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Does it really need an additional digital payment system?

NAVNEET SINGAL
International Tax Expert

Critical analysis on implementation of Central Bank Digital Currency ('CBDC')

Central Bank Digital Currency (CBDC) or e₹ is a digital rupee, a mode of digital payments that will have legal tender and will be issued and backed by the sovereign through their central banks, i.e., Reserve Bank of India (RBI) in the case of India. CBDCs will be in digital mode (cryptography) and will appear as a liability on the RBI's balance sheet. As of September 30, 2022, 105 nations, representing over 95% of global GDP, were exploring CBDC, and 50 of them were in an advanced stage of exploration (development, pilot, or launch). CBDC has been fully launched in 10 nations, and 15 nations are at the pilot stage.

Private cryptocurrencies, such as Bitcoin and Ethereum, have long been in use; however, they have never been backed by a sovereign and have no intrinsic value. As of August 1, 2022, the market cap of all private cryptocurrencies was $1.06 trillion, and more than 300 million people worldwide were using or owning private cryptocurrencies worldwide. This illustrates the depth of private cryptocurrencies as a means of digital payment. India is one of the frontrunners in digital payment. India has made significant progress, adopting cutting-edge payment techniques like RTGS, NEFT, IMPS, UPI, BBPS, and NETC, among others. On November 1, 2022, it launched a pilot version of CBDC in the wholesale segment and registered itself in one of the few countries that have been able to do so.

When the current system of digital payment is working flawlessly, the question arises as to whether India really needs another way of digital payment system, i.e., CBDC. If indeed the development of CBDC is exclusively intended to defend the India Monetary System against the threat posed by private cryptocurrencies or due to the inherent qualities and advantages of CBDC.

In the Concept Note on CBDC issued by the RBI on October 7, 2022[1], the central bank appears to have addressed some, if not most, of the concerns regarding its requirement over private cryptocurrencies and available digital payment systems. In this article, the author has attempted to analyse challenges in the introduction of CBDC due to its design, technology considerations, security, legal framework, etc. amid its numerous benefits. This paper also includes an analysis of the threat to the financial ecosystem from cryptocurrencies and case studies of the implementation of CBDC in Canada, China, and the Bahamas which are frontrunners in its implementation.

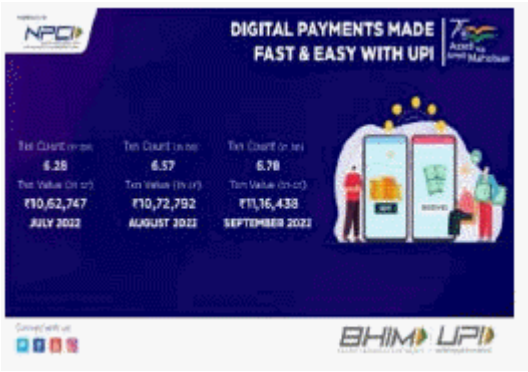
A. Introduction of CBDC in India – Why it is needed?

We are currently at the vanguard of a watershed movement in the history of money that will fundamentally alter what money is and how it works. Despite the fact that more than half of the population still prefers cash as a form of payment, particularly for small transactions[2], digital transactions have grown significantly and reached more than 6.78 billion in India on September 22 [2]. The transition from paper money to digital money is changing rapidly. The Reserve Bank Digital Payment Index (RBI-DPI) demonstrates significant growth in adoption and deepening of digital payments across the country since its inception, which is 349.30% over a period of 4 years. **Central banks around the world are currently facing two major challenges when it comes to digital transactions. The first is whether the current digital payment system can handle the rapidly growing demand for a digital payment system. The second is whether it can accept transactions through private cryptocurrencies as an additional mode of a digital payment system to fill this gap where it is not legal tender and doesn't have any intrinsic value.**

In modern economies, currency is a form of money that is issued exclusively by the sovereign (or a central bank as its representative) and is legal tender. It acts as (i) medium of payment, (ii) a unit of account, and (iii) a store of value for a jurisdiction. The launch of CBDC may offer the general public a risk-free virtual currency that will grant them legal advantages without the hazards associated with using private virtual currencies. In addition to protecting the public from the high level of volatility in private cryptocurrencies, this could also meet the demand for digital currency that is safe.

Bank of international Settlements (BIS) in its report outlined the core features and foundational principles of a CBDC, i.e.,

1. Do no harm principle
2. The coexistence principle
3. The innovation and efficiency principle



These principles emphasise that the creation of a CBDC should not conflict with governmental goals or hinder banks from fulfilling their monetary stability obligations, that it should be used in conjunction with and as a supplement to existing forms of payment, and that it should encourage innovation and competition to improve the overall effectiveness and accessibility of the payment system. In the Union Budget presented to Parliament on February 1, 2022, the Government of India (GoI) announced the launch of CBDC on April 1, 2023. The broad objectives to be achieved by the introduction of CBDC using blockchain and other technologies as a 'more efficient and cheaper currency management system' were also laid out in the budget.

B. Design framework of CBDC, what can work for India?

The concept note on CBDC describes the following design framework, which needs to be understood to analyse the challenges and trade-offs for the implementation of CBDC in India, i.e.

(i) Types of CBDC

- Retail CBDC-R: would be potentially available for use by all, viz., the private sector, non-financial consumers, and businesses.
- Wholesale CBDC-W: designed for restricted access to banks and selected financial institutions

The model of CBDC-R and CBDC-W has been accepted by most countries including India.

(ii) Models for issuance and management

- Direct Model,where the central bank would be responsible for managing all aspects of the CBDC system, viz.,

issuance, account-keeping, and transaction verification.

- In an indirect model, the obligation to provide CBDC on demand would fall on the intermediary, and the central bank would track only the wholesale CBDC balances of the intermediaries.
- In the hybrid model, the commercial intermediaries (payment service providers) provide retail services to end users, but the central bank retains a ledger of retail transactions.

The concept note considers the indirect Model, to be suitable for India.

(iii) Storage value – Deposit or cash

- Remunerative: The CBDC would have storage value and carry an interest rate.

- Non-remunerative: It is treated exactly like cash and has no interest in its storage time. It would be money deposited in the current account.

In the concept note, RBI has preferred the non-remunerative model over the interest-bearing model.

(iv) Structure of CBDC

- Token-based: A token CBDC is a "bearer-instrument" like banknotes, meaning that whoever 'holds' the tokens at a given point in time would be presumed to own them.
- Account-based: Account-based CBDC would require the keeping of a record of the balances and transactions of all holders of the CBDC, like the balance of o/s in a bank account.

The CBDC-W may be issued in account-based form, whereas the CBDC-R is primarily designed for general public consumption, with features similar to those of physical cash, such as anonymity, a unique serial number, and so on.

The Bank of International Settlement (BIS), has tried to define the taxonomy of CBDC through a money flower that illustrates (Graph 1) several key aspects of fiat currency, CBDCs and cryptocurrencies, including the issuer (Central Bank or intermediaries), Form (Digital or legacy fiat), accessibility (widespread use or specialized use), and technology (token-based or account based). In the illustration, Private Digital Tokens represent cryptocurrencies.

C. How can CBDC complement the current system and provide benefits?

CBDC would differ from existing digital money available to the public because a CBDC would be a liability of the Reserve Bank and not of a commercial bank. The sovereign or central bank will be 100% responsible for its liquidity and payment. CBDC, being a sovereign currency, holds unique advantages, including trust, safety, liquidity, settlement finality and integrity. The key benefits of CBDC can be described as follows:

(*i*) Reduction in operational costs involved in physical cash management

(*ii*) No credit and liquidity 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[3].

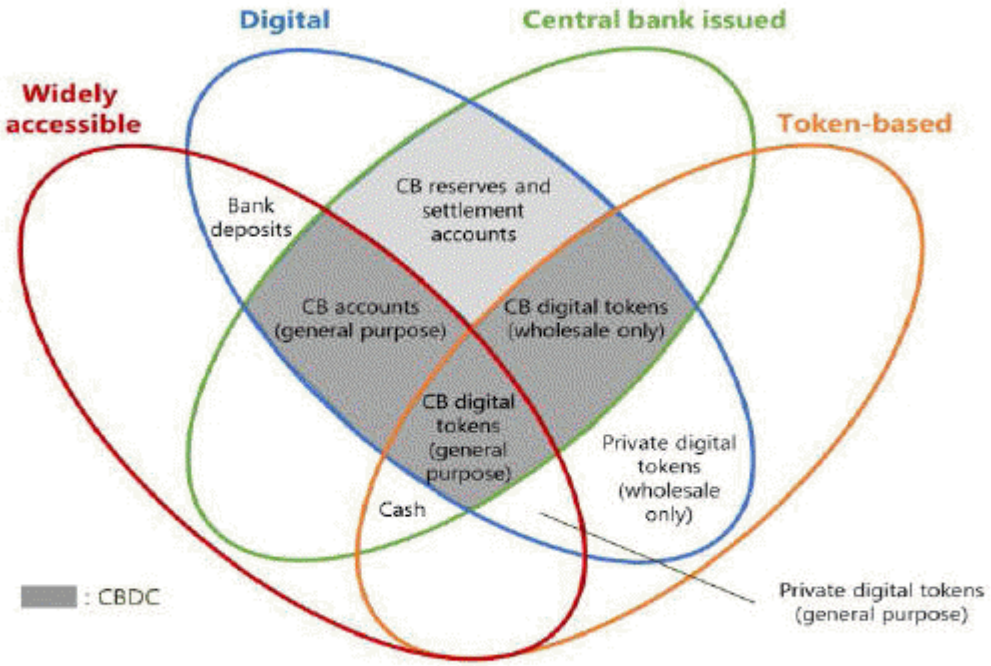
(*iii*) Fostering financial inclusion: CBDC may provide the public with safe, sovereign digital money for meeting various transaction needs. It will make financial services more accessible to the unbanked and underbanked population.

(*iv*) Bringing resilience and efficiency benefits when electrical power or a mobile network are not available or given the geographical spread and pockets where making physical cash available is a challenge, CBDC is expected to facilitate seamless transactions.

(*v*) Providing the public with the uses that any private virtual currency can provide without the associated risks.

(*vi*) Provide entrepreneurs with a platform to create new products and services

The money flower: a taxonomy of money — Graph 1



Notes: The Venn-diagram illustrates the four key properties of money: *issuer* (central bank or not); *form* (digital or physical); *accessibility* (widely or restricted) and *technology* (account-based or token-based). *CB* = central bank, *CBDC* = central bank digital currency (excluding digital central bank money already available to monetary counterparties and some non-monetary counterparties). *Private digital tokens (general purpose)* include crypto-assets and currencies, such as bitcoin and ethereum. *Bank deposits* are not widely accessible in all jurisdictions. For examples of how other forms of money may fit in the diagram, please refer to the source.

Source: Based on Bech and Garratt (2017).

D. Interbank Settlement and Cross-Border Payment – Giant Leap for Banking System

CBDC will eliminate the need for ***interbank settlement*** by giving choices to market participants to choose among the various settlement options such as settlement in Central Bank / commercial bank accounts with / without using clearing corporations; or settlement on a bilateral basis without use of central counterparty by directly using CBDC accounts. It can be compared to a cash-based transaction, where instead of banknotes, CBDC is handed over, leading to instant settlement. This is expected to bring about further efficiency in the payment system. On November 1, 2022, the RBI launched its first pilot project of the digital rupee in the wholesale segment in which government securities worth Rs. 275 Crs. were traded using CBDC on its 1st day of launch. The RBI said that *"Settlement in central bank money would cut transaction costs by doing away with the need for settlement guarantee infrastructure or collateral to mitigate risks. Other wholesale transactions and cross-border payments will be the focus of future pilots, based on learnings from this pilot"*.

In a cross-border context , CBDCs can be implemented in different ways. On the one hand, they could be used to make payments to and from another currency area. On the other hand, different jurisdictions may facilitate the interoperability of their domestic CBDC platforms to simplify cross-currency payments.[4] The resulting benefits could be substantial and may include (i) faster transaction processing on a 24/7 basis; (ii) improved transparency; or (iii) enhanced settlement mechanisms (e.g., "atomic" settlement, which guarantees, in a bilateral settlement, that transfer of a currency in one direction occurs if and only if a corresponding transfer is made in the opposite direction) that could, among other things, facilitate intraregional trade.[5]

Wholesale CBDC involving different currencies is the subject of the BIS innovation hub project, which involves the central banks of China, Hong Kong, the United Arab Emirates, and Thailand collaborating on the Multiple Central Bank Digital Currency (mCBDC) Bridge Project. This project aims to develop an international settlement platform through which central banks can utilise CBDC for transactions by financial institutions. The mCBDC project would enable cross-

border payments that can be done in real-time between the four jurisdictions 24x7, with the foreign exchange leg settled in real time.

E. Out of the box benefits using CBDC

i. The CBDC-W can make settlement systems for financial transactions done by banks in the G-Sec Segment and capital market safer, less expensive to run, and better at using collateral.

ii. The CBDC-W provides retail access for purchasing assets such as G-secs, CPs/CDs, primary auctions, etc. without using a bank account. If assets are also tokenized in the case of g-secs, non-residents may be allowed to invest in domestic asset classes.

iii. As demonstrated by Project Jasper (Canada) and Ubin (Singapore)[6], CBDC-W could be utilised to increase the effectiveness of interbank payments or securities settlement.

iv. Specific use through pre-programmed CBDCs

(*a*) A possible use case for CBDC is 'fit-for-purpose' money used for social benefits and other targeted payments in a country. For example, pre-programmed CBDC could be issued for LPG subsidies as direct benefit transfer (DBT) or such subsidies can also be extended to other sectors such as agriculture, where subsidies for fertilisers could be transferred via the CBDC route. This CBDC could only be accepted at authorised fertiliser outlets, ensuring minimal leakage in the subsidy programme.

(*b*) Programmable payments can be used by organisations for their employees' expenses, including fuel and telecom bills.

(*c*) Pre-programmed digital CBDC can be used in industrial supply chain ecosystems. In this case, CBDC could only be used for specific purposes, such as fuel expenses and state border taxes

F. Hazards associated with using private cryptocurrencies. Whether these will sustain?

Private cryptocurrencies cannot be compared to the CBDC, and the author believes that accepting private cryptocurrencies as a mode of payment would be disastrous. According to some analysts, we shouldn't compare apples with oranges or say that it should be viewed as a stock rather than a currency. But how can something that has no inherent value or guarantee and whose value is entirely based on supply and demand be referred to as currency or money? An analysis is as follows:

- Private cryptocurrencies are not commodities or claims on commodities as they have no intrinsic value, which is the fundamental notion of money.
- It is more geared to bypass the established and regulated intermediation and control arrangements that play a crucial role of ensuring integrity and stability of monetary and financial eco-system
- The mining of private cryptocurrencies is in private hands which can cause no control over its demand and supply and its value can be highly fluctuated. For, e.g., between 2012 and 2022, the price of Bitcoin has increased by over 540,000%.
- Lack of any sovereign authenticity can cause, introduction of 'n' number of cryptocurrencies. As of now, there are more than 6,000 types of private cryptocurrencies are in the market.
- The proliferation of private cryptocurrencies can pose significant risks related to Money Laundering & Financing of Terrorism being its anonymity and non-controllable features.
- The unabated use of crypto assets can be a threat to the monetary policy objectives as it may lead to creation of a parallel economy and will likely undermine the monetary policy transmission and stability of the domestic currency.
- It will also adversely affect the enforcement of foreign exchange regulations, especially, the circumvention of capital flow measures.

G. Challenges amid numerous benefits in introduction of CBDC by Central Banks

Even though using CBDC has the potential to boost the financial ecosystem in many ways, there are also risks associated with it that cannot be ignored. This risk may affect how the technology is designed, how interoperable it is, and how important public policy issues like the risk to financial stability, monetary policy, the makeup of the financial markets, and the cost and accessibility of credit are handled. They must be carefully weighed against any potential advantages.

(1) Distributed ledger technology (DLT) vs. Centralize database system – Trust assumption

The infrastructure selected for implementing CBDC could be based on a conventional, centrally controlled database, or on a distributed ledger. In conventional databases, resilience is ensured by storing data over multiple physical nodes, which are controlled by one authoritative central entity, i.e., the top node of the hierarchy. On the other hand, in DLT-based systems, the ledger is usually managed jointly by multiple entities in a decentralised manner, and each update needs to be harmonised amongst the nodes of all entities without the requirement of a top node.

The Federal Reserve Bank of Boston (Boston Fed) and the Massachusetts Institute of Technology's Digital Currency Initiative (MIT DCI) are collaborating on exploratory research known as Project Hamilton[7], a multiyear research project to explore the CBDC design space. Phase 1, the executive summary notes, found that "***a distributed ledger operating under the jurisdiction of different actors was not needed to achieve our goals.***" In plain English, they said that no blockchain is needed to implement a CBDC. What's more, they said that a distributed ledger did not match the "trust assumptions in Project Hamilton's approach," which assumes that the platform would be administered by a central actor (e.g., a central bank), and they found that even when run under the control of such a single actor, the architecture creates "performance bottlenecks."

The Deputy Governor of the Bank of England, Jon Cunliffe, who is overseeing the bank's work on CBDCs, recently said that any proposed digital pound would likely be managed through some sort of account rather than working like coins or banknotes. His comments seemed to imply that tokens on a blockchain are not all that when it comes to a population-scale cash alternative or some form of electronic legal tender. Given the foregoing, DLT is not considered suitable technology at this time, except in very small jurisdictions, due to the likely low volume of data throughput.

(2) Offline transactions - Technology and security concern

India's small communities continue to experience problems with access to internet and electricity. Problems with banking density can arise in electronic transactions. Through its offline transaction facility, CBDCs can bring a boom to digital payments.

Near-field communication (NFC) technology may be the foundation of the offline wallet, which would generally be a separate wallet. The digital wallet/application can be used on either a feature phone or a smartphone that supports NFC. The Bank of Japan (BoJ) has published a research paper exploring the potential offline use of a digital yen using central bank digital currency (CBDC). Some of the solutions examined in the paper include using a chip (IC) on a SIM card but with a feature phone rather than a smartphone. Visa has also proposed an Offline Payment System (OPS). The protocol outlined by Visa allows CBDCs to be directly downloaded onto a personal device, such as a smartphone or tablet. The money is stored on a secure hardware embedded in that device and managed by a wallet provider. CBDC can be transferred from one device to another directly without any intermediaries, such as banks, payment networks, or payment processors, using Bluetooth and near-field Communication. However, Visa's solution does not account for double spending of tokens.

Any offline solution requires a token-based system, which presents difficulties due to issues with enforcement of anti-money laundering law and the necessity for proper cybersecurity. Furthermore, the level of cryptography necessitated the need for improved mobile wallet accessibility, as well as smartphone adoption, all of which are required for developing comprehensive and secure CBDC wallets.

(3) Interest bearing CBDCs – a threat to commercial banks

The financial system may experience a large amount of disintermediation if a CBDC is designed that moves

from "cash-like" to "deposit-like" features. This is because banks would lose their deposits, which would restrict their capacity to generate credit for the economy. Interest will make CBDC more alluring when combined with other CBDC advantages, which could lead to a major transfer of deposits away from commercial banks. CBDC, being a form of central bank money, can still be an attractive payment option, although it is losing some of its appeal as a store of value (savings instrument) due to the lack of interest. Both China and the Bahamas do not currently pay interest on their CBDC assets. In all cases, it is intended to prevent CBDC from being a direct competitor with bank deposits.

A CBDC that doesn't pay interest may not improve the transmission of monetary policy in India. To get around this issue, a conversion cap can be put in place between cash or deposits to CBDC, or between paying no interest or lower interest rates on CBDC compared to bank deposits.

(4) Anonymity (a challenge in itself) - AML/CFT compliance

CBDC can be considered "a nail in the coffin for privacy." Even though public documents from central bankers talk about privacy as a feature of CBDCs, no explanation exists for how this will work. In contrast, the BIS reported that *"full anonymity is not plausible. […] For a CBDC and its system, payments data will exist, and a key national policy question will be deciding who can access which parts of it and under what circumstances."*

One of the primary benefits of cash is anonymity, but as digital payments proliferate and create digital footprints, the legal or reasonable demand for anonymity is threatened. Although anonymity is considered a potential problem in the digital ecosystem, it will improve CBDC's user base, acceptability, and usage. Additionally, anonymity can be abused and undermine AML/CFT policies. Therefore, anonymity presents a trade-off for policies: the greater the anonymity, the higher the risk for criminal use.

The idea of perfect anonymity in the digital world is a misnomer when you take into account the potential concerns related to privacy and anonymity. The degree to which a central bank should permit anonymous spending in digital money is up for debate. However, the managed anonymity concept, which states that "anonymity for little value and traceable for great value," may be applied, similar to the anonymity connected with actual cash. To promote usability and greater acceptance, it is crucial to take data privacy and personal information protection into account.

(5) Integration with existing Payment Systems and interoperability

In order to achieve adoption, coexistence, innovation, and efficiency for end users, payment system interoperability is necessary. The current payment infrastructure in India, including UPI and digital wallets like Paytm and Gpay, should be usable by an Indian CBDC. APIs should be used to integrate different systems, enabling a simple yet secure interoperable architecture. For increased cyber security, it will be required to guarantee the resilience of APIs as well. However, there would probably be obstacles to interoperability that dealt with technical, business, and legal issues. To overcome issues, dialogue with stakeholders would be essential. All industry participants in the Indian payments ecosystem must actively participate in the collaborative process of achieving interoperability.

(6) Security Considerations - Policy framework

Public block chains maintain transparency, but they do not by themselves offer cyber protection. In the same manner, centralised systems also face the same cyber security issues which the current digital system is facing. Therefore, *before launching CBDCs for the general public, security concerns would also need to be reduced through policy decisions, including setting caps, improved risk management and governance structures, and thorough testing of features through a pilot.*

(7) Technological Consideration – Scalability and recoverability

While crystallising the design choices in the initial stages, the technological considerations may be kept flexible and open-ended in order to incorporate the changing needs based on the evolution of the technological aspects of CBDCs. (It can be centralized or be based on distributed ledger system.) *It is expected that every CBDC project will start with a limited scale pilot and would subsequently be scaled up at population scale*. Despite

being a limited pilot, it will always be essential that the system should be designed so that it can be extended in the future and used in production or large-scale deployments.

In respect of *recoverability*, the issue does not arise as the identity of user shall always be available where the account is held. However, in the case of token-based models, based on whether CBDCs will be recoverable or not, the system can support two types of wallets based on user consent, i.e., (a) custodian model, where there will an intermediary to take care of the account balance and update the same to the central node from time to time, and (b) user held model, where the balances will be taken care by the user only. Hence, it totally depends upon the policy that which model the central government want to opt for the purpose of recoverability of the data.

(8) Benefit of data Analytics amid concerns related to anonymity

After factoring in the concerns related to anonymity, appropriate analytics of Big Data generated from CBDC can assist in evidence-based policy making. It may also become a rich data source for service providers for financial product insights. Further, the data would be highly useful for enforcing money laundering regulations. It may also generate intelligent leads that may assist in curbing non-compliance of existing rules and regulations, thus assisting in risk-based approach to curb money laundering by identifying potential risks and assisting in developing strategies to mitigate them.

(9) Mining of CBDC like cryptocurrencies and sovereign authority

CBDCs would not be "mined" as is understood in the context of private cryptocurrencies, wherein, any individual can compete to mine and create the cryptocurrency. In the case of CBDC, it will only be the sovereign or central bank that will be competent and authorised to issue the CBDC and can simply opt for the conversion of the bank's existing balances to CBDC balances. For the purpose of creating CBDCs, RBI can either do it internally or create a separate technical subsidiary for the same. For distributing CBDCs, external agencies can certainly be engaged.

It is also necessary that while engaging any technology service provider, there should not be a vendor lock in and in case any proprietary systems are being used, there should be enabling clauses to allow complete ownership by the Central Bank.

(10) Energy efficiency and environment friendliness as core of resource intesiveness

As discussed above, Central Banks shall be issuing CBDCs based on algorithm driven processes rather mining through competitive reward methods. These algorithms shall have energy efficiency and environment friendliness as their core principles. Therefore, issuance and management of CBDCs is expected to have much lesser energy consumption vis-à-vis more energy intensive processes normally associated with mining and distribution of private cryptocurrencies. Therefore, technology choice also needs to factor the resource intensiveness of the system.

H. Implementation of CBDC – Developed Countries vs. Emerging Economies

Advanced economies generally have weaker motivations to launch CBDCs as they tend to be mostly concerned with payment safety and opportunities to improve the efficiency of cross-border payments.[8]. Even for central banks actively involved in CBDC-related research, the instrument can be seen as a solution searching for a problem. While in emerging market economies, by contrast, need is greater and thus overall interest in CBDC projects is much higher. The motivations of emerging market economies are also more varied than the developed economies, including goals as different as improving domestic payments efficiency and financial inclusion. This greater interest is more likely to lead to actual CBDC implementation. In fact, according to the BIS, *"[e]very central bank that has progressed to development or a pilot [CBDC] project is an (emerging market economy) institution"*[9]. Overall, unlike developed economies, emerging market economies appear to emphasize the practical implementation of CBDCs aiming to resolve a broader variety of challenges.

I. Case studies: Projects for CBDC in Canada and China

(1) Canada's CBDC Project – Project Jasper [10]

It was the first time in the world that a central bank participated in a distributed ledger technology (DLT) experiment in partnership with the private sector. In its four phases, phases 1 and 2 involved building and testing a proof of concept distributed ledger wholesale interbank payment system. Phase 3 involved implementing a CBDC for delivery-versus-payment settlement of tokenized assets. In phase 4, the Bank of Canada and the Monetary Authority of Singapore joined forces to work on a cross-border cross-currency distributed ledger-based system which combines Project Jasper with Singapore's Project Ubin.

Following these stages of research and testing, the Bank of Canada published its evaluation of the need for it to issue a CBDC entitled "Contingency Planning for a Central Bank Digital Currency." The document made clear that the central bank had "***no plans to launch a CBDC,***" but was building the capacity to issue "a general purpose, cash-like CBDC should the need to implement one arise". *According to the Bank of Canada,* ***advance planning was necessary because capacity building would take several years***. The Bank of Canada has concluded that a CBDC could "become beneficial or even necessary" if (i) the use of banknotes declined beyond a certain threshold level, limiting the ability of Canadians to use cash widely as a payment instrument, or (ii) Canada's monetary sovereignty is threatened by the emergence of one or more alternative digital currencies replacing the Canadian dollar as the main form of money in the country.

(2) The People's republic of China CBDC Project - Digital Currency/Electronic Payment (DCEP)

The e-CNY pilot operated in ten regions across China before it was introduced to Olympic Games venues in Beijing and Zhangjiakou in February 2022. The People's Bank of China ('the PBoC') has not released official numbers on e-CNY adoption and usage since October 2021. However, earlier this year, some Central Bank officials said that there are 261 million wallets, with total transaction values over RMB 87 billion (~$13.75 billion).

e-CNY users can choose between individual or corporate wallets, which offer different transaction limits. Wallets can also be software based — the e-CNY mobile app, which allows users to manage their e-CNY transactions — or hardware based, an electronic card that allows for touch-based transactions. In terms of technology choices, China is using a centralized ledger to record retail transactions and, in parallel, implements a tribute ledger for the reconciliation period at the end of the day. This indicates that China is exploring the use of blockchain technology in its digital currency. The PBoC, like many other Central Banks, would like to remain technology agnostic for now. However, its hybrid technology choice suggests it would be willing to move to a permissioned distributed ledger technology (DLT) in the long run. There is a trade-off between the anonymity requirements of the digital wallets, and balance and transaction limits. Wallets with lower balance and transaction limits can keep their anonymity, but upgrades to transaction limits require higher identification and know your customer (KYC) standards.

China has plans for cross-border wholesale testing underway in addition to its use in the domestic market. It is working with the Bank of International Settlements on its mBridge project, along with Hong Kong, Thailand, and the United Arab Emirates to develop a prototype for an interoperable wholesale CBDC. China is also working on interoperability of the e-CNY with Hong Kong's Faster Payment System, building toward a launch of the e-CNY in Hong Kong. PBoC officials stated that they will follow the "do no harm" principle in cross-border testing and will ensure that all compliance concerns are being met.

(3) Bahamian CBDC Project – Sand Dollar

On 20th October 2020 the Central Bank of the Bahamas took Sand Dollar from pilot to production in a national rollout, which made the central bank digital currency available to the general public. The primary stakeholder groups for the digital currency include the Central Bank, the general public, financial intermediaries licensed by the Central Bank, the public sector (including the National Insurance Board), and general businesses and entities other than licensed financial intermediaries. They each have different respective roles to play in the modernisation process.

The first phase covers the end of 2020 and the first quarter of 2021. It focuses on making the sand dollar available across the private sector, among three tiers of authorized accounts: (i) low-value personal wallets with lower transaction limits, (ii) regular personal accounts, and (iii) business or enterprise accounts. Each tier comes with different know-your-customer requirements. The second phase (first and second quarters of 2021) targets government services and public utilities.

Sand dollar wallets are protected by multi-factor authentication (all mobile devices must support a device passcode or biometrics). All authorized sand dollar wallet providers are expected to offer interoperable sand dollar services. Digital B$ (Sand Dollar) can be accepted by anyone with a Central Bank approved e-Wallet. Some examples include, Government services, merchants and individuals. It has a legal tender. Like fiat (the physical dollar and coins), Sand Dollar is backed by the foreign reserves of the Central Bank of the Bahamas. At the moment the digital B$ (Sand Dollars) can only be used within The Bahamas. However, your payment services providers can enable you to purchase foreign exchange with Sand Dollars to complete electronic payments in foreign currency. This is a feature that providers are authorised to develop.

J. Conclusion and way-forward

The CBDC is a complex piece of software and a complex digital framework capable of generating both economy-wide benefits and shocks. The establishment and operation of a CBDC by any country will require considerable expertise and a deep understanding of the designs and issues this fundamentally new form of currency gives rise to in the local context.

While referring to CBDC, Mr. Agustin Carstens, General Manager, BIS, quoted

> *"The monetary system is the backbone of the financial system. Before we open up the patient for major surgery, we need to understand the full consequences of what we're doing"*

Published research, policy work, and proofs-of-concept from central banks have gone a long way towards establishing the practical benefits and challenges in any issuance. A CBDC must be convertible, convenient, accessible, and low-cost. The underlying system should be resilient, available 24/7, flexible, interoperable, private, and secure for the general public. Today, vast sums flow within and between economies every day using the arrangements already in place. With a mandate for stability, central banks' introduction of CBDC should complement these pre-existing systems. Given the speed of innovation in payments and financial technology, central governments should prioritise this work appropriately and proceed quickly. As a result, the following way forward is suggested:

- **(*i*)** It will be incumbent on the *central banks to continue monitoring CBDC developments around the world while staying abreast of and potentially contributing to research and technical experimentation.* This shall facilitate staying up to date with the latest research, trends, and findings related to CBDC, including those that can affect the economy, and designing policy measures to address the reputational risk associated with widely available retail CBDC.
- **(*ii*)** CBDC, across the world, is in conceptual, development, or pilot stages. Therefore, in the absence of precedent, *extensive stakeholder consultation along with iterative technology design* must take place to develop a solution that meets the requirements.
- **(*iii*)** While the intent of CBDC and the expected benefits are well understood, it is important to *identify innovative methods and compelling use cases* that will make CBDC as attractive as cash if not more.
- **(*iv*)** The Central Governments should not hurry in implementation of the CBDC. It is not the time for countries in the region to issue a CBDC, but *it is the time to begin to develop the expertise and understanding*. Understanding such matters requires focused study, and substantial time for reflection and working through all potential consequences.
- **(*v*)** Arguments for and against issuing a CBDC and the design choices being considered are driven by domestic circumstances and domestic CBDCs would have international implications. *Cooperation and coordination are*

essential to prevent negative international spill overs and simultaneously ensure that much needed improvements to cross-border ayments are not overlooked.

(*vi*) *Central banks should build a prototype and conduct pilot test in different phases* before the implementation of final run of CBDC, i.e.

(*a*) The prototype should be as per the recommendations of the stakeholders and banks should specify technical requirements to technology partners.

(*b*) They should test the idea in an operationally controlled environment to examine its functionality, including the design, deployment plan, and success criteria.

(*c*) Test cases should be performed with both positive and negative scenarios to examine its durability and document the results. Results should be evaluated to finalize the design of the prototype.

(*d*) Banks should conduct large scale pilots with a diverse and larger user base. Participants of the pilots must include users from different income levels, literacy levels, regions, genders, and age groups.

(*e*) The results and learnings of the pilot need to be carefully evaluated and must be incorporated into the final design of the CBDC.

There will be no "one size fits all" CBDC. It may not be easy or straightforward, but bright minds in Central Banks can succeed in implementation and develop a fruitful regime of CBDC. The great inventor Thomas Edison had acknowledged that, *"There is no substitute for hard work."*

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