

Central Bank Digital Currency E Rupee

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Abstract— This paper explores the concept and potential implementation of a Central Bank Digital Currency (CBDC) in India, referred to as the digital rupee. As digital payments gain prominence globally, the Reserve Bank of India (RBI) is considering the introduction of a CBDC to enhance payment efficiency, foster financial inclusion, and ensure monetary policy effectiveness. The study examines the technological, economic, and regulatory dimensions of launching a digital rupee. Key areas of focus include the underlying blockchain technology, the impact on financial institutions, potential benefits for economic stability, and the challenges posed by cybersecurity and data privacy concerns. By analyzing these factors, the paper aims to provide a comprehensive understanding of the implications of a CBDC for India's financial ecosystem.

Keywords— Central Bank Digital Currency (CBDC), India, digital rupee, financial inclusion, monetary policy, digital payments, blockchain, regulatory framework, economic impact, RBI (Reserve Bank of India)

INTRODUCTION

Central Bank Digital Currency (CBDC) represents a significant innovation in the financial sector, involving the issuance of digital money by a central bank. In India, the Reserve Bank of India (RBI) is exploring the potential of a digital rupee to enhance the efficiency and inclusiveness of the country's payment systems. The introduction of a CBDC could transform the landscape of digital payments, providing a secure and resilient alternative to physical cash and private digital currencies. This initiative aligns with global trends where central banks are investigating the adoption of digital currencies to improve monetary policy effectiveness, financial stability, and economic growth. The deployment of a CBDC in India presents opportunities and challenges, including technological infrastructure, regulatory frameworks, and the potential impact on banking and financial services. This paper examines the key aspects of a CBDC in the Indian context, focusing on its design, implementation, and the broader economic implications.

DESIGN CHOICES

A retail CBDC can be seen as a sort of digital banknote that can be used by individuals and businesses (including merchants) to pay each other. A wholesale CBDC is restricted to use by financial institutions to settle trades in financial markets. In either the fact that CBDCs are a claim on the central bank clearly differentiates them from existing forms of cashless payment instruments for

consumers, such as credit transfers, direct debits, card payments and e-money, which are liabilities of the issuing institution. They are also different from other types of digital money in the form of crypto assets, stable coins, and other digital assets

Core factors.

1. Objective(s) for a CBDC. Countries may have a range of objectives for issuing.

CBDCs, including.

- Increasing financial inclusion, or more generally, broadening access to the financial system to serve the unbanked and under-banked population.
 - Extending public access to safe central bank money (as opposed to private digital currencies).
 - Safely meeting future needs and demands for payment services, including ensuring competition, data privacy and the integrity of the payment system.
 - Reducing costs and improving access to domestic and cross-border payments.
 - Contingency planning in case cash use suddenly declines or a private digital currency is widely adopted.
 - Countering tax evasion and criminal uses of currency.
 - Avoiding currency substitution and preparing for potential competition from other CBDCs.
 - Creating a payment foundation to better support innovation (e.g. smart contracts, internet of things etc).
 - Facilitating the distribution of central bank money and government benefits, particularly in remote areas.
- Each jurisdiction will have its own objectives, which may differ from those of other.

Use case for a CBDC. This is closely related to the objectives for introducing a CBDC and defines the decision to adopt. The associated design choices depend on external factors within the country such as the degree of financial literacy and inclusion, user characteristics (trust, knowledge etc), the availability of technological infrastructure and the level of digitalisation. This means that even when two central banks share the same objective, the decision about whether to adopt a CBDC or how.

to design it may vary considerably. For example, while two central banks might have “Financial inclusion” as an objective for a CBDC project, their use cases could be very

different – one may have digital infrastructure covering 45% of the population and another more than 85%. For some central banks, decisions may be reliant on securing

technological coverage in remote areas, while another central bank's choices might be influenced by financial literacy and cultural factors.

External factors

External factors play a key role in shaping the scope and design of CBDC projects and may also impact strategy and project governance decisions. These vary by jurisdiction.

Therefore, it is useful for central banks to identify those factors and dependencies.

that could affect the success of the project, to ensure that they are considered.

in the scoping and design stages of CBDC projects.¹¹ As an important step in risk management assessment and strategy, robust analysis should be undertaken.

Ecosystem features.

These reflect the current financial, technological, and legal environment in which the central bank operates. Relevant factors include the:

- Legal framework – the law governing financial services, payments, and sovereign currency.
- Level of digitalisation – the level of technological preparedness of the population and the availability of technological infrastructure. This could be measured, for example, by mobile telephone usage and access to broadband internet, or trends in the proportion of cash vs digital payments.
- Level of financial development – including the technological and risk management skills of financial institutions, financial literacy among the population, financial inclusion, degree of development of the local economy, size of the informal economy and the use of cash for payments. This could be measured, for example, by access to different types of financial services and the types of digital financial products available.
- Innovation capacity – a jurisdiction's track record and potential for innovation that can support the development and implementation of a CBDC, which can impact the speed of the project and its effectiveness. This could be measured, for example, through the World Intellectual Property Organization Global Innovation Index.
- Geopolitical considerations – includes technological/digital infrastructure availability based on geographical and/or political circumstances, regional settlement agreements and prioritisation to support the issuance of a CBDC.

Operational skills and capabilities.

This includes the availability of human resources.

in a jurisdiction to (i) support existing and new technologies required for a CBDC; and (ii) develop or integrate existing technological infrastructure for use for a CBDC. It is helpful to perform a gap assessment of a central bank's internal skills and capabilities.

to determine whether it can recruit or acquire resources externally; this will in turn.

delineate the work that should be performed internally and the work to be.

outsourced to third parties. This factor can be categorised as both external and internal, and will influence the CBDC project environment. It will therefore be a source.

Internal factors

Trade-offs exist when selecting a particular type of CBDC. In addition to the external factors mentioned above, central banks should consider a variety of internal factors.

There is no "one model fits all" kind of choice for CBDC designs. Accordingly, we note.

the following key considerations for a CBDC project with a particular focus on OR.

CBDC models and architectures. CBDC models can take retail or wholesale forms.

A retail CBDC is a claim on the central bank that is available to all households and firms in the economy. Regardless of whether a CBDC is account or token based, there.

are three general models or architectures available to central banks (see Graph 4):

(i) Direct: single-tier retail CBDC in which the central bank directly handles all payments by the public and enterprises, and keeps all records of direct retail holdings by all participants in real time.

(ii) Hybrid: two-tiered retail CBDC model in which intermediaries onboard clients, perform know-your-customer (KYC) checks and handle.

consumers' payments in real time, and the central bank periodically records retail balances.

(iii) Intermediated: two-tiered retail CBDC model in which the main difference with the hybrid model is that the central bank only processes.

and records wholesale payments and balances, whereas intermediaries handle retail payments.

On the other hand, a wholesale CBDC is a direct claim on the central bank that is.

only available to financial institutions or a subset thereof. These institutions could

hold the CBDC to back their own issuance of "CBDC-related claims" to the public.

Different models and architectures for CBDC have specific implications in terms.

of OR for central banks, as they entail different levels of internal handling vs.

delegation to third parties of features such as record-keeping, security, integrity and availability.

Different levels of internal handling vs delegation to externals can be.

established for the various aspects of a CBDC, including the technological

infrastructure and operating needs.

The following sections of the report will further explore OR categories for CBDCs.

CBDC technology

A CBDC could run on a conventional, centrally controlled database (centralised ledger technology (CLT)) or be fully or partly deployed on a

system based on distributed ledger technology (DLT) in which the database is.

updated in a decentralised manner after different nodes have confirmed the transaction. Design options for DLT can include public and private ledgers, as well as permissioned or permissionless systems. CBDC can also use hybrid technology, in which DLT and CLT are used in different parts of the CBDC project. CLT and DLT infrastructures can and usually do store data in multiple, separate locations as a means of securing operational resilience.

Availability (online/offline).

A decision must also be made on whether a CBDC would be available to use in the absence of an internet connection. Offline transactions could ensure CBDC availability by making payments possible even if there is no connection to the internet. However, it also increases the possibility of digital counterfeiting and double spending. As such, this decision needs to be assessed based on preserving the confidentiality, integrity and availability (CIA)

Cross-border vs local features and capabilities. Cross-border payments are usually carried out through a network of correspondent banks. This tends to be inefficient given differing technologies and legal/regulatory frameworks, unaligned time zones, and operating hours, and differences in technical/security standards that could contribute to critical OR. These factors may result in cross-border payments that are particularly difficult to effect in some EMEs, even though these jurisdictions may receive many remittances. The bulk of settlements in correspondent banking takes place for the purposes of commercial bank credit and these cross-border transactions imply credit, liquidity and settlement risks which could be reduced through cross-border CBDC arrangements. Local features should be analysed, considering central bank capabilities to comply with the expected (regulatory) framework as well as operational standards for a secure cross-border CBDC.

Account vs token based.

Account-based CBDC requires user identification for access. However, for token based CBDC the access mechanism is via private/public keys and, while this allows for anonymity, it also implies risks related to the loss or theft of keys. Further, it could also enhance money laundering and terrorist financing. risks. This decision can be used to support several objectives; it could be a means to reach unbanked or underbanked populations that have access to mobile telephones, or it could be a mitigation strategy to address risks related to the privacy and security of CBDC.

Project implementation/management. Delivering a CBDC is a large-scale project that requires robust project management. Central banks have choices to make in terms of the project management methodology they will use (e.g. iterative approaches such as agile, or traditional/waterfall project methodologies, or a hybrid combination for different stages of the process).²⁸ A multidisciplinary group of participants should be formed at the outset of the project and central banks should use this group, at all stages, to consider.

Figures & Tables
 Table 1

period	RBI-DPI Index
March 2018	100
March 2019	153.47
September 2019	173.49
March 2020	207.84
September 2020	217.74
March 2021	304.06
September 2021	349.30

To further the cause of digitisation to achieve a less cash economy. India has a unique case where the cash in the economy has shot up despite rapid digitisation. in the payments space. The growing use of electronic medium of payment has not yet resulted in a reduction in the demand for cash. The percentage increase in value of banknotes during 2020-21 and 2021-22 was 16.8 per cent and 9.9 per cent respectively and the percentage increase in volume of banknotes during 2020-21 and 2021-22 was 7.2 per cent and 5.0 per cent respectively. (Source: RBI Annual Report for the year 2021-22) The year (2021-22) witnessed a higher than average increase in banknotes in circulation primarily due to precautionary holding of cash by the public induced by the second wave of COVID-19 pandemic. Further, a pilot survey conducted by the Reserve Bank on retail CBDC can be a preferred mode of holding central bank money rather than cash in any uncertain situation like the one of pandemic COVID-19. Further, the preference for cash transactions for regular expenses and small payments for its anonymity, may be redirected to acceptance of CBDC, if reasonable anonymity is assured. This shall further the digitisation process in the country. The Reserve Bank Digital Payment index (RBI-DPI) demonstrates significant growth in adoption and deepening of digital payments across the country since its inception. This increase indicates that the digital payments are further deepening and expanding in the country and is an indication that, Indian citizens have an appetite for digital payments. Therefore, the digital currency issued by the central bank shall provide yet another option for furthering the cause of digital payment, apart from the range of other digital payment instruments available, given its ease of usage.

have an appetite for digital payments. Therefore, the digital currency issued by the central bank shall provide yet another option for furthering the cause of digital payment, apart from the range of other digital payment instruments available, given its ease of usage. coupled with sovereign guarantee. Supporting competition, efficiency and innovation in payments

The digital revolution is taking the world by storm and no other area have witnessed such. metamorphosis as payment and settlement systems, resulting in an array of digital options. for the common man. Consumers now have a range of options to choose from when selecting. a payment method to complete a transaction. They make this selection based on the value. they attribute to a payment method in a certain situation as each payment mode has its own. use and purpose. The shift from cash to electronic payments increase the reliance on electronic payment systems, which has implications for the diversity and resilience of the payments landscape.

CBDC could further enhance resilience in payments and provide core payment services. outside of the commercial banking system. It can provide a new way to make payments and also diversify the range of payment options, particularly for e-commerce (where cash cannot be used, except for the Cash on Delivery (COD) option). The CBDC based payment system is. not expected to substitute other modes of existing payment options rather it will supplement by providing another payment. avenue to the larger public. As has been the experience with many payment products, once. CBDC is introduced, innovations around the product would only expand the choices. available and healthy competition will help. bringing about both cost and time efficiencies. Most payments in a modern economy are made. with private money maintained by banks, which are in the form of demand. deposits and therefore liabilities of these banks. A key feature of bank deposits is that. commercial banks guarantee convertibility on demand to central bank money at a fixed price, namely, at par, thereby maintaining the value of their money. Nevertheless, in a fractional reserve system, a commercial bank—even if solvent—may face a challenge to meet with any. sudden spurt in demand to convert substantial. amount of bank deposits to central bank money. A significant difference between the central bank money and commercial bank money is. that central bank can meet its obligations using its own nonredeemable money, while the latter entails counterparty risk. Central Bank money is. the only monetary asset in a domestic economy without credit and liquidity risk. Therefore, it is. preferred asset to settle payments in financial. market infrastructures (see CPMI-IOSCO Principles for Financial Market Infrastructures (2012)).

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