–2017)

The growth of other crypto currencies and Bitcoins altered everything. This type of private digital money exposed that individual wanted more quickly, digital medium to pay. And now Central banks discovered that if that didn't produce their own digital currency, private enterprises overtake financial systems. During the course of this time, countries like Uruguay started small trails to watch if a digital currency could be useful for regular individuals.

c. From Research to Reality (2018–2022)

It was around this time that “thinking” gave birth to “reality” and 2020 builds history as The Bahamas initiated the first official CBDC named as “Sand Dollar”. This was followed by Nigeria by starting eNaira as the first CBDC in Africa. China also commenced with the testing of the e-CNY (Digital Yuan) and distributed it to millions of customers to use in stores as well as for transportation.

d. The Global Standard (2023–2026)

Now, CBDCs are taking place globally and it is not “luxury” tech- savvy countries. More than 130 nations or 98% of the world economy are currently investigating a CBDC according to the Atlantic Council Tracker. Including India other nations have started with short trails and on in addition to it. European Central Bank is all set for a “Digital Euro”. Now, emphasis is on guaranteeing that digital currency from various countries can “talk” to each other to quickly and affordably make international payment

Evolution of CBDC in India

a) By the institutions

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b) By the customers

The Indian economy proved the outstanding durability in a demanding global environment, maintaining its posit as it is the economy and it is considered as the fastest-growing economy and is having a real GDP growth of 6.5%. The financial year was through a healthy reduction in inflation, which benefitted to 4.6% and a considerable upgrade in the state of the banking industry, taking part in multi-decade robust capital buffers and low non-performing assets.

A remarkable culmination was the RBI's personal financial stability, presenting a historic ₹2.68 lakh crore surplus, a 27% expansion during the preceding year determined by profits from foreign exchange transactions and better investment returns. At the same time the record balance promising with-in FY26, it highlights the demand for endless awareness against global trade tensions, multi-governmental hazard and the soaring discomfort of technological fraud and cybersecurity.

The development of the CBDC in India known as the e₹ and it is an essential motion as how currency flows not just technical upraise.

Captivating from the RBI, BIS and current economic studies, here is how the electronic rupee has advanced for administration and ordinary individuals.

a) *Evolution by Institutions: The Backbone of the System*

For the RBI and commercial banks, the CBDC commenced as an answer to upgrade the "wholesale" side of finance - the immense, behind-the-scenes deals.

The Wholesale Pilot Phase: The RBI Concept Note (2022) notes that the major purpose of the Wholesale CBDC pilot program, which was established in November 2022, was to increase interbank market efficiency. Banks can use the digital rupee to settle secondary market transactions involving government assets without the need for considerable levels of collateral or conventional settlement through a central clearing

- agency. Because real-time, final settlement is made feasible by this strategy, settlement risk is considerably decreased.
- The Bank for International Settlements, 2024 has recorded strong features for the finance institutions the Central Bank Digital Currency minimize the necessity of handling these currencies individual.
- Operational Efficiency: As per the Annual report of RBI 2025 notes, the central bank has focused on making the system "interoperable (harmonious)". This means banks don't have to create completely innovative methods; rather than, the CBDC can work close by functioning procedures like UPI.
- Programmability: Programmability is like giving a bank special rule to follow, according to the Report of RBI, 2025 then bank is more emphasized towards goal-oriented money. For instance, the bank can create money in digital form that can only be helpful in purchasing fertilizers for agriculture. This way Government assure that finance is only used for the intended purpose.



b) *Evolution by Customers: The Digital Pocket*

For the people who are already using digital payments; for those people e-rupee should be much easier than that of it

- **Mimicking Cash:** The concept note of Reserve Bank of India ,2022 highlights the INR that was intended to have the special “feature of having physical cash.” The RBI Concept Note (2022) very similar like the tangible 100 rupees note. The RBI promises that digital money is like the real cash and we can use it in purchasing small things without acknowledging who we are and why we are using it and also we are not requiring to have the bank account as money is already there and it is ready to use .
- **The "UPI" Bridge:** In advance, customers were having confusion what is the need of CBDC if they already had UPI. The solution of this confusion is as noted in the RBI Annual Report (2025), as the RBI enabled QR code interoperability and this permitted customers to use their CBDC wallet to scan any available UPI or QR code at a local grocery store. For adoption, this was a pivotal moment.
- **Offline Functionality:** The major advantage of this is that customers can use it in offline more also for doing payments. It is researched by Agrawal et al. (2024) in the NBER paper argues that in a nation like India, a CBDC must worked in those areas where the internet connection is poor and customers can use it easily without hazel. The RBI has started working on “proximity-based” solutions for instance Bluetooth or NFC so that customers can swap digital currency even in basements or in a remote village

Feature	UPI (Unified Payments Interface)	CBDC (e-Rupee)
Nature of Money	Bank Account Deposit (Private Money)	Central Bank Liability (Sovereign Money)
Settlement	Settles between two commercial banks	Settles directly on the RBI ledger
Intermediaries	Requires a bank account to function	Can technically function via a digital wallet
Anonymity	Fully traceable by the bank	Potential for "managed anonymity" (like cash)
Risk	Credit risk of the commercial bank	Zero credit risk (backed by RBI)
Programmability	Limited	High (can be "locked" for specific uses)

Table No.1 Comparative Table (CBDC vs. UPI)

Source(s): Collated by authors from (Reserve Bank of India, 2022) **Reference:** Reserve Bank of India. (2022).



The Global Regulatory Standard

Literature suggests the most of the rules related to digital money have been made by The IMF (International Monetary Fund) and the BIS (Bank for International Settlements) are two main organizations that make the rules for how digital money called CBDC should be managed and controlled.

Regulations are world-wide shifting to legal enablement from theoretical research. The International Monetary fund mentioned that for a digital money called CBDC; if needed to be work well a country required to change its rule so the people can use this digital money and it can officially be recognized as real money like paper bills. There are certain rules to make sure that money will not going to be used in wrong way. One rule is termed as “Anti-Money Laundering”; which means minor transactions are private but large ones are monitored and controlled to prevent financial crime. This is the regulatory control or one can termed it as obstacle.

The European Union: Privacy-First Regulation:

As of right now EU is creating the globe’s most comprehensive legislative framework for a currency that will be significant for a reserve

The term “Strategic autonomy” is going to be finished by 2026 and this is the aim of the Digital Euro Regulation. This regulation assures that when there is less connectivity or no connectivity, it focused on the regulation and can be used offline also. In contrast to Crypto -currency, the EU makes in mandatory that the Central Bank be unable to ascertain what customers are planning to buy , so can be transformed into the Digital **Banknote**.

The United States: The "Anti-Surveillance" Approach

United State regulations are focusing more on warning and limitation

As of right now US regulations are characterized by the **CBDC Anti-Surveillance State Act**. The main regulatory issue in the US is that a Central Bank currency might make it possible for the government to keep tabs on every citizen's expenditure. As a result, US currently favours wholesale CBDC (used by banks) over retail CBDC (used by Citizens) with a strong focus on maintaining the function of private commercial banks.

China: The Leading Operational Framework

With many provinces having advanced past the pilot level, China has the most developed regulatory structure.

"Double-Layered" regulations govern the e-CNY. The currency is issued by the People's Bank of China (PBoC) to "authorized operators" (commercial banks), who subsequently disburse it to the general public. Financial inclusion (reaching the unbanked) and programmability (enabling the government to control how subsidies, like as food coupons, are used through smart contracts) are the regulatory focus here.



Adaptation by Institutions (Wholesale - e₹-W)

The institutional adaptation focuses on the **Financial Market Infrastructure (FMI)**. It aims to replace traditional interbank settlement methods with more efficient, real-time digital rails.

- **Primary Use Case:** Resolution of Government Securities secondary market transactions (**G-Secs**). By using e₹-W, institutions greatly lower the "settlement risk" by doing away with the requirement for collateral or infrastructure for settlement guarantees.
- **Expansion to non-Banks (2025):** The RBI added Primary Dealers and Select Non-Bank Payment System Providers to the wholesale pilot in addition to the original nine banks, which was a significant evolutionary step that allowed for a more varied source of liquidity. Those 9 banks are SBI , BoB, UBoI, HDFC Bank, ICICI Bank , Kotak Mahindra Bank , Yes bank , IDFC First Bank and HSBS
- **Interbank Money Market:** In order to test the effectiveness of atomic settlements (where assets and money move simultaneously), institutions are currently using e₹-W for the call money market.

Adaptation by Customers (Retail - e₹-R)

Convenience, trust and cutting-edge features that set it apart from current bank-to-bank transfers like UPI are what drive customer adaptation.

It can be seen that in 2006, India's CBDC in retail has been reached at a massive scale , there are 350,000 participating businesses and 7 million customers that are currently using it. A primary driver of this growth is the starting of the concept named as "Purpose-specific" money. which has been revolutionized as DBT: Direct Benefit Transfers. This allows the government to issue e₹ tokens which are restricted to the specific areas such as pupils buying stationary item or agricultures purchasing fertilizers and this ensures that funds are getting used in an intended way

To bridge the digital divide, the RBI successfully launched offline functionality using Bluetooth and NFC technology, enabling secure transactions in "dark zones" where internet connectivity is unreliable. This technical accessibility is further bolstered by seamless interoperability, which was established in 2025. Today, users no longer need specialized QR codes; they can simply use their CBDC wallets to scan any existing UPI QR code, a move that has effectively integrated digital currency into the nation's everyday financial fabric.

Conclusion

The journey of CBDC is not merely a technical marvel but also a structural shift in the architecture of money-in-motion. It is now given that CBDCs will compliment the existing payment mechanism systems whether it is UPI in India or anything else outside. It is up to the planners to create the necessary infrastructure to elevate the levels of robustness, inclusivity and democratisation around CBDC. One has to wait and watch how CBDCs are likely to redefine issuance, transference and governance.

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