

# Exploration of its Evolution, Implications, and Prospects within the Framework of Central Bank Digital Currency

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## Abstract:

This paper discusses the multifaceted landscape of Central Bank Digital Currency (CBDC), examining its historical evolution, present implications, and prospects. Beginning with elucidating CBDC's definition, the study underscores the importance of exploring its intricate dynamics. The evolutionary trajectory of CBDC is traced from its conceptual inception to critical milestones in its development, juxtaposed against traditional currency systems and cryptocurrencies. Furthermore, the paper analyzes the far-reaching implications of CBDC across economic, social, and international spheres. Economic ramifications encompass its impact on monetary policy and financial stability, while social implications touch upon issues of accessibility, inclusivity, and privacy. CBDC's effects on global financial systems and cross-border transactions are scrutinized internationally. Subsequently, the study navigates the potential benefits and challenges inherent in CBDC adoption, emphasizing efficiency gains in payment systems and reductions in transaction costs, counterbalanced by technological hurdles and regulatory complexities. The prospect and potential scenarios surrounding CBDC adoption are also explored, including adoption trends, central bank roles, and stakeholder collaboration.

**Keywords:** Central bank digital currency; Digital currency; Cryptocurrency; Household; Government.

## 1. Introduction

The emergence of digital currency signifies a significant shift in how societies interact with monetary systems. A growing number of central banks are exploring Central Bank Digital Currencies (CBDCs), with some advancing to proof of concept or pilot phases, while others have already introduced CBDC initiatives. Common motivations include improving financial inclusion and streamlining monetary and fiscal policies. The progress of CBDCs is driven by emerging technological opportunities, potentially positioning them as competitors or alternatives to cryptocurrencies governed by decentralized mechanisms. Bitcoin, created by Nakamoto in 2008, introduced the concept of blockchain-based electronic cash and paved the way for the development of digital currencies. Unlike cryptocurrencies, which operate on decentralized networks, CBDCs are digital currencies regulated by central banks, reflecting centralized authority. As cash usage declines, central banks are motivated to promote electronic currencies that are widely accepted and easily integrated into existing systems.

China's national digital currency, the DCEP, which is intended to replace physical currency. The DCEP is is-

sued by the central bank in cooperation with commercial banks and operates within a framework consisting of three centers: the DCRC, the IAC, and the BDAC. Unlike blockchain-based cryptocurrencies, the DCEP is subject to centralized management. Its launch will have a significant impact on the effectiveness of monetary policy, the operations of banks and payment institutions, the development of the digital economy, the internationalization of the RMB, and even social governance [1].

Meanwhile, The Federal Reserve and its branches have been researching various aspects of implementing a CBDC in the U.S. financial system since 2021. The U.S. urgently needs to accelerate work on digital currencies to stay caught up to other countries globally. Despite the Fed's research efforts, progress on the digital dollar has been slow due to regulatory intricacies, political disagreements, and ideological differences. In contrast, countries such as China have made significant progress in the development of digital currencies, potentially threatening the dollar's global dominance. Businesses are advised to prepare to shift to a digital currency environment by focusing on compliance, operational readiness, cybersecurity, and regulatory compliance [2].

Amid a wave of countries trying to implement central

bank digital currencies, IMF member countries are seeking insights and best practices on central bank digital currencies (CBDCs) from other member countries. Drawing on its globally dispersed membership, the IMF has gathered a variety of inquiries during numerous visits aimed at assisting policymakers considering CBDC issuance and improving central bank capacity in this area. Efforts are underway to develop a CBDC handbook that will address the critical issues in individual countries [3].

CBDCs have been noted to have multiple applications in the financial sector. Central bank digital currencies (CBDC), tokenized deposits, and stablecoins are the main alternatives for financial markets and essential transactions. Certain banks are actively developing tokenized deposit solutions. Wholesale CBDC is a method of tokenizing the cash portion of a transaction that can be used directly in a distributed ledger technology (DLT) network. Although, this approach may pose challenges to the implementation of monetary policy or a bank's liquidity management strategy [4].

Several scholars have modeled the impact of central bank digital currencies on the financial sector. Some of the factors that hinder the adoption of central bank digital currencies are presented, and potential solutions are suggested. They analyzed media perceptions of central bank digital currencies (CBDCs) as a whole and locally issued digital currencies. Their study showed a strong correlation between overall negative media sentiment towards CBDCs and negative sentiment towards locally issued CBDCs [5]. In order to investigate the impact of CBDC in the economic, social, and international spheres, a base model was developed using CBDC as the sole medium of exchange, focusing on its impact on bank deposit and loan rates, business investment, and the overall macroeconomic landscape. Subsequently, the model is extended to cash in entrepreneurs' portfolios to explore the practical implications of the co-existence of legal tender CBDCs and physical cash during the initial (or long-term) period of CBDC issuance [6]. In addition, a game model is introduced that describes the interaction between a typical household and the central bank within the framework of government interests. Through an analytical approach, they identify solutions for household consumption, CBDC holdings, and central bank interest rates, providing insights into various dependent variables. Their findings reveal the dynamics of the interaction between households and the central bank in the context of digital currency adoption [7]. However, the introduction of central bank digital currency (CBDC) needs to be done with caution, and its design limitations and its ability to conflict with multiple objectives are further mentioned. The report suggests avenues for further research, such as identifying the

optimal CBDC design that harmonizes different objectives and conducting empirical studies on its impact on the cost of credit and financial stability. The critical importance of prioritizing security and privacy measures when implementing CBDCs is also emphasized [8].

The trajectory of retail and peer-to-peer payments is unmistakably pointing towards digitization. Four guiding principles are proposed to drive the development of central bank digital currencies (CBDCs): provide a transparent value proposition for users; promote more favorable risk-balanced design decisions; recognize capacity and institutional constraints to the introduction of CBDCs; and minimize barriers to CBDCs in international wholesale payments [9]. The rise of digital currencies requires adjustments to payment regulations and the legal frameworks that govern their issuance, transfer, and storage. To mitigate risks, the legal framework should gain public acceptance, recognize the issuance rights of CBDCs, and clarify their legal tender status [10].

## 2. Evolution

### 2.1 Transformation of Money Form

Since the financial crisis of 2008, cryptocurrencies, represented by Bitcoin, have boomed and attracted the attention of central banks and financial regulators. As fintech and digital currencies continue to evolve, countries have begun to prepare for the establishment of their own digitized fiat currencies, called "central bank digital currencies (CBDCs)." As per the Bank for International Settlements (BIS), over 80% of countries are considering the implementation of CBDC [11], highlighting the widespread recognition of CBDC as an unavoidable trend in the evolution of monetary systems within the digital economy era.

The Central Bank digital currency (CBDC) has had a transformative impact on the financial community, revolutionizing the concept of currency and changing the way it is transacted.

Fiat money, typically represented by paper bills and coins, contrasts significantly with central bank digital money (CBDC) in terms of form, function, and underlying infrastructure. Fiat money relies on physical circulation, requiring manufacturing, distribution, and secure storage, all of which contribute to higher costs and logistical challenges. CBDC, on the other hand, is entirely digital, eliminating the need for physical handling and allowing transactions to occur instantaneously across digital networks. This shift from tangible to digital currency transforms the speed and efficiency of transactions, as CBDC can facilitate near-instant transfers without the constraints of physical movement [1]. This advancement significantly

boosts the speed and efficiency of transactions, offering a myriad of benefits not only to individuals and businesses but also to entire economies.

## 2.2 Innovation in Finance

The quick and cost-effective nature of digital transactions reduces businesses overhead and speeds up consumer payments, leading to broader economic activity and growth.

Additionally, CBDC's ability to facilitate instant transactions contributes to greater financial inclusion. Providing access to digital banking services helps connect marginalized populations who might not have had access to traditional banking infrastructure and can use a smartphone or other digital device to access CBDC-based financial services to the broader financial system. This inclusion not only empowers individuals with more economic opportunities but also fosters a more robust and inclusive economy.

This digital approach not only mitigated health risks but also ensured that financial transactions could continue, supporting economic stability and aiding in broader public health efforts.

Furthermore, the adoption of CBDC aligns with broader trends in financial technology, contributing to a more modernized and resilient financial system. By embracing digital currencies, countries can reduce the risks associated with cash handling, streamline payment processes, and foster remarkable economic growth through increased efficiency and reduced costs. This evolution in currency trading and financial services demonstrates the significant role that CBDC plays in shaping the future of the financial community and driving economic development.

## 3. Challenges and Risks

### 3.1 Impacting Commercial Banks

Legalizing central bank digital currencies may impact the existing system of commercial bank operations. In the current general environment, the significant advantages of digital currencies must be leveraged with state credit for further development [12]. Similarly, citizens use cryptocurrencies only as speculative assets, not out of distrust of fiat currencies [13]. In countries with a robust central bank or monetary authority, CBDCs are more likely to be embraced. Nevertheless, in nations where trust in the central bank is lacking, the introduction of CBDCs may face significant challenges, prompting citizens to opt for alternative cryptocurrencies. Consequently, there might be an inverse relationship between the level of household trust in central bank digital currencies and the adoption rates of other cryptocurrencies. According to Finder's Cryptocurrency Adoption Index, the global average adoption rate is

14%. India tops the list with 29%, Germany with 6%, and the U.K. and Japan with 7% [14].

The relationship between commercial banks and central banks will be transformed due to the issuance of central bank digital currency. Prior to this, the relationship between the central bank and commercial banks was one of regulation and supervision. However, after the issuance of legalized central bank digital currency, there is an additional layer of competition between central banks and commercial banks. Risk-free CBDC provides investors with a safer way to make deposits, which may cause bank runs [1]. For instance, during times of economic instability, people are more likely to move their deposits from commercial banks to legally tender digital RMB accounts because the CBDCs stored on the central bank's private cloud servers offer greater security [12].

The launch of CBDC accounts will diminish the amount of private credit available to commercial banks by reducing their supply of deposits, leading to higher nominal interest rates and lower reserve ratios for these banks [8]. As the central bank nationalizes deposits by absorbing substantial amounts from commercial banks, this will negatively affect their ability to grant credit and create credit money. Consequently, this reduces the banks' ability to support the real economy through lending. This shift could undermine financial stability by heightening the risk of bank panics, where commercial banks do not have sufficient cash reserves to meet depositor demands.

### 3.2 Regulatory Issues

The legalization of central bank digital currencies presents difficulties for both financial stability and national security. The distributed ledger technology used in these digital currencies decentralizes transaction data processing, making regulation more complex. Furthermore, as a tool that offers both cash liquidity and anonymity without the physical limitations of cash, CBDCs could heighten the risk of criminal activities [10]. Without significant technological advances in regulation, new financial instruments arising from central bank digital currencies, like digital wallets and supply chain finance, could quickly become avenues for speculation or arbitrage. This would pose significant challenges to the current financial stability and regulatory frameworks.

Additionally, delays in regulation can lead to national security issues as the introduction of legal digital currencies expands the possibilities for cross-border capital movements, posing threats to monetary and financial security. With the legalization of digital currencies, a country's currency might be transferred internationally through the purchase of legal digital currencies, escaping regulatory oversight. This could prompt irrational, large-scale

cross-border capital flows, such as through transactions in legal tender, potentially destabilizing financial stability [12].

### 3.3 Conflict Between Privacy and Untraceability

On the other hand, central banks face the dual challenge of ensuring the security of CBDCs while also protecting their privacy, meaning making them untraceable. Some consumers hesitate to embrace digital payment methods, including CBDCs, due to concerns over privacy loss [15]. According to a consultation by the European Central Bank published in 2021, 43% of respondents identified privacy as a critical concern, while 18% emphasized the importance of security [16].

### 3.4 Public Issues

The lack of digital skills among citizens is also a significant barrier to the adoption of CBDCs [5]. Digital financial services, such as mobile money, offer secure and cost-effective ways to store and transfer funds across distances. However, these services can be challenging for those with limited education, the economically disadvantaged, and older individuals. For instance, in the Bahamas, only 7.9% of the population uses the CBDC, with just \$338,908 in sand dollars circulating [17]. Similarly, the World Bank Group's Global Findex Indicators data for 2021 reveals that only 13% of Jamaicans have a mobile money account, with 7% using it at least twice a month, and only 10% can use such services without assistance [18].

In areas where electronic online payments are already prevalent, central bank digital currencies (CBDCs) see limited use because people need to perceive a difference between them and existing mobile payment options. From traditional methods like cash, debit, and credit cards through platforms like PayPal to more contemporary services like Apple Pay and Alipay, these payment methods can act as competitors to or hinder the adoption of CBDCs [5]. For instance, in China, a country with a robust digital payment ecosystem, over 96% of small retail transactions are conducted via Alipay or WeChat Pay [19]. Despite the successful pilot of its CBDC, efforts to promote the digital currency through methods like lotteries have met with limited interest from some participants, who feel that the digital RMB does not offer any benefits over other online payment applications like Alipay and WeChat Pay [20].

## 4. Solutions and Prospects

In addressing the multifaceted challenges and risks associated with the implementation of Central Bank Digital Currencies (CBDCs), it is imperative to formulate com-

prehensive solutions that ensure seamless integration with existing financial systems, enhance regulatory frameworks, and promote inclusivity.

First and foremost, it is crucial to maintain the traditional role of commercial banks within the CBDC framework. Allowing these banks to serve as intermediaries for CBDC transactions not only retains their vital function in the financial system but also ensures a seamless transition to and broad acceptance of digital currencies [5]. In China, the adoption of a dual circulation model that incorporates both CBDC and traditional banking strikes a balance, leveraging the benefits of digital currencies while minimizing disruptions. This approach demonstrates that if the CBDC system is implemented as a hybrid or synthetic model rather than a direct one, commercial banks will be less impacted, thus preserving the stability of the financial system [5].

Moreover, enhancing the sophistication of financial regulatory and supervisory frameworks is essential. The use of advanced analytics and artificial intelligence can significantly enhance the capacity to monitor CBDC transactions effectively, addressing challenges such as speculative trading and potentially illegal financial activities [1]. It is also vital to establish a comprehensive legal framework that clearly outlines the usage, limitations, and auditing standards for CBDCs, which is crucial for preventing financial destabilization and ensuring robust regulatory oversight.

Beyond regulation, upholding stringent privacy and security standards is crucial. Privacy-focused CBDCs need to comply with legal standards and adhere to anti-money laundering (AML) and counter-terrorist financing (CFT) regulations while also supporting the notion that CBDCs can only mirror the transactional privacy of cash when implemented on token-based systems [21]. Maintaining a balance between transparency and user confidentiality is essential to enhance trust and facilitate broader acceptance. Additionally, central banks must ensure that the Distributed Ledger Technology (DLT) systems they utilize for deploying CBDCs include robust security measures; specialized, single-purpose devices that store value locally should be available, as they are resistant to network attacks or natural disruptions and are essential for guarding against emerging cyber threats and preserving the integrity of digital currency systems [8].

Enhancing financial inclusion and education is a crucial aspect of the CBDC strategy. Developing accessible CBDC platforms and educational programs can significantly boost digital literacy, thus extending the reach of digital financial services to underbanked and unbanked communities. For instance, the Bahamas has initiated a Sand Dollar CBDC training program aimed at "accelerating education around digital financial services." Conduct-

ing pilot programs across various demographic groups can yield important insights into the obstacles hindering CBDC adoption and help shape strategies to enhance both accessibility and practicality [17].

## 5. Conclusion

This paper explores the transformative potential and significant challenges associated with the adoption of Central Bank Digital Currencies (CBDCs). It highlights the efficiencies and enhanced security that CBDCs could bring to monetary systems, such as the reduction of transaction costs and the facilitation of more transparent financial processes. However, the study also addresses the considerable disruptions that CBDC implementation may pose to existing financial ecosystems, potentially undermining the traditional roles of commercial banks and altering the dynamics between monetary and fiscal policies. Furthermore, it discusses the critical need for robust technological infrastructure and strict security measures to mitigate associated risks, including cyber threats and privacy concerns. The paper also examines the broader international implications of CBDCs, emphasizing the need for global regulatory harmonization to manage the effects on international financial stability and cross-border transactions. Ultimately, while CBDCs offer promising benefits for economic growth and financial inclusion, their successful integration into global financial systems will require careful and coordinated policy efforts.

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