10

Central Bank Digital Currencies

Can it Have a Role in Enhancing Financial Inclusion?

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10.1. Introduction

Currencies have a long history. In the long list of various shapes of and forms of currency, the latest kid in the block is Digital currency. What will it look like? Admittedly, not all digital payment methods will succeed and we already know that the use of cryptocurrencies like Bitcoin as money has failed. Recently, the value of these tokens has decreased by two thirds. Prices are separated from any underlying economic worth yet being frequently exchanged and subject to extensive speculation. Although stable coins are intended to reduce volatility, many of them have shown to be anything but stable and rely on the strength of the reserve assets that back them.

A central bank digital currency (CBDC) is a nation's fiat money in digital form. A CBDC will be produced and governed by central banks; it will promote financial inclusion and facilitate the implementation of monetary and fiscal policy; it will not be able to anonymize transactions like some cryptocurrencies because it is a centralised form of money.

To give businesses' and consumers' privacy, transferability, ease, availability, and financial security are the main objective of CBDCs. CBDCs can provide those who currently use alternative money transfer methods with lower-cost options, could also lessen the maintenance requirements of a complex financial system and reduce cross-border transaction costs. Digital currencies issued by central banks would also lessen the risks associated with utilizing them.

This chapter is devoted to a specific aspect of CBDC, viz., what role can it play in enhancing financial inclusion.

10.2. Financial Inclusion in Developing Economies

In developing countries bringing financial services to the underbanked/unbanked via technology is not enough, people must also have the basic skills to use self-service technologies like mobile banking. India has implemented the "phygital banking" model where Business Correspondents (BCs) go to rural areas with handheld digital banking devices and provide doorstep banking services to farmers and other villagers where there are no bank branches (RBI, 2010).

Financial Literacy is another major issue among poor people who lack awareness about financial products and services which match their needs. Many people who do have access to financial services do not know that there are alternative channels to access the same financial services at a much lower cost and in a more convenient way.

The lack of formal identification documents is also a major issue. Without proper identification documents the bureaucratic hurdles to open a bank account increase, disincentivising the poor/unbanked people from making any efforts to open an account. Social Benefit Schemes like Direct Benefit Transfers cannot be availed without a bank account. In India, this problem has been solved to a major extent after

the rollout of Aadhaar in 2009 but this problem is still prevalent in most African countries.

Financial Consumer Protection is very important to build trust among the unbanked/underbanked people to adopt the formal financial system. We see a lack of trust due to security and reliability issues with mobile banking, mobile wallets, internet banking, ATMs, PoS and other technologies used for financial inclusion.

Lack of collateral for access to credit is also an issue, having a transaction account is the first step towards financial inclusion, it not just provides remittance and payment solutions but also creates transaction data of the person, which can be used by credit agencies to determine the creditworthiness of the person. Micro Finance Institutions provide small-ticket, collateral-free loans to poor people where these transaction data play a key role in determining creditworthiness and the interest rate to be charged for proper loan appraisal and risk management. In developing countries, cash is so prevalent that there is no proper credit/transaction history of borrowers forcing banks and other financial institutions to demand collateral (World Bank, 2022).

Role of Technology

Technology has made financial inclusion easier, faster and affordable for governments of developing countries. In India, the JAM Trinity- Jandhan, Aadhaar and Mobile has played a key role (Jain, 2022). RBI comes out with a Financial Inclusion Index to capture to what extent financial services are accessible to the common people of the country. The three broad parameters that make up the FI-Index are Access (35%), Usage (45%), and Quality (20%). The Index shows India's score of 56.4 out of 100 which is better than the previous year's score of 53.9. (RBI, 2021).

Similarly, a mobile banking application called M-PESA was brought in by Kenya's largest mobile network operator named Safaricom in 2007 where people with no bank accounts could send and receive money on their mobile phones via SMS. People could also very easily convert their money in an M-PESA account into cash at M-PESA outlets distributed across the country. Many unbanked and underbanked rural population of Kenya got access to payments and remittance services in a very short span of time without the need for any formal banking system (Ignacio Mas and Amolo Ng'weno, n.d.).

There are deprived populations globally who reside in a state where their domestic currency does not churn as extensively in their area. Such community participants need to trade their merchandise with each other for a native economy to prosper. State currency is usually needed for this trade. Internal trade loosens up and the local market becomes unsteady due to low liquidity in a neighbourhood. To rectify this issue Community Inclusion Currencies (CICs) have been introduced which functions as a medium of trade. A certain community or network can only use these currencies. To inspire holders to spend the currency rather than hoarding it certain incentive mechanisms are designed. The productive ability of the community can support the CICs. Local government or aid organisations can possibly seed it but it can also function without any support. Mutual credit network is a term occasionally mentioned for CICs as (interest free) credit is being given by the members to each other in the system. Members are motivated to do business with each other since the credit can only be consumed within the network. This nurtures the development of network participants and keeps the value within the network. "Sarafu Network is a CIC that was formed in Kenya. It is the result of eleven years of experimentation by Grassroots Economics (GE). GE works with persons, parties and associations to assist them to issue credit against their impending production in the mode of vouchers. After this, GE facilitates network members to trade these vouchers among communities and themselves in exchange for goods and services. The vouchers function together with government issued currency and are not intended to substitute it. Digital vouchers as blockchain-based tokens called Sarafu are being issued to network members from August 2018. To trade their Sarafu tokens users do not need internet connection or a smartphone. As an alternative, transactions happen through USSD codes that can be sent between feature phones and the local telecom network—comparable to how a mobile

TABLE 10.1
Indicators of Financial Access Survey

	No. of ATMs per 1000 km², 2021	*Outstanding Loans from Commercial Banks (% of GDP), 2021*	*Outstanding Deposit with Commercial Banks (% of GDP), 2021*
Bangladesh	107.79	36.35	43.01
Honk Kong	3142.86	378.53	529.61
China (Mainland)	100.96	118.91	152.68
India	74.58	46.85	66.40
Japan	353.57	111.23	171.80
Kenya	4.16	26.91	36.80
Nepal	30.17	16.33	30.58
Pakistan	21.22	127.36	146.43
UK	220.72	246.96	299.86
Singapore	3660.08	86.96	98.31

Source: IMF (2021).

money system like M-Pesa functions. A point to be noted is that in the Sarafu setup, users are communicating with a blockchain and not using national currency" (African Crypto Research, 2021).

In China, the country that invented paper money during the Song Dynasty today has proved that cashless transaction is the future of payments. Super Apps like WeChat and AliPay provided payment services embedded with other value-added services like messaging, social media, online shopping, online food delivery and booking cabs all in a single app. This concept of Super Apps has been imitated by other companies around the world. Such embedded payment services have played a key role to help China bring millions of people out of poverty and have reduced the cost of intermediation significantly (Cag, 2021).

The IMF annually publishes the Financial Access Survey (FAS) for 189 countries based on data collected by central banks and other regulators. While financial hubs like Hong Kong and Singapore have many ATMs per 1000 km² but African countries like Kenya have very few ATMs per 1000 km² (Table 10.1).

Risk to the Banking sector from CBDCs

The creation of a CBDC will bring forth new priorities such as revenue strategy for commercial banks and data protection and environmental impact for regulators and citizens. Reassessment of their own role will become a major issue for commercial banks. Indeed, some CBDC models are based on a disintermediation system in which accounts can be maintained directly by central banks which are directly linked to households and firms. CBDC might appear to be more secure and liquid if its launch is accompanied by a competitive interest rate. This could lead to transfer of funds in cash from commercial bank accounts to CBDCs accounts of the central bank. The services, customers and profits may consequently diminish leading to the undermining of the banking sector. The issuance of CBDCs could also lead to financial instability (Maldonato et al., 2022).

"BIS, thus defined three significant foundational philosophies for central banks to reflect in issuing a CBDC:

1. It should not hinder with public policy intentions or stop banks from carrying out their monetary stability obligation (a "do no harm" principle).
2. It should be used in conjunction with and supplement prevailing forms of money (coexistence principle).
3. It should stimulate innovation and competition to increase the overall efficiency and availability of the payment system (the innovation and efficiency principle)." (Reserve Bank of India, 2022).

Domestic circumstances drive the design choices considered for issuing a CBDC in India. "There cannot be a one size fits all approach to CBDC, resilient and secure infrastructure is needed that can be scalable to support users on a massive scale, designs and systems will differ by jurisdictions, so will the risk, which will require significant research by a central bank before implementation" (Reserve Bank of India, 2022).

Key Design Choices for CBDCs

CBDCs all around the world are using different types of designs based on their suitability for the country in which they are being used in. When it comes to India, RBI has to consider a whole gamut of factors while deciding upon the design of an 'Indian' CBDC which is suitable for the country while taking into consideration all sorts of benefits and challenges the Indian financial system and economy faces; while also ensuring a much-needed financial inclusion of currently excluded segments of the Indian society.

Based on the usage, functions and different level of accessibility of the CBDC, it is distinguished into two broad types viz. general purpose (retail) (CBDC-R) and wholesale (CBDC-W) (RBI, 2022). "A CBDC design which envisages that the circulation of digital currency will be limited and end-users will only be financial institutions is called wholesale CBDC" (RBI, 2022). This type of CBDC is intended for limited right to use to chosen financial establishments, planned for the settlement of interbank transfers and associated wholesale transactions (Didenko & Buckley,2021). This design is being used for Project Jasper (Canada), Ubin (Singapore), and Inthanon (Thailand) (Didenko & Buckley, 2021).

On the other hand, Retail CBDC is an electronic version of cash primarily meant for retail transactions. Retail CBDC envisages potential availability for use by all viz. private sector, non-financial consumers and businesses. Retail CBDC is a direct liability of the Central Bank and so it is believed that it can provide access to safe money for payment and settlement (Didenko & Buckley,2021). This type of CBDC is essential for financial inclusion as people are directly involved in its use (RBI, 2022).

CBDCs can have either token-based or account-based internal design which differ mainly in verification need and process. In a token-based CBDC a person who holds the tokens at a given point in time is the owner of it which is equivalent to a bearer-instrument like banknotes. Genuineness about the ownership of a token can be verified only by the person receiving it (RBI, 2022). Meanwhile, in account-based CBDC systems, control of the account is linked to the account holder's identity similar to the typical bank account model (Didenko & Buckley, 2021). "Maintenance of record of balances and transactions of all holders of the CBDC and indicating the ownership of the monetary balances is required in account-based system" (RBI, 2022).

Based on the respective roles of the central bank and the private sector in facilitating access to, and use of a CBDC there are three prototypes for the issuance and management of CBDCs across the globe. Structure of legal claims and the record kept by the central bank are the key differences (RBI, 2022). Firstly, we have the 'direct CBDC model' which is being considered for e-krona of Sweden, Sand Dollar of Bahamas and DXCD project of Eastern Caribbean States. In this, the central bank is repositioned as the only provider of CBDC for citizens (Maldonato et al.,2022). Secondly, we have 'The indirect (or synthetic) CBDC model' which has been chosen for Jasper of Canada, Khokha of South Africa and Aber project of Saudi Arabia and United Arab Emirates. In this model commercial banks would issue their own e-money, 100% backed by the CBDC as they are Payment Services Providers (PSP). In this model, CBDC could be held in an account/ wallet with a bank, or service provider (Maldonato et al.,2022). Finally, we have the 'Hybrid CBDC model' which is being incorporated in e-CNY of China, e- euro of European Union and Ubin project of Singapore. In this, "the central bank would directly issue CBDCs to end users and would rely on commercial banks, or other PSPs, to manage the transactions, KYC and related services" (Maldonato et al.,2022). Table 10.2 provides a comparison between CBDCs and existing central bank money.

TABLE 10.2
Important Design Characteristics of Central Bank Money

	Current central bank money		*Central bank digital currencies*		
	Cash	*Reserves and settlement balances*	*General-purpose*		*Wholesale-only token*
			token	*accounts*	
24/7 accessibility	✓	×	✓	(✓)	(✓)
Anonymity vis-à-vis central bank	✓	×	(✓)	×	(✓)
Peer-to-peer transfer	✓	×	(✓)	×	(✓)
Interest-bearing	×	(✓)	(✓)	(✓)	(✓)
Limit or caps	×	×	(✓)	(✓)	(✓)

✓= prevailing or likely feature (✓)= possible feature ×= not typical or possible feature

Source: Aggarwal (2020).

10.3. CBDCs for Financial Inclusion: The Opportunities

Cash is the most popular way of paying for goods and services at retailers. Micro, small, and medium-sized enterprises (MSME) merchants make and take over USD34 trillion in payments per year in the form of wages and salaries for employee's payments to suppliers, and receipts from customers according to a report by the World Bank Group and World Economic Forum. Estimates place the percentage of payments made electronically at 44%, with cash or checks accounting for the remainder (World Economic Forum, 2016). Offline CBDC can fill this gap. A retail CBDC uses NFC technology with RFID module to make payment in offline mode. For example, recently introduced eCedi by the Bank of Ghana aspires to be usable by everyone and anywhere in the nation, even when there are no mobile data networks in rural areas. As a result, its design strives to utilise and make it possible to use offline payment capabilities (Bank of Ghana, 2022).

A CBDC can save cash management expenses, which are often high in developing nations due to things like high distribution and storage costs and dependence on bank branches (Raghuveera, 2020). It can reduce the expense of preserving the availability of physical money and safeguarding it from forgery. By lowering bookkeeping, operating, and payment reconciliation expenses, it can also help private payment system operators (Cenfri, 2019). Lower cash logistics may be advantageous to businesses, while reduced ATM withdrawal fees may be advantageous to consumers (Cenfri, 2019).

As compared to physical cash money laundering, proliferation and terror financing can be controlled to a great extent by usage of Blockchain or Distributed Ledger Technology in CBDC. This is because the central banks would typically control and monitor issuance of CBDC tokens through themselves or through banks and authorized non bank entities. Hence many-to-one ("collection of donations") and one-to-many (distribution of e-cash) transactions could be easily tracked making it difficult to fund the terrorist organizations as the central bank can implement a mechanism to track the transactions originating out of or terminating into CBDC accounts which are under the lens.

The use of CBDC creates an electronic trail and as such this could be useful in assigning any credit score more efficiently to individuals and could be, theoretically, used for monitoring spending vis-à-vis repayments thus helping reduce NPA of the banks.

One of the biggest challenges in farming communities, is inadequate compensation to farmers and the leakages in the subsidies due to multilayered hierarchy in the agricultural produce markets. While much headway has been made to ameliorate their lot, by enabling payment for purchases using smart cards, use of CBDC will allow them to create a digital record of transactions that can be used for directed subsidy and

credit access. To reach vulnerable individuals, governments can also use CBDC to issue welfare vouchers. To reach farmers who have been impacted by climate change-related disasters the CBDC-enabled G2P payments with a high level of finality and irrevocability can be used. In addition to ensuring that the next payment will be received, digital payments are advantageous because they make payments more predictable and reliable, which may enable people and households to plan and make long-term investments that can boost resilience. "CBDC could also be developed as an continuously-offline bearer instrument, for example, on a stored-value card, as was the Bank of Finland's Avant CBDC started in 1993" (Grym, 2020).

"Retail CBDC can be developed to lessen identity gaps, and mobile phone and digital access divisions by its exclusive capability to produce digital identity proxies and permit offline abilities even though being gadget agnostic. Among all application scenarios, a crucial feature of CBDC's value hypothesis is its tried capacity to drive interoperability and channel omnipresence for users by providing appropriate payments across any provider – via any apparatus, to any provider – as a common device. This standing as a general-purpose or ubiquitous gadget is a key difference from other digital instruments like electronic (e)-money or electronic money transfers (EFTs)" (Alliance for Financial Inclusion, 2022).

"CBDCs could offer a chance for governments and central banks to stimulate widespread access. If accepted as legal tender, governments will try to guarantee CBDC is available and used by all citizens. Where central bank and market forces have been incapable to bring about interoperability so far, CBDC could provide the requisite interoperability and interlinkages with different payment highways. CBDC can also be used by the public establishments to create a base level of service quality and put competitive force on private sector providers to upgrade upon their delivery of financial services" (BIS, 2022).

"To tackle some vital concerns in the current payments scene many central banks see CBDC as a novel instrument. CBDC systems could be designed in a way that includes all PSPs, banks and non-banks; offers a strong and low-cost public sector technological basis and innovative interfaces; offers low service fees; reconsiders access policies to embrace all; permits remote registration; simplifies access of merchants, micro and small enterprises; allows access to special groups with constraints; and nurtures interoperability with domestic and cross-border systems, without the inadvertent fallout of new patterns of exclusion. If designed with inclusion in mind, CBDCs form an extension to the policy toolbox to support access to payments and financial services for all" (BIS,2022).

Table 10.3 below summarizes demand and supply side hurdles for financial inclusion and the CBDC characteristics and use cases that could address them. This can provide a basis for design alternatives by regulators and policymakers.

10.4. Financial Inclusion through CBDC: The Challenges

Onboarding the remotest area of the country to the financial system and providing affordable financial services to the citizens with the least possible intermediation refers to financial inclusion. Governments across the globe are looking at CBDC as a facilitator of their financial inclusion goals. But, the question is, Is CBDC an optimal way to financial inclusion? It is still an area of exploration, financial inclusion through CBDC comes with certain challenges that we have explored as follows.

CBDC requires some infrastructure such as internet connectivity, electricity, households having smartphones, proper cellular network coverage, onboarding with digital payment systems, etc. The aforementioned infrastructure is available with some of the countries, but on the larger side, other countries have to upgrade themselves to these basic infrastructures for somewhat smooth functioning of the CBDC. Taking India as a reference, India has a robust digital payment system since the introduction of UPI, in October 2022, 7,305.42 million transactions amounting to INR 12115.83 billion were directed through UPI (NPCI, not dated), there already exists an ecosystem with significant volumes, which makes it hopeful to be successful in the proper implementation of

TABLE 10.3

CBDC Characteristics and Financial Inclusion Hurdles

FI Hurdles	*Market Context*	*CBDC Characteristics*	*Use Cases Promoted*
Demand-Side	1. Trust	> Because of bad practices there is low faith in commercial providers > Absence of control over transactions (cash can at all times be accessed and any alteration in income can be noted instantly) > Absence of appeal if problems happen	> Accessible 24/7 > Clearing and value transfer happens immediately > Payments are irreversible and final > Wallet audit trail and recourse process to restore locked value > During network issues or dearth of airtime there is offline capability > CBDC with smart card capability, cost is low, airtime or phone not needed, and have both offline and online capability
	2. Fees	> High apparent fees for transactions > Monthly account or wallet fees destroy value	> Risk can be reduced due to decentralized distribution, intermediaries have less participation, channel operational and security processes are reduced due to use of a secure instrument, this leads to overall lower costs > There is accumulation of scale advantages due to ubiquity of channels
	3. Merchant acceptance	> Tax evasion and privacy > Merchant-specific KYC records are absent > Merchants do not have access to POS terminals	> Tax payments are automated > POS is not needed by merchant; NFC reader or mobile phone can be used by them > CBDC wallet offers value-added services
	4. Literacy	Low levels of financial and digital literacy	Designed for simplicity
	5. Identity	Dearth of identification both digital or physical leads to exclusion as KYC regulations demand the same	> CBDC can turn out to be an identifier > Digital identity proof options in keeping with FATF guidance > Can be associated in digital ID stack and can be implemented as part of a national ID
	6.Connectivity	> access to high-speed internet is deficient > Access to smartphones is minimal	> Offline and online capabilities > Design for low connectivity and feature phones
Supply- Side	1. Interopera-bility	Due to a dearth of interoperability inter-provider payments are expensive and complex (it is performed through third parties or bilaterally)	Through payment instrument standardization CBDC reduces the need for complex and new integrations thereby lowering provider costs and soothing out the processes
	2. Cash Management	> Liquidity management is inadequate > PSP access points are inadequate > Liquidity costs are high	> Through more direct access to liquidity for rebalancing it enables better liquidity management > As liquidity restraints are eliminated it allows each access point to assist more clients > The costs involved in handling liquidity risks will be reduced due to lesser liquidity risks
	3. Instant payments	Inclusive instantaneous payment systems are constrained by legacy systems. To manage credit and settlement risks existing systems tie up PSP funds	Immediate clearing and settlement can be enabled by CBDC, credit and settlement risks can be lowered

Source: Alliance for Financial Inclusion (2022).

CBDC, on the other hand, various countries in the region lack the hands-on experience.

Smartphone penetration is important to develop and enable mobile wallets with a sufficient level of security. Financial and technological literacy are other important pillars for the successful implementation of CBDC in the retail segment of any country as they help the smooth functioning of the system and subsequently reduce the operational costs of CBDC at a granular level, but the challenge lies in educating the users of the facility, given the scarce resources and complexity of the task small countries may find it difficult to achieve the targets.

Another challenge faced by the governments and central banks is the level of trust the citizens have in them, taking the payment systems to the next level for the retail market involves a crucial factor of trust. The trust factor is a crucial one due to the certain events that some countries faced, Ecuador can be a suitable example, the government in the past had defaulted on their obligations on sovereign bonds, which led the citizens of Ecuador to consider keeping the deposits with the commercial banks were less risky than keeping them with the central bank (Central Bank of Ecuador, 2018). Thus, the reputation of the central bodies will play an important role in financial inclusion at the retail level with CBDC.

Taking CBDC to the masses will expose it to a greater risk of getting exposed to the breach of cyber security which doesn't even spare the people with adequate financial literacy. Keeping in mind the aforementioned risk there is a need for a sufficiently robust regulatory and legal framework for the same, such kind of advanced framework contributing to the handling of the risks with such high magnitude is missing in developing countries.

The introduction of CBDC in the retail market may also raise unwanted competition. Central Banks may get into competition with various parties such as commercial banks, central banks of other countries, and even with some payment system operators.

Approximately half of the population in India is financially excluded, according to RBI's Financial Inclusion index, which is published by RBI, currently is 56.4, this indicates that India is just a little above the halfway mark to financial inclusion.[1] The reasons for financial exclusion as identified by the government of India by National Financial Inclusion Strategy (2019-24) are lack of trust, absence of funds, limited awareness, insufficient documents with the public, high transaction costs, inability to approach the service provider, and services provided are poor (RBI, 2020). Some of these challenges may be attributed to CBDC also unless it is properly addressed before the full scale roll out.

With the implementation of CBDC, comes a lot of concerns regarding the security and safety of the transactions done by the players, going at the retail level the number of players increases substantially, and safeguarding their interests becomes a crucial task that generates a need for proper grievances redressal centres and framework.

For a CBDC to penetrate the retail market CBDC must have features like cash, such as anonymity while completing transactions, easy access, liquidity, and universal acceptance. Keeping CBDC anonymous, brings some other concerns to the table, which are money laundering, bribing, and other dark concerns. So, to control these concerns, a CBDC should be anonymous but to an extent of preventing the aforementioned concerns.

Financial Inclusion through CBDC also aims at providing financial services such as credit, insurance, and other government-driven initiatives and schemes to the masses at lower

1. In discussion with Government and corresponding sectoral regulators the FI-Index has been gestated by the RBI as "a comprehensive index incorporating details of banking, investments, insurance, postal as well as the pension sector. The index captures information on diverse aspects of financial inclusion in a single value spanning between 0 and 100, where 0 represents complete financial exclusion and 100 indicates full financial inclusion. The FI-Index takes three broad parameters (weights recorded in brackets) viz., Access (35%), Usage (45%), and Quality (20%), as its components, with each of these comprising of varied dimensions, which are computed based on a number of indicators. The FI-Index has been created without any 'base year' and as such it echoes collective endeavor of all stakeholders over the years towards financial inclusion. The annual FI-Index for the period ending March 2021 is 53.9 as against 43.4 for the period ending March 2017."(RBI,2021)

costs, this presents a challenge in minimizing the costs of transactions facilitated through CBDC, the cost of transacting through CBDC should be lower or at par with the traditional way of transacting and transferring funds of government schemes. If the challenge of lower transaction costs gets solved, the problem lies in every adult having at least one bank account to get onboarded on CBDC or such a model should be followed in which the account opening for CBDC is done directly by the Central Bank. As of 2017, two-thirds of the adult in the world had no bank accounts, at the same time in Africa this number was half, and around 40% in Latin America (Chen et al., 2022).

10.5. CBDC for Financial Inclusion: Potential for India

Problem of Financial Exclusion in India

Jan Dhan accounts, Aadhaar cards and penetration of Mobile Phones into India has created what is known as JAM (Jan Dhan-Aadhaar-Mobile) Trinity. This trinity accompanied by PMJDY scheme has led to a successful financial inclusion of previously un-banked people on a massive scale in the last few years.

RBI has still noted the limitation of over reliance on access to bank accounts particularly in a scenario where 'marginally banked' people do not fully utilize these accounts and continue to fall back upon the informal economy to meet their financial needs. The Financial Inclusion (FI) index published by the RBI currently stands at 56.4 (March 2022) which is little above the halfway mark to full inclusion. This points to existing challenges which perpetuate exclusion of large sections of the population and prevents them from engaging with the formal economy.

Absence of funds, inability to provide necessary documents, limited awareness and lack of trust are examples of structural factors which impede financial inclusion whereas market features which lead to exclusion are high transaction costs, remoteness of service provider, poor quality of services and absence of customer centric designs, among others. Furthermore, these factors disproportionately affect vulnerable groups such as women, micro and medium and small enterprises (MSMEs), remote communities and other marginalized populations.

Development of Digital Infrastructure

Under the Digital India programme, many Digital Infrastructure initiatives have been taken in India. For the sake of putting the role of CBDC, a brief discussion of the following digital forms of payments seems to be in order.

Bharat Broadband Network (BBNL): This project will create the National Optical Fiber Network (NOFN) and would connect around 2.5 lakh Gram Panchayats spread over 6600 Blocks and 641 Districts by laying optical fiber cable and would bring high-speed internet to remote villages.

DigiLocker: It is a digital wallet to keep critical lifelong documents/certificates as digital documents in a secure cloud-based platform. It is a step towards the government's plan of paperless governance. With DigiLocker citizens can store, share and verify digital documents issued by over 100 issuers which are both Central and State agencies.

Digital Saksharta Abhiyaan (DISHA): It is a National Digital Literacy programme to provide IT training to over 50 lakh people like ASHA workers, authorized ration dealers, Anganwadi workers etc. The programme aims to train non-IT literate citizens to become IT literate.

Direct Benefit Transfer (DBT): The goal of the scheme was to streamline and speed up the current government welfare schemes delivery system to ensure precise beneficiary targeting, lower fraud rates, and less duplication of paperwork (Government of India, 2022a).

Additionally, the Payment and Settlement Systems Act of 2007 resulted in the establishment of several Digital Payment Infrastructures like the National Payments Corporation of India (NPCI) which acts as an umbrella organisation for managing retail payments and settlements solutions in India. Some important digital infrastructures created by NPCI are as follows: "RuPay; Immediate Payment Service (IMPS); National Automated Clearing House (NACH); Aadhaar enabled Payment System (AePS); Aad-

haar Payment Bridge (ABPS); National Financial Switch (NFS); Unified Payments Interface (UPI); Bharat Bill Payment System; National Electronic Toll Collection (NETC)" (NPCI, 2022).

On February 1, 2022, India joined a growing list of countries who have publicly announced their interest in developing and deploying a CBDC. Though the Reserve Bank of India (RBI) has been exploring the topic for some years, the earliest mention of CBDCs was in a report dated February 28, 2019, by a committee headed by the Secretary, Department of Economic Affairs.

CBDCs should assimilate all possible features of the physical currency as it is equivalent to an electronic form of sovereign currency (RBI, 2022).

Global interest in CBDCs is guided primarily by a desire to protect monetary sovereignty against a surge of private backed digital currencies which are scalable enough to upend the existing payment system. For emerging markets and developing economies like India, a new form of fiat currency which is digital in form is seen as a potential alternative to the cash based informal economy and a key enabler of financial inclusion.

"The determining factor of the design of CBDC for India is the functions it is expected to perform, out of which one of the main considerations is that the design features of CBDCs should be least disruptive to the status quo of the banking and financial sector" (RBI, 2022).

How different is CBDC from UPI? In an interview, RBI Governor has explained the difference between UPI and CBDC and went on to say:

> "The first difference is, UPI is a payment system while the CBDC is the currency itself. Secondly, UPI involves the intermediation of banks, you pay somebody through mobile, then the message goes to the bank, your account gets debited, the bank transfers the money to the recipient's bank account and the recipient's bank account sends a message that so much money has been received. So, there is an intermediation of the bank. CBDC is like currency notes. … What is more about CBDC is that there is an automatic sweep-in and sweep-out facility. 24 hours, you can draw CBDC and if you are carrying excess CBDC, you can put it back into your bank account. So, there is an automatic sweep-in and sweep-out facility. The third is the huge logistics, the cost of printing notes that is not there. Manufacturing paper, getting the ink, and having a printing press, all these things will become outdated over a period of time. Logistics-wise, CBDC will be much simpler, and it will be much faster." (Das, 2022)

Pilot Testing of CBDC for Retail by RBI in India

A pilot testing program on retail CBDC was launched on December 1, 2022 by the Reserve Bank of India in four cities, Mumbai, New Delhi, Bengaluru, and Bhubaneswar as part of the phase 1 of the project. The retail CBDC is named e-rupi (e₹-R), the central bank has partnered with four banks: State Bank of India, ICICI Bank, Yes Bank, and IDFC First Bank for the launch of its pilot project on retail CBDC. Subsequently, another four banks, viz., the Bank of Baroda, the Union Bank of India, the HDFC Bank and the Kotak Mahindra Bank will participate in the retail pilot (Government of India, 2022b).

The e₹-R is in the form of a digital token that represents legal tender. It is being issued in the same denominations as the paper currency and coins. In the first phase of the project, the participating banks will be offering a digital wallet to transact with the CBDC being offered by the RBI in selected cities. The payments will be designed in such a way that users can transact by scanning the QR codes available at merchant points, the payments can be made to both Person to Person (P2P) and Person to Merchant (P2M), and the CBDC will not earn any interest in the digital form but can be converted in other forms such as deposits with banks, the liability of Digital Rupi will be shown on the balance sheet of the Central Bank.

The testing of CBDC for retail will undergo a phase-wise expansion of features and geographies to test the robustness of the Digital Rupi (Economic Times, 2022). It has components based on blockchain technology. Onboarding of more than 50,000 customers and 10,000 small merchants including Reliance Retail which is India's largest retail chain has happened till now.

What uses CBDCs in India could be put into is still to be decided. Programming retail CBDC for specific uses is one of the thought process. For instance, any tokens delivered In connection to a government subsidy project could only be consumed on merchandises for that project. offline payments and programmability are other use cases being examined. A CBDC with the best of features will be rolled out in India based on the outcome of these experimentations (Singh, 2023).

10.6. Concluding Observations

A CBDC is a central bank public good which seeks to modernize payment systems and introduce a new form of currency, digital in form but with the convenience and liquidity of cash. India has made giant strides in financial inclusion through the Jan Dhan no frills accounts, Aadhaar digital ID and penetration of mobile phones commonly referred to as the JAM trinity. But gaps in MSME credit have adversely affected economic growth and employment opportunities in the rural and semi-urban areas which faced the brunt of the Covid crisis.

When the poor and marginalized transact in digitally native fiat money stored on decentralized ledgers, they create verifiable trails of cash flows and can tap into alternative methods of raising capital for their daily operations. Smart contracts provided on blockchains can automatically unlock a suite of applications such as embedded finance which can directly benefit those at the bottom of the pyramid. Conditional transfers (based on self-executing codes) of the digital rupee to 1.2 billion mobile phone users can be a gamechanger for onboarding the unbanked onto the formal economy. But there are clear risks of introducing a new form of fiat money, particularly with regard to disintermediation of the commercial banks. Central banks are carefully considering all options to do no 'harm' to the existing 2-tier financial system before proceeding with the implementation of a CBDC in their respective jurisdictions.

CBDC should be a token-based mechanism as India already has a pseudo-wallet-like infrastructure via UPI and for better facilitating the transactions with the least hurdles such tokens should be storable in both cloud wallets as well as in physical wallets such as in a mobile phone or a pen-drive like device for better usability.

The digital rupee wallet may be contemplated as a mobile app. Going forward, this app can have many attractive value-added services such as programmable rupee, based on tokenisation and smart contracts. This can easily automate the conditional payments scheduled as per the contracts. The app can grow in the future to become a multisided platform for cash management, fund transfer (including direct benefit transfer or DBT), trade financing (for example supply chain financing), lending (micro lending and P2P lending), remittances (say, cross-border), exchanging securities (instantaneous delivery on payment), information sharing (for e-invoicing and goods and services tax), taxing (direct and indirect), regulating, etc. It can even be a super app for the citizens of India in the upcoming years (Ray et.al, 2022).

Small transactions using CBDCs should be kept anonymous and may be able to operate in no internet connection areas. Larger transactions should be recorded to prevent money laundering activities. However, CBDCs could never provide the degree of anonymity provided by physical cash as every transaction and deposit could have digital footprint. Security should be given due importance since the token based system has a chance of receiving counterfeit token or double spending.

CBDCs should be designed in a way so that they facilitate easy remittances across borders as well, to do so the international acceptance of a country's CBDC is important. CBDCs can be made an attractive alternative for the current processes of the cross border transactions, since the current methods are of high cost and slow execution.

In a sense, CBDC, an entity, is still shrouded in mystery. It has huge potential for enhancing financial inclusion. The eco-system needs be developed with appropriate design backed by adequate financial literacy. The future looks challenging but exciting.

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