



# Digital Currencies and The Monetary System: Review and Issues



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## Abstract

This paper is a review article on digitalization, generating issues from the discourse. The place of digital currencies in the contemporary world of banking and commerce was discussed, and so were their attractiveness and variants in the emergent trend. The evolution and the conditions for the effectiveness of digitalization, differentiated policy goals of the various central bank digital currency projects as well as the regulatory and supervisory authorities were articulated and highlighted. Three competing models of central bank digital currency concerning the allocation of the functions of issuance, the validity of transactions, ledger update, user interface, user data and customer service were identified and distinguished by the different involvement of the central bank, commercial banks and the private sector in the functions identified. The choice of optimal technology underpinning the central bank digital currency was justified. The characteristics and functions of the various central bank digital currency designs were identified and discussed. Actual and potential challenges of the various central bank digital currencies gave insights into the present and possibly the future operating procedure of the central bank digital currencies. Perceived potential risks of central bank digital currency on commercial banks, financial stability and monetary policy as well as the likely combating measures would shape the future of the monetary system. However, the drivers of the reserve currency status would most likely remain unchanged. Central bank digital currency could offer the opportunity to address the challenges of cross-border payments.

**Keywords:** Digital Currency; Monetary System; Financial Stability; Fintech; Distributed Ledger Technology; Global Reserve Currency

**Abbreviations:** CBDC: Central Bank Digital Currency; DLT: Distributed Ledger Technology; IMF: International Monetary Fund; KYC: Know Your Customer; AML: Anti-Money Laundering; CFT: Combating The Financing of Terrorism

## Introduction

The contemporary monetary system consists of central bank money such as banknotes (cash), referred to as “fiat currency” issued by a central bank and backed by the credibility of a government, and private money (or private sector-issued money) like bank deposits [1]. Under this system, the central bank is tasked with the responsibility of issuing money with the primary objective of maintaining price stability. However, the Fintech-led evolution in payment systems has seen an unprecedented transformation in the concept of currency [2]. This technological revolution that saw the emergence of digital ledger, blockchain, and other technological developments, as well as the advent of private virtual currencies, “stablecoins”, have forced the central banks to actively pursue the merits of issuing the so-called “central bank digital currency” [3], (CBDC).

Similarly, many global trends and some jurisdiction-specific motivations have influenced the interest of central banks and

accelerated their work on CBDC [4]. These global trends are, first, the rapid increase in interest in Bitcoin and other cryptocurrencies that compete with traditional forms of money; second, the advent of private sector-issued stablecoins, which are distinct from other cryptocurrencies as they are designed to maintain a stable value through their backing of assets with major currencies; third, the entry of big tech into payments, and the several challenges that the huge volume of personal data that is collected and processed as an input into big tech business activity presents for central banks, and fourth, the impact of coronavirus disease (COVID-19).

This article is on the relevance and significance of digital currencies within the context of the monetary system. It is structured as follows. The section after this presents a global picture of the emerging trends followed by the one on challenges in the field. The final section discusses the future of the monetary system as would be shaped by digital currencies.

### Emerging Trends

Bitcoin is a foremost cryptocurrency, launched in 2009, it markedly changed the concept of 'virtual currency' by introducing a cryptographic form of electronic cash employing a blockchain protocol – a peer-to-peer distributed ledger technology (DLT) that securely records transactions across computers [5]. Carstens (op. cit.) referred to Bitcoin as a speculative asset rather than money since it is based on decentralized consensus among network participants to determine what constitutes valid payments and that it poses its unit of account, but fluctuations in value mean it is unrealistic to set prices in bitcoin which reduces its usefulness as a means of exchange and makes it a poor store of value.

The so-called “stablecoins” are another form of emerging “digital currency” discussed in Carsten (op. cit.). They were described as cryptocurrencies that sought to stabilize their value against sovereign fiat currencies offering more credibility than Bitcoin. Nevertheless, Carstens (op. cit.) pointed out that it raises grave “governance concerns if a private entity issues its currency and is responsible for maintaining its asset backing”. Consequently, private stablecoins cannot serve as the basis for a sound monetary system, and to remain credible and part of the existing financial system, they need to be heavily regulated and supervised. Nonetheless, Facebook's proposal of 'Libra' with its massive global reach among users introduced the prospect of creating a widely available alternative monetary instrument to be used across a range of payments platforms, posed a potential threat to the 'sovereignty' aspect of money, which elicited responses and backlashes from regulators worldwide [6]. As a result, Facebook backtracked from its original plan of a multi-currency asset-pegged Libra to issuing a single currency \$-backed coin (Diem).

For there to be digital money, therefore, Carsten (op. cit.) stressed the need for the central bank to play “a pivotal role, guaranteeing the stability of value, ensuring the elasticity of the aggregate supply of such money, and overseeing the overall security of the system. Such a system must not fail and cannot tolerate any serious mistakes”. These developments led to the prospect of central bank digital currency. Central bank digital currency has been defined as “a new form of money, issued digitally by the central bank and intended to serve as legal tender” [7].

BIS surveys revealed that central banks are increasingly considering the digitization of their currencies [8]. Boar and Wehrli [9] observed that in the last four years, the share of central banks actively engaged in different forms of CBDC projects grew by about one-third to 86% of 65 sampled central banks as of late 2020. This had risen to 90% of 81 central banks representing 94% of the global economic output in the latest survey of 2021, including already issued retail CBDCs, the Sand Dollars by Bahamas in 2020 and the e-Naira by Nigeria, as well as released pilot projects by the Eastern Caribbean and China, DCash and e-CNY, respectively [10].

The number of central banks in the advanced stages of CBDC projects increased remarkably in the last year. According to Kosse and Mattei (op. cit.), the share of central banks currently developing a CBDC or running a pilot was 26%, almost double the share of 14% in Boar and Wehrli (op. cit.). In addition, 62% were conducting experiments or proofs-of-concept compared to 60% in the previous year. Both surveys showed that while some of the central banks were primarily engaged in the wholesale side, some were primarily in retail, but the largest number were working on both [11]. However, Kosse and Mattei (op. cit.) found that about one-fifth of central banks are developing or testing a retail CBDC, which is twice the share of central banks building or piloting a wholesale CBDC.

The International Monetary Fund (IMF) [12] evaluated six (6) advanced CBDC projects at various stages through collaboration and exchanges with the respective central banks to obtain insights into their projects. Of the six, which included Bahamas, China, Uruguay, Eastern Caribbean, and Canada, only Bahamas has issued a CBDC. Seven main policy goals of the CBDC projects whose level of importance differs from one jurisdiction to another were identified by IMF (op. cit.) as (i) financial inclusion, by ensuring access to appropriate and affordable services, which is linked to poverty reduction; (ii) access to payments, especially with declining cash usage or in times of crisis or a remote area with low-income earners, low presence of financial institution, and with different forms of impairments; (iii) making payments more efficient, by offering digital forms of payment that have lower operational costs than both physical and existing digital payments; (iv) ensuring the resilience of payments, such as in ensuring urgency in the payment and extension of government transfers to people under severe circumstances where cash is not available. Likewise, it assuages the fear of disruption in digital services in the event of failure of dominant operators by serving as a backup; (v) reducing illicit use of money, by addressing the undesirable features of cash, such as anonymity and lack of an audit trail, which make it attractive for illegal acts that include tax evasion, money laundering, and terrorist financing; (vi) monetary sovereignty, which will be difficult if a sufficiently large portion of the population adopts a foreign digital currency or a global stablecoin, thus, CBDC helps ensure that important central bank functions like monetary policy and lender of last resort are not adversely affected; (vii) competition, as it offers increased competition in a country's payments sector by competing directly with existing forms of payments and indirectly, by providing a platform open to private payment service providers, if designed for such.

The last point in the preceding paragraph had been noted to have made it less difficult for new entrants into the payment sector. In addition, Kosse and Mattei (op. cit.), identified financial stability and the enhancement of cross-border payments as growing reasons for CBDC. They noted that financial stability was of greater importance in an advanced economy, especially

in the last year, probably driven by concerns of regulatory and supervisory authorities of the potential systemic risks of the emergence of stablecoins and other cryptocurrencies, which has also accelerated the interest in CBDC. While the emphasis on enhancing cross-border payment had declined in advanced economies, its importance had risen in emerging markets and developing economies.

In addressing the issue of the roles of a central bank and the private sector CBDC or the operational architecture of the CBDC, three operating models were described in IMF (op. cit.) concerning the allocation of the functions of issuing, validation of transactions, ledger update, KYC-AML/CFT [13], user interface, user data, and customer service. They were a) unilateral (tier-1) CBDC, in which the central bank performs all functions in the payments systems like issuance and distribution of CBDC, ledger update, and interaction with end-users; b) intermediated (tier-2) CBDC, where the intermediaries can be financial institutions, payment service providers and mobile phone operators with the central bank saddled with functions such as issuing the digital currency, and regulation and supervisory functions; c) synthetic CBDC, in which case, digital currency is issued by private firms rather than the central bank, but is backed by holding central bank liabilities. IMF (op. cit.) observed that while the last model is not necessarily a CBDC but a stablecoin, or a special type of e-money, it can be viewed as an alternative to CBDC since it is backed one-to-one by central bank-issued assets.

Kosse and Mattei's (op. cit.) findings indicated that more than 70% of central banks engaged in some form of CBDC work were considering a two-tiered (or intermediated CBDC model), where functions such as onboarding of clients (including the performance of know-your-customer (KYC) processes and anti-money laundering/combating the financing of terrorism (AML/CFT) procedures), as well as the handling of retail payments, were left in the hands of private firms. The findings also showed that recording of retail transactions or ledger updates could also be handled by the private sector according to many central banks, however, a third would prefer it to be left in the hands of central banks. Besides, 76% of the central banks working on a retail CBDC were exploring interoperability with existing payment system(s).

According to Kosse and Mattei (op. cit.), interoperability can encourage the adoption of CBDCs and enable the coexistence of central banks and commercial banks as well as facilitate payments across systems by banks and other payment service providers without participating in multiple systems. As a result, end users can easily move their money in and out of their CBDC accounts.

Another model, the business model of CBDC described in IMF (op. cit.) stems from the desirability of cost-recovery by the central banks, although they are not-for-profit organizations, and the need for the private sector to make a profit, at least in the medium-term, if they are to perform a role in the CBDC ecosystem.

Recent literature points to the importance of optimal technology underpinning the CBDC. IMF (op. cit.) observed that while "the centralized ledger, owned and updated by a single entity, is still the standard approach among central banks", the distributed ledger technology (DLT), a decentralized technology, the best known of which is blockchain, has recently emerged as a promising alternative to centralized ledger technologies. There are three alternatives of DLT explained in IMF (op. cit.): The first involves the central bank owning the infrastructure of the entire ledger and updating it (for example, the Bahamas Sand Dollar). Second, the central bank owns the ledger, but private intermediaries update it. The third requires a private intermediary to own part of the ledger and update that same part of the ledger, conditional on the central bank's approval.

There are also two forms of DLT: the permissionless technology that is used in cryptocurrencies, and the permission form, in which a network of known and vetted validators jointly augments a ledger [14]. Because the "permissionless" based on "proof of work", whereby unknown validators perform the updating of transactions is inefficient, environmentally harmful and can lead to multiple equilibria, some central banks are considering decentralization in the form of "permissioned" DLT, in which a network of preselected entities that do not trust each other's data jointly perform the updating and management of the ledger, by independently verifying each new transaction [15]. Auer et al (op. cit.), however, showed that both permissioned DLT and centralized validation can be optimal under different conditions. The traditional centralized system can fare better only when validators are sufficiently trustworthy.

Several features have been incorporated into the design of CBDC projects by different central banks. These are the characteristics and functions of the CBDC designs. IMF (op. cit.) identified them as follows.

### Restrictions Aimed at Ensuring Financial Stability

A growing literature has pointed out the potential risk that the introduction of CBDC could have on commercial banks and aggregate lending or investment; on financial stability and as a new monetary policy tool (Auer et al, op. cit.). Central banks engaged in CBDC projects have committed to not jeopardizing financial stability and avoiding any sudden shifts to the structure of the financial system, and the effects that include crowding out banks and facilitating bank runs can be mitigated through limits on CBDC (IMF, op. cit.). These limits fall under two main categories: restrictions on the remuneration of CBDC and quantitative restrictions on holdings and transactions of CBDC.

In the case of restrictions on the remuneration of CBDC, the no interest on CBDC will reduce its attractiveness as a savings instrument, but it remains attractive as means of payment. IMF (2022) noted that there is a potential policy trade-off between

limiting competition with bank deposits and ensuring an effective transmission mechanism of monetary policy because a zero percent interest rate on CBDC could reduce the ability to carry out a negative interest rate monetary policy. In addition, the attractiveness of bank deposits versus CBDC would diminish with lower policy rates. A possible solution suggested is a CBDC with an interest rate that is consistently lower than the policy rate. Alternatively, fees can be imposed on transactions above a certain threshold. Quantitative restrictions are aimed at limiting competition with bank deposits but also to foster financial inclusion. There to lower the threshold for new users, small CBDC holdings are allowed without the need for identification or other KYC procedures. However, it becomes impossible to send money to a wallet that has reached its specified limit. To overcome this CBDC holdings, according to IMF (op. cit.), may also be connected to a bank account to which excess holdings of CBDC may automatically be transferred.

### Anonymity

There is a policy trade-off between anonymity/financial inclusion and AML/CFT compliance. IMF's (op. cit.) findings revealed that the approach was to provide a tiered selection of wallets with different levels of thresholds. Hence, wallets with lower thresholds are allowed for greater anonymity. Consequently, CBDC can seamlessly be carried out in rural or disadvantaged areas where virtual identification can be difficult. Therefore, the utilization of tiered CBDC wallets will lead to "policy synergies" between anonymity, risk-reduction (of bank runs), and financial inclusion.

### Off-Line Capacity

Some of the central banks in the IMF (op. cit.) noted the importance of ensuring payments even when not connected to the main communication system. This helps to ensure resilience, especially in times of crisis or in areas of poor connectivity. Although, it was pointed out that achieving that had been difficult.

### Cross-Border Payments Using CBDC

IMF (op. cit.) noted that although CBDC is generally carried out with the domestic economy in mind, discussions on the potential use of CBDC in cross-border payments – including the adverse macroeconomic implications, such as increased currency substitution and vulnerability to financial shocks and ways of mitigating – were ongoing. The six jurisdictions in the IMF study examined the issues of cross-border payment carefully but largely on the side of their domestic considerations.

### Challenges

In the IMF (op. cit.) study, some challenges were raised by the different jurisdictions in the course of the investigation, testing, and launching of CBDC. These were,

**i. Lack of precedents:** The lack of or inadequate experience in the design of the CBDC projects, or the availability of established standards is a challenge.

**ii. Lack of resources:** CBDC projects are resource-intensive and become even more so as their scale increases. Thus, the Peoples Bank of China (PBOC) raises resources as a constraint. In other words, resource constraints constitute a major obstacle.

**iii. Unwillingness to adopt digital payments among the population:** One major challenge is the unwillingness of the populace to adopt the payment system due to trust and privacy issues. Carstens (op. cit.) noted that in Europe and the United States, surveys showed that people are more worried about their privacy.

**iv. Legal issues:** Amendments to existing laws and regulations were one of the major obstacles identified by most central banks in the IMF study. This is considered in detail in Bossu et al (op. cit.).

**v. Cyber security:** One of the main challenges in implementing the CBDC project is ensuring an acceptable level of cyber security.

**Technological uncertainty:** The decision to choose the best technology that is still developing is deemed a challenge. Zamora-Perez, et al. [16], also, argued that central banks might, in some cases, be faced with difficult decisions in terms of balancing the following three aspects: (i) keeping the current order of priority for policy goals, (ii) opting for designs and strategies that could increase the likelihood of adoption, and (iii) using designs that avoid negative economic effects. Finally, an identification issue. Carstens (op. cit.) opined that for validity purposes and safety of the payment system, there should be an identification of the object being traded as with transaction balances or account-based-access or physical cash and the other modern media of exchange (sort of, token-based-access) before it. This is necessary to prevent fraud and support the AML/CFT drive. He wrote, "there are trade-offs between access and traceability".

### Future of The Monetary System

Carsten (op. cit.) pointed out that money is an instance of a public-private partnership, hence, CBDC should take advantage of private sector innovation and fashion out a role for both the private sector and the central bank or other public authorities. This can be either two-tier "Intermediated" CBDC architectures or its "Hybrid" variant. Therefore, if CBDCs are properly designed and widely adopted, CBDCs could serve as a complementary means of payment that addresses distinct use cases and market failures and can spur continued innovation and competition in payments, finance, and, commerce at large.

There are potential risks of CBDC on commercial banks, financial stability, and monetary policy as pointed out under



restrictions aimed at financial stability. These potential risks and the actions being (or that will be) taken to address them will also shape the future of monetary policy. The risk of CBDCs on commercial banks such as heightened volatility of their funding sources, bank runs, and the potential for disintermediation can be addressed with limits on the size of CBDC holdings, or the use of variable interest rates that act as a disincentive for very large holdings by users, and quick intervention to provide liquidity back to commercial banks if depositors temporarily moved funds from bank deposits to CBDCs during a crisis (Carstens, *op. cit.*, IMF, *op. cit.*). As suggested by IMF (*op. cit.*) and noted under restrictions aimed at ensuring financial stability, CBDCs could be interest-bearing with a rate consistently lower than the policy rate, not only for effective monetary policy but also to increase its attractiveness as a store of value.

Similarly, Carstens (*op. cit.*), pointed out that retail CBDCs could be interest-bearing, thereby influencing monetary policy transmission and clearing the path for more negative policy rates in some advanced countries. However, Carstens did not believe these issues will negatively affect the monetary system in the future. In his speech, he remarked that it should be borne "in mind that since CBDC would complement cash rather than replace it, and since another policy objective is to limit the central bank's systemic footprint, these monetary policy effects might be contained in practice". Also, as cash holdings and even total central bank assets are currently moderate to bank deposits, he expected that CBDC holdings will not become very large, implying that the central bank toolkit will remain largely unaffected.

In terms of the international monetary system, CBDC is expected to pose a threat to international currency competition. It is believed that foreign CBDC issuance will make it easier for users to adopt a foreign (digital) alternative (Carstens, *op. cit.*). There is even an argument that China's digital currency could upstage or challenge the US dollar as a global reserve currency [17,18]. However, Carstens (*op. cit.*) believed that CBDC cannot tip the balance in favor of China's currency for the main reason that the attractiveness of a reserve currency is related to the macroeconomy, hence, the dollar is the world's reserve currency because of its stable value (low inflation), a large supply of safe assets and the credibility of the US economic and legal system. In addition, US's deep and efficient capital markets can be accessed by investors without the fear of capital controls. Therefore, global reserve currency status will still be driven by these factors.

On the implications of CBDC on cross-border payment, Auer et al (*op. cit.*) noted that cross-border payments suffer from

four primary challenges: they are generally costly, slow, have low traceability and transparency, and are largely inaccessible to some people. Hence, many central banks see CBDCs as an opportunity to address these persistent challenges. Also, Carsten (*op. cit.*) remarked that beyond currency competition, there are opportunities for CBDCs to enhance the efficiency of cross-border payments.

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