



CBDCs: A New Asset Class to Streamline Value Transfer Mechanism

¹Pratibha Panwar

*Department of Computer Science & Engineering
Suresh Gyanvihar University, Jaipur*

Abstract - The current payment system is rapid but has limits in terms of internet consumption, visibility, and usability. It is based on physical cash and online transactions. Central bank digital currencies strive to tackle the difficulties that afflict the current economic system by providing total transparency of the money supply. As opposed to completely decentralized cryptocurrencies, central bank-issued digital currencies are the most centralized. However, centralization will be advantageous in terms of money programmability, improved transparency, and financial crime monitoring. Before digital currencies can be widely used, a strong security framework, data protection, and effective governance will be required.

Keywords — *Central Bank Digital Currency, Project Index, Distributed Ledger Technology, Zero Trust, Digital Currency.*

I Introduction

When it comes to the future of economies and how they will be governed with respect to the value provided, Central Bank Digital Currencies [CBDC] will be playing a major role in modernizing the process of value transfer. Human civilization has come a long way from exchanging goods via barter systems to digital payments in the 21st century. The mode of payments has expanded many folds, now we have multiple modes

of value transfer mechanism but there's still room for improvement. We need a faster and more efficient payment system that can not only satisfy users' demand for value transfer but also act as a tool for governments to distribute aid.

Let's understand what made CBDC emerge in the first place? CBDCs are based on the concept of blockchain and ledger systems. Cryptocurrencies are based on a similar concept, in 2008 when Bitcoin emerged the concept behind this was blockchain. Blockchain is a system in which a record of transactions is kept across numerous computers linked in a peer-to-peer network. This is the fastest and most secured method of value transfer.

Rising innovations in payments and technology have enhanced interest in CBDCs. The major shift and quick adoption happened after digital currencies as a medium of exchange started growing. The idea of central banks releasing digital money for widespread circulation is a logical evolution from the printing of fiat money. Furthermore, for several decades, banks have had access to digital representations of central bank money via the wholesale payment system. Though the payments for individual users via CBDCs are substantially new and are being tested with a smaller audience before releasing it on a larger scale.

While we are witnessing a major cash usage decline with an increase in online and UPI payments provided by partner banks. CBDCs will play a vital role in increasing the monitoring and involvement of the central bank. This will further streamline the central bank's function of releasing money, stabilising financial conditions, and tracking the flow of money with a purely digitalized economy.

The goal for faster payments accelerated digitization, and enhanced risk mitigation for payment clearance and account settlement drives global demand for CBDCs. Furthermore, there is a demand for more efficient domestic and cross-border value transfers, as well as financial inclusion for individuals and organizations at large. These advantages have compelled world economies to begin research into the release of digital fiat money.

In the past few years, central banks have started their pilot projects to better understand the use of Distributed Ledger Technology (DLT) for government-issued digital currencies. Since 2016, central banks have been issuing currencies for wholesale purposes, which entail the settlement of high-value interbank transfers and cross-border payments utilising wholesale CBDCs.

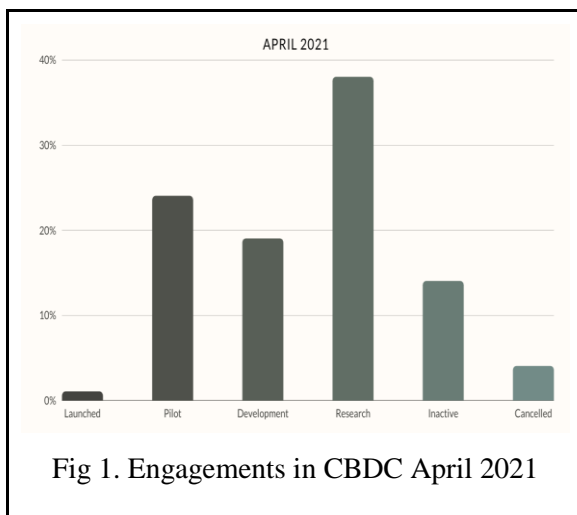


Fig 1. Engagements in CBDC April 2021

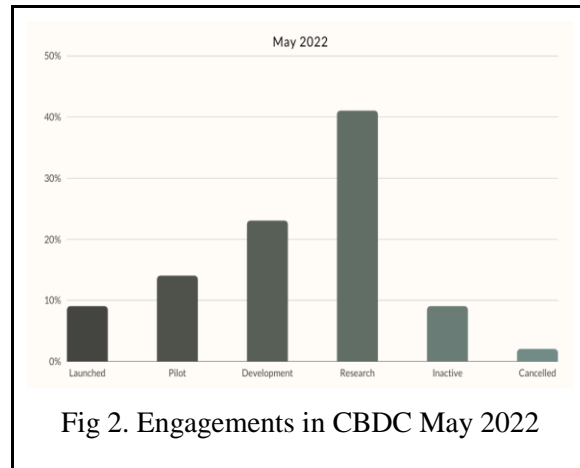


Fig 2. Engagements in CBDC May 2022

II CBDC Projects Driver As Per Data

The adoption of CBDCs are mapped using a machine learning data-driven system. Many economic and technological factors are used to predict the advancements in CBDC usage. To understand the advancements we will consider Project Index (PI) as a fixed variable and other factors like governments' progress in economy and technology as independent variables [8].

A. Project Index (PI)

The Central Bank Digital Currency Project Index was developed by Auer et al. to measure its progress. The index value ranges from 0 to 3:

- 0 - No CBDC projects
- 1 - In the research phase
- 2 - Pilot runs and testing completed
- 3 - CBDC project is live

B. Research Methodology

Our main objective is to gain a better understanding of the CBDCs' growth primary motivators and factors influencing a nation's propensity to pursue this endeavour. CBDC project index is our objective variable and the influencing factors depending on the economic and technical progress of the nation.

C. Countries With PI Score (May 2022)

Country	PI Score	Wholesale	Retail
India	2	1	1
Switzerland	3	2	1
France	3	2	1
Bahamas	3	3	0
Japan	3	2	1
Canada	3	2	1

Table 1. Countries and Their PI Scores

To extract the most crucial variables we decide to use the random forest. This being the main model learns intricate nonlinear functions. To generate a comparison for our primary model we will deploy a multilayer perceptron (MLP).

D. Research Outcome

The methodology mentioned above generates datasets with the help of trained models. Out of 145 countries, there are only 6 with a project index of more than 3. As per the feature extracted by random forest using May 2022 data, the financial development index is the most valued variable followed by GDP per capita and effectiveness of the government respectively.

The research conducted using machine learning methodologies confirmed that countries with higher financial development index work developing more advanced CBDC projects. CBDC project index can be used as a fixed variable to get the status of countries' CBDC development at any time.

III Proposed System Design

A. No Network Payments

Offline CBDCs will enable payment settlements without the internet using SMS-based services, Near Field Communication (NFC) technology, or similar technology that can be used to complete payments.

B. System Design

Most CBDCs work on Distributed Ledger Technology (DLT) which is a modern and more sophisticated method of storing transaction data in a decentralised environment, unlike centrally administered databases. Distributed ledger technology is a digital mechanism for recording asset transactions that store the transactions and their associated information in multiple locations at the same time. Unlike traditional databases, distributed ledgers lack a centralised data repository and administrative capabilities [9] [10].

Adopting features like blockchain and DLT, on the other hand, comes with challenges and trade-offs that must be carefully considered. Centralised ledgers are the most often used data storing solution in finance and can be stored on several physical nodes, but control is held by a trusted administrator who has access to these databases.

Decentralized Finance (Defi) and Web 3.0 are bringing in some of the most advanced developments in the financial sector [11]. By reducing the need for intermediaries and promoting inclusivity, Defi has the potential to provide economic and social benefits, perhaps destabilising the financial industry. Similarly, Web 3.0 allows users to complete financial transactions with ease among users using smart contracts allowing transactions to be completed without intermediaries or a 3rd party service provider involved [12]. Now central banks across the globe working towards CBDC adoption has two choices in terms of issuing currency - the first token-based approach and the second account-based approach.

The transfer of cash in a token-based method is predicated on the transfer of an item of value from one

wallet to another. Whereas in the account-based method, there's a value transfer from one account to another [13]. The token-based approach contributes toward financial inclusion goals; both users just require an internet connection to complete the transaction. Additionally, the token-based system provides customers with a high level of anonymity [14]. On the other hand, an account-based approach allows authorities to monitor transactions closely and participate in the entire payment process. Most central banks and regulators are considering the token-based approach to deploy CBDCs [15].

C. Zero Trust for CBDCs

Existing security models are inefficient in safeguarding the financial assets of individuals and organisations. These legacy infrastructure are prone to breaches and data theft resulting in losses when it comes to financial technologies. Research shows that humans are the weakest link in any security framework. They fall prey to the socially engineered data breach system created by hackers.

To mitigate the biggest risk, Zero Trust Architecture (ZTA) works towards lowest resource accessibility. ZTA considers every user as a malicious hacker and asks for access credentials at every step. ZTA in CBDCs will be a multi-layered security framework working on an identity centric model. It will continuously monitor users accessing the data, verify risk factors in real time covering all aspects of digital security.

IV CBDC Use Cases

A. P2P Rapid Transactions

Similar to online payments services provided by fintech service providers, CBDCs will facilitate instant peer-to-peer payments much faster than the current conventional method.

B. Money Programmability

CBDCs have the ability to be programmed and used for a specific purpose for which they have been issued. This feature enables easy value transfer by the government for public welfare, scholarships, and schemes. This will

improve the direct benefit transfer and subsidy deployment.

C. Cross-Border Settlements

Commercial payments involving huge transactions or individual payments can be done easily in the case of cross-border payments with CBDCs. It will also facilitate securities settlement and foreign exchange in multiple currencies.

V Conclusions

CBDCs will be impacting global economies at a substantial rate in the coming 5 years. Many countries are at the end of their trial while others have started their research in exploring ways to implement CBDC adoption. Token-based CBDCs will be the closest replacement to cash in the form of retail CBDCs and the future of value transfer. While wholesale CBDCs will fill the gap of huge financial transactions among organisations, cross-border settlements, and inter-bank payments. The impact of this new asset class on the balance sheets of banks, customer value propositions, and the long-term sustainable benefits it brings in terms of rapid transactions while reducing settlement risks is overwhelming.

For CBDC use case in India, RBI deputy governor said, there's something unique about the digital payments proliferation in India. There's equal importance of cash usage in small businesses when it comes to small value transactions. This high preference of cash represents that there's still some discomfort among the masses for digital payments usage. CBDC adoption can be redirected to improve digital payments adoption and solve the current problems prevailing with the private digital systems.

REFERENCES

1. Raphael Auer, Jon Frost, Leonardo Gambacorta, Cyril Monnet, Tara Rice, and Hyun Song Shin, Central Bank Digital Currencies: Motives, Economic Implications, and the Research Frontier. Annual Reviews of Economics, 2022.

- <https://doi.org/10.1146/annurev-economics-051420-020324>
2. Gabriel Soderberg, Ms. Marianne Bechara, Wouter Bossu, Ms. Natasha X Che, Sonja Davidovic, Mr. John Kiff, Ms. Inutu Lukonga, Mr. Tommaso Mancini Griffoli, Tao Sun, and Akihiro Yoshinaga, Behind the Scenes of Central Bank Digital Currency: Emerging Trends, Insights, and Policy Lessons, IMF eLibrary, 2022. <https://doi.org/10.5089/9798400201219.063>
 3. Itai Agur, Ani Ari, Giovanni Dell'Ariccia, Designing central bank digital currencies, Journal of Monetary Economics, Volume 125, January 2022, Pages 62-79. <https://doi.org/10.1016/j.jmoneco.2021.05.002>
 4. Mrs. Sarwat Jahan, Ms. Elena Loukoianova, Mr. Evan Papageorgiou, Ms. Natasha X Che, Ankita Goel, Mike Li, Umang Rawat, Yong Sarah Zhou, and Ankita Goel, Towards Central Bank Digital Currencies in Asia and the Pacific: Results of a Regional Survey, September 2022. <https://doi.org/10.5089/9798400221521.063>
 5. Jianguo Xu, Developments and Implications of Central Bank Digital Currency: The Case of China e-CNY, June 2022. DOI:10.1111/aepr.12396
 6. Selcen Ozturkcan, Kerem Senel, and Mesut Ozdinc, Framing the Central Bank Digital Currency (CBDC) revolution, July 2022. <https://doi.org/10.1080/09537325.2022.2099261>
 7. Ahmed H. Elsayed, Muhammad Ali Nasir, Central bank digital currencies: An agenda for future research, December 2022. <https://doi.org/10.1016/j.ribaf.2022.101736>
 8. Elcelina Carvalho Silva and Miguel Mira da Silva, Research contributions and challenges in DLT-based cryptocurrency regulation: a systematic mapping study, January 2022, <https://doi.org/10.1007%2Fs42786-021-00037-2>
 9. Yi-Ran Wang, Chao-Qun Ma, Yi-Shuai Ren, A model for CBDC audits based on blockchain technology: Learning from the DCEP, Research in International Business and Finance, Volume 63, December 2022. <https://doi.org/10.1016/j.ribaf.2022.101781>
 10. Fitri Handayani, Design And Legal Aspect Of Central Bank Digital Currency: A Literature Review, Journal of Central Banking Law and Institutions, December 2022. <https://jcli-bi.org/index.php/jcli/article/view/35/21>
 11. Joost Bambacht, Johan Pouwelse, Web3: A Decentralized Societal Infrastructure for Identity, Trust, Money, and Data, Cornell University, March 2022, <https://doi.org/10.48550/arXiv.2203.00398>