



CENTRAL BANK DIGITAL CURRENCIES AND THE RESTRUCTURING OF FINANCIAL SYSTEMS: AN ANALYTICAL STUDY OF INTERNATIONAL EXPERIENCES

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Abstract:

This study analyses international experiences in the issuance of central bank digital currencies (CBDCs) and examines their implications for financial systems and financial inclusion. By comparing advanced economies, developing countries, and regional cross-border initiatives, the research identifies key determinants of successful CBDC implementation, including digital infrastructure readiness, regulatory coordination, institutional trust, and user adoption incentives. The findings indicate that while CBDCs hold significant potential to enhance payment efficiency, financial inclusion, and monetary sovereignty, their effectiveness depends on systemic integration and governance frameworks rather than technological deployment alone.

keywords: Central Bank Digital Currency; Financial Inclusion; Digital Payments; Monetary Sovereignty; Financial Stability

Introduction:

In the contemporary digital era, central bank digital currencies (CBDCs) have emerged as one of the most significant innovations reshaping global financial systems. Defined as digital representations of sovereign currency issued and regulated by central banks, CBDCs aim to modernise payment infrastructures, enhance transaction efficiency, reduce cross-border transfer costs, and potentially expand financial inclusion. Their rapid diffusion across both advanced and developing economies reflects a broader transformation in monetary architecture driven by technological advancement and the digitalisation of economic activity.

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Despite their promising potential, CBDCs raise complex economic, regulatory, and institutional questions. While proponents emphasise their capacity to strengthen payment systems and improve access to financial services, critics highlight concerns related to financial stability, cybersecurity risks, legal frameworks, and the possible disintermediation of commercial banks. Consequently, CBDCs are not merely technical instruments but structural reforms with implications for monetary sovereignty, banking sector dynamics, and macro-financial governance.

This study addresses the following central research question:

To what extent do central bank digital currencies reshape financial systems, and what role can they play in promoting financial inclusion while preserving financial stability?

To examine this question, the study advances three core hypotheses. First, CBDCs are expected to improve the efficiency of financial systems and reduce transaction costs, particularly in cross-border payments. Second, CBDCs may contribute to financial inclusion by expanding access to digital financial services for unbanked and underbanked populations. Third, the implementation of CBDCs faces significant challenges-especially in relation to cybersecurity, regulatory harmonisation, and integration with existing financial infrastructures-which may constrain their stabilising effects.

The growing academic literature reflects these multidimensional dynamics. Auer and Böhme (2020) analysed the technological foundations of CBDCs, particularly distributed ledger technology (DLT), and its implications for monetary systems. The Sveriges Riksbank (2021) examined the Swedish e-krona as a complement to declining cash usage, highlighting regulatory and technical uncertainties. Duggal (2021) explored China's digital yuan and the competitive tension between state-issued digital currency and dominant private payment platforms. Meanwhile, IMF reports (2023) have assessed the experiences of the Bahamas and Nigeria, underlining the practical difficulties of achieving widespread adoption and meaningful financial inclusion in developing contexts.

However, despite the expanding body of research, a critical gap persists. Much of the existing literature remains fragmented, focusing either on technological design, regulatory frameworks, or single-

country case studies. There is limited integrative analysis examining how CBDCs structurally transform financial systems across different economic environments, particularly in terms of their differentiated effects on financial stability and inclusion in both advanced and developing economies. Furthermore, regional and cross-border dimensions remain underexplored.

By analysing international experiences comparatively, this study seeks to contribute to a more comprehensive understanding of CBDCs as instruments capable of reconfiguring financial intermediation, payment infrastructures, and monetary governance. In doing so, it situates CBDCs within the broader debate on digital transformation, financial inclusion, and systemic stability in an increasingly interconnected global economy.

1-The Conceptual Framework of Central Bank Digital Currencies (CBDCs)

Central Bank Digital Currencies (CBDCs) represent one of the most significant developments in the global financial system in recent decades. Issued by central banks, these currencies constitute a novel form of digital money aimed at enhancing the efficiency of financial systems and reducing transaction-related costs.

1.1-The Emergence and Evolution of Central Bank Digital Currencies

1.1.1- The Conceptual Phase

Although the concept of CBDCs has become central to contemporary financial debates, its origins predate the widespread proliferation of cryptocurrencies. In the early 1990s, growing interest emerged globally in digital money, envisaged as an electronic form of currency based on digital payment technologies.

The Bank of Finland was among the first institutions to experiment with digital money through the issuance of the Avant smart card in 1993. Although the initiative was relatively short-lived, it represented a pioneering step towards what is now recognised as central bank digital currency (Auer, 2022). The Avant card aimed to provide an electronic payment instrument that mimicked traditional cash in digital form.

The launch of Bitcoin in 2009 significantly intensified interest in digital currencies. The rise of cryptocurrencies reopened debates



concerning the potential need for central banks to issue their own digital currencies in order to preserve monetary sovereignty and ensure financial stability.

By 2018, reports from the Bank for International Settlements (BIS) indicated that over 70% of central banks had begun exploring the feasibility of issuing CBDCs (BIS, 2022). Developments in the cryptocurrency ecosystem accelerated this trend, highlighting the necessity for regulatory responses to emerging digital monetary instruments.

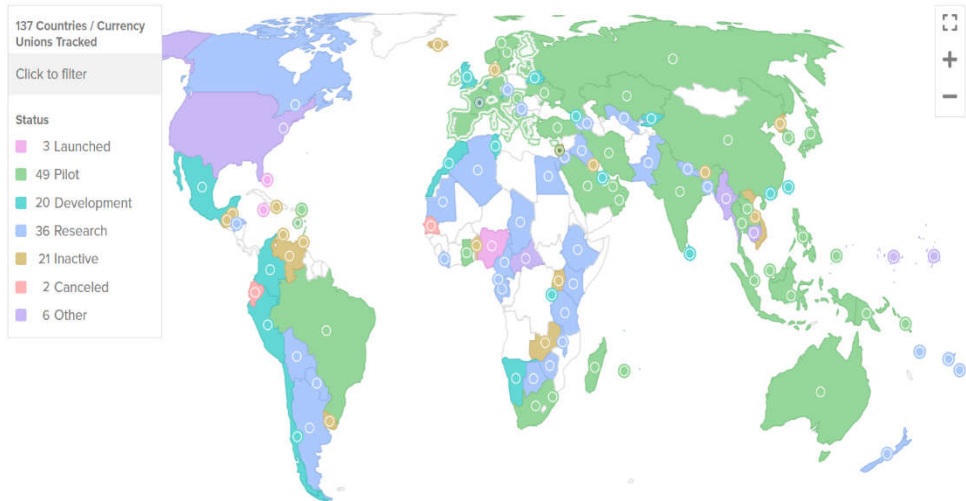
1.1.2- From Experimentation to Implementation: Global Developments

As the concept moved from theoretical exploration to practical implementation, numerous central banks initiated pilot projects. The People's Bank of China (PBoC) stands as one of the most prominent examples, having developed the digital yuan (e-CNY) in 2020 following a series of successful domestic trials (PBoC, 2021). The initiative sought to provide a fully central bank-backed digital currency enabling citizens to conduct everyday transactions without reliance on physical cash.

Beyond China, both Bahrain and The Bahamas have issued CBDCs. The Bahamas launched its "Sand Dollar" in 2020 as part of a broader initiative to promote financial inclusion and expand access to financial services for underserved populations (IMF, 2022). These experiences illustrate the gradual transition towards leveraging advanced technologies to deliver more efficient financial solutions.

Similarly, Norges Bank has evaluated the potential of a CBDC to enhance domestic payment systems and reinforce trust in the financial system (Auer, 2022). Such pilot initiatives are essential for understanding the systemic implications of digital currencies and provide valuable empirical evidence for further policy evaluation.

Figure N°01: Status of global central bank digital currency projects.



Source: Atlantic Council (2025). Central Bank Digital Currency Tracker.

1.1.3- Blockchain and Distributed Ledger Technology (DLT)

A key driver of CBDC development has been the adoption of blockchain and Distributed Ledger Technology (DLT). These technologies offer alternatives to conventional payment infrastructures by enhancing security, transparency, and transaction speed.

For instance, the People's Bank of China has incorporated DLT elements in developing the e-CNY, with the objective of improving cross-border payment efficiency while maintaining high security standards (PBoC, 2021). Likewise, Project Dunbar, launched by the BIS, demonstrates the application of DLT in developing a shared wholesale cross-border payment platform (BIS, 2022).

While blockchain integration strengthens the operational capacity of central banks, implementation poses challenges, including the need for advanced technical infrastructure, privacy protection mechanisms, and interoperability across systems.

1.2- Definition of Central Bank Digital Currency

According to the Bank for International Settlements, a CBDC is a new form of digital money issued by a central bank, distinct from



reserves or settlement balances held by commercial banks. Stanley defines it as a digital version of central bank-issued money regulated by the issuing authority. It is sometimes referred to as sovereign digital currency.

CBDCs may be classified according to:

- Issuer (central bank or otherwise)
- Form (digital or physical)
- Accessibility (general public or restricted)
- Technology (token-based or account-based)

Token-based systems resemble digital cash, whereas account-based systems rely on account balances-similar to the structure of commercial bank deposits.

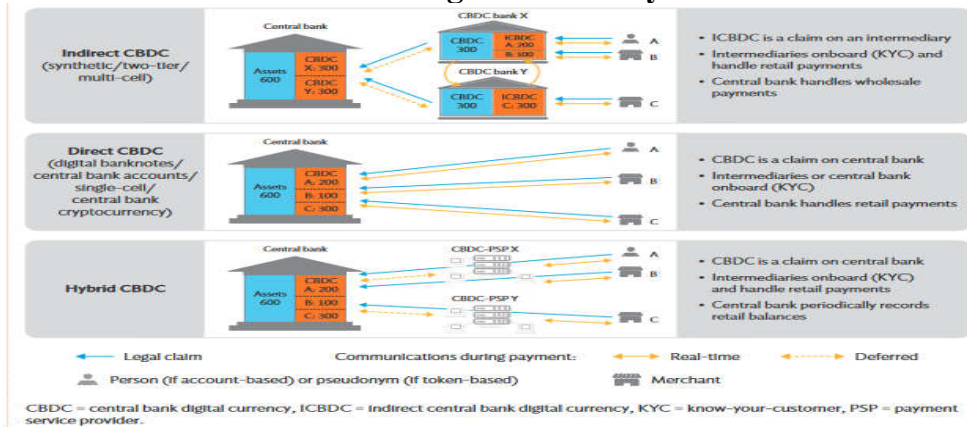
Types of CBDCs

CBDCs are generally categorised into:

- a) **Wholesale CBDC** – restricted to commercial banks and financial institutions for interbank settlements.
- b) **Retail CBDC** – accessible to the general public. Retail CBDCs may take three principal forms:
 - **Direct CBDC**: Issued and managed directly by the central bank. The central bank assumes responsibility for compliance functions, including Know Your Customer (KYC) and Anti-Money Laundering (AML) requirements.
 - **Hybrid CBDC**: Issued by the central bank but distributed through commercial banks and financial intermediaries.
 - **Synthetic (Indirect) CBDC**: Commercial banks issue digital currency backed by central bank reserves, under central bank supervision (Park, 2022).

Technological choices vary, with some projects relying exclusively on DLT, others employing conventional technologies, and several adopting hybrid approaches. Many projects have yet to determine their final technological architecture.

FigureN° 03: Overview of the Potential Architecture of a Central Bank Digital Currency



Source :Albert Park. (2022). The Role of Central Bank Digital Currencies in financial Inclusion. China: Asian Development Bank., p 25.

1.3- Advantages of Central Bank Digital Currencies

- Enhancing Financial Inclusion: One of the principal advantages of CBDCs is the promotion of financial inclusion. CBDCs may extend financial services to unbanked populations, particularly in rural regions and developing economies (Tan, 2023).

The IMF (2023) reports that central banks in developing economies view CBDCs as effective tools for expanding financial access. By enabling digital payments without requiring traditional bank accounts, CBDCs may reduce financial exclusion and enhance economic participation.

-Reducing Transaction Costs: CBDCs offer potential reductions in transaction costs, particularly for cross-border transfers. According to the World Bank (2023), digital currencies may significantly lower remittance fees and eliminate reliance on costly intermediaries (Banet & Lebeau, 2022).

Furthermore, CBDCs may accelerate transaction processing and improve capital flow efficiency across jurisdictions (Dionysopoulos, 2024).

-Strengthening Financial Stability: CBDCs may enhance macroeconomic stability by providing central banks with improved liquidity management tools (Nakamura, 2024).



During periods of financial stress, CBDCs may enable more precise liquidity injections and better monitoring of monetary flows (Porcellacchia, 2023). Consequently, they may serve as an additional instrument for safeguarding systemic stability.

1.4- Challenges Associated with CBDC Issuance

Despite their potential, CBDCs present substantial challenges relating to cybersecurity, legal frameworks, and their impact on commercial banking systems.

-Cybersecurity Risks: CBDC systems represent high-value targets for cyberattacks and may constitute potential single points of failure (Auer, 2023). The BIS (2024) warns that CBDC infrastructures may amplify existing cyber risks and introduce new vulnerabilities, including key theft, malware attacks, data manipulation, and quantum computing threats. Operational failures or system outages could undermine public trust in the monetary system (Ferri, 2022; Federal Reserve, 2022).

-Regulatory Challenges: The issuance of CBDCs requires robust legal and regulatory frameworks. Currently, no universally accepted international standards govern CBDC implementation (Park, 2022). Key issues include AML compliance, data protection, cross-border interoperability, and consumer protection (Auer et al., 2024; IMF, 2024).

Concerns regarding privacy and potential financial surveillance have also been raised, emphasising the importance of embedding privacy safeguards within CBDC design (Whited, 2023).

-Impact on Commercial Banks: A major concern is financial disintermediation. Retail CBDCs may prompt deposit migration from commercial banks to central banks, potentially reducing bank lending capacity (Tian & Zhao, 2023). The Federal Reserve (2022) notes that CBDC introduction could alter funding structures and reshape the banking ecosystem.

In times of crisis, rapid deposit shifts towards CBDCs could intensify pressure on traditional banks (Bundesbank, 2023). Consequently, CBDCs may fundamentally transform commercial banks' business models and financial intermediation roles (Ferri, 2022).

2-International Experiences in CBDC Issuance and Their Impact on Financial Systems

This section examines previous studies analysing the experiences of countries that have issued central bank digital currencies (CBDCs) and their impact on financial systems and financial inclusion. The discussion is structured into three parts: first, experiences of advanced economies; second, experiences of developing economies; and third, cross-border regional initiatives.

2.1- Experiences of Advanced Economie

3.1.1- The Chinese Experience: The Digital Yuan (e-CNY)

The People's Bank of China (PBoC) launched the digital currency project known as the e-CNY, or digital yuan, as one of the earliest large-scale initiatives undertaken by a major economy within the broader digital transformation of its financial system. The project represents a significant step towards modernising China's monetary and payment infrastructure and pursues several strategic objectives:

- **Modernisation of payment infrastructure:** The digital yuan seeks to upgrade the traditional financial system and facilitate electronic payments within the digital economy. Updating payment infrastructure has become essential to keep pace with technological advancement, thereby enabling faster and more secure transactions (Zohar & Auer, 2020).
- **Promotion of financial inclusion:** One of the principal objectives of the e-CNY is to ensure that digital cash remains accessible to all segments of society as either an alternative or complement to physical cash. This initiative aims to enhance financial inclusion by enabling unbanked individuals to access digital payment services (Auer, 2021).
- **Strengthening monetary innovation and international positioning:** The project also aims to expand the domestic and international use of the digital yuan, potentially reducing the dominance of the US dollar in the global financial system and enhancing China's influence in international payment networks (Auer & Böhme, 2020).



A-Challenges in the Adoption of the Digital Yuan

Despite its ambitious objectives, pilot programmes conducted across various Chinese cities revealed that adoption progressed more slowly than anticipated. Although extensive field trials were undertaken, widespread public uptake did not materialise. A key explanation lies in the already dominant presence of private digital payment platforms such as Alipay and WeChat Pay, which effectively satisfy consumer needs (Zohar & Auer, 2020).

The digital yuan was designed primarily as a substitute for cash rather than as a comprehensive replacement for existing digital payment platforms. Consequently, consumers have demonstrated limited incentives to switch systems where established alternatives already offer convenience and reliability.

B-Digital Transformation and Financial Inclusion

In relation to digital transformation and financial inclusion, the e-CNY has achieved considerable progress in infrastructure development and technological innovation. However, its broader impact on financial inclusion has been more limited than initially expected. Although official policy documents emphasised the goal of ensuring equal access to digital payment services (People's Bank of China, 2020), practical barriers to adoption have persisted. The principal challenge has not been technological feasibility but rather user motivation in an environment already characterised by efficient private-sector solutions.

C-Transformative Impact on the Financial System

The Chinese case demonstrates that the state can play a transformative role in shaping digital payment systems. However, it also suggests that the mere introduction of a CBDC is insufficient to guarantee systemic change. China's private banking and payment ecosystem remains sufficiently robust to limit the relative advantage of a CBDC in domestic retail use. The central challenge lies in articulating a clear value proposition for users (Zohar & Auer, 2020).

D-The International Dimension of the Digital Yuan

Strategically, the international dimension of the e-CNY may prove more consequential than its domestic role. The digital yuan aims to facilitate cross-border settlements and enhance the international use of the renminbi. Some analysts argue that China

aspires to position the digital yuan as a key instrument in global payments, thereby potentially reducing reliance on the US dollar in international trade (Auer & Böhme, 2020).

2.1.2 The Swedish Experience: The e-Krona

In 2017, Sveriges Riksbank initiated the development of the e-Krona in response to the sharp decline in cash usage in Sweden. As Sweden has become one of the most cash-light societies globally, the central bank explored the issuance of an official digital complement to cash to meet the needs of an increasingly digital economy. The objective was not to replace physical cash but to complement it, foster competition in the payments market, and stimulate innovation (Sveriges Riksbank, 2020).

The Riksbank launched a pilot project in collaboration with Accenture to test a DLT-based technical infrastructure within a controlled environment. The pilot examined technical stability, operational performance, and resilience under offline conditions. Results indicated that the system could function effectively even without continuous internet connectivity (CoinMarketCap, 2021).

A-Success and Links to Digital Transformation

From a digital transformation perspective, Sweden represents one of the most advanced electronic payment ecosystems worldwide. The e-Krona project reflects the government's commitment to maintaining a sustainable and secure digital payment framework aligned with global financial trends (Sveriges Riksbank, 2020).

B-Financial Inclusion Considerations

Although Sweden does not face severe financial exclusion challenges compared with developing economies, the e-Krona aims to ensure universal access to state-backed digital money, including for individuals with limited access to traditional banking services. The project is intended to complement rather than replace private-sector financial services (Riksbank, 2020).

C-Political and Regulatory Challenges

Despite technical progress, the political decision regarding full issuance remains pending. The Riksbank has noted that the societal need for a digital currency has not yet been definitively established. Legislative and policy considerations require further evaluation to



determine the long-term economic and social feasibility of the e-Krona (Riksbank, 2021).

2.2- The Role of Developing Economies

This section examines pioneering experiences in developing economies that have launched CBDCs to enhance financial inclusion and payment efficiency, notably The Bahamas (Sand Dollar) and Nigeria (e-Naira).

2.2.1-The Bahamas: Sand Dollar

The Bahamas became one of the first countries globally to launch a CBDC, introducing the Sand Dollar in October 2020. The initiative aimed to expand financial access to remote island communities lacking adequate banking infrastructure and to modernise the national payment system (IMF, 2024).

Despite early adoption, uptake remained limited through 2023. Although digital wallets were introduced, operational costs were relatively high compared with transaction volumes. While the Sand Dollar incorporated features such as partial offline functionality and digital identity integration, adoption challenges persisted (CBDC Tracker, 2023).

From a financial inclusion perspective, the initiative improved access in underserved regions; however, widespread public adoption has yet to materialise.

2.2.2-Nigeria: The e-Naira

Nigeria launched the e-Naira in September 2021 under the supervision of the Central Bank of Nigeria. The initiative aimed to accelerate digital payments, enhance financial services, and promote financial inclusion in a country with a substantial unbanked population (Onigiri, 2024).

Although the e-Naira expanded access to digital payments, adoption rates fell short of expectations. Challenges included limited digital infrastructure, low technological literacy, and insufficient public trust (eLibrary, 2024).

2.3- Project Aber: Saudi Arabia and the United Arab Emirates

Project Aber represents a joint initiative between the Saudi Central Bank (SAMA) and the Central Bank of the UAE (CBUAE) to explore the issuance of a wholesale CBDC (wCBDC) for cross-border interbank settlements. The primary objective is to reduce settlement

time and transaction costs while testing DLT-based solutions in a regional context (SAMA, 2024).

Technical trials demonstrated the feasibility of using DLT to facilitate cross-border interbank settlements. Nevertheless, regulatory harmonisation, governance arrangements, and system integration remain key challenges (CBUAE, 2024).

Although primarily focused on wholesale payments, the project contributes to regional financial integration and digital transformation. Its direct impact on retail financial inclusion, however, remains limited, given its institutional focus.

3- Discussion

This study examined international experiences in the issuance of central bank digital currencies (CBDCs) and analysed their implications for financial systems, monetary sovereignty, and financial inclusion. The comparative evidence from advanced economies (China and Sweden), developing economies (The Bahamas and Nigeria), and regional wholesale initiatives (Project Aber) suggests that CBDCs represent institutional monetary innovations rather than purely technological upgrades. Their effectiveness depends on ecosystem readiness, regulatory coherence, and behavioural adoption.

3.1- Technological Readiness versus Adoption Dynamics

A consistent finding across advanced economies is the divergence between technological capability and effective user adoption. In the Chinese case, the rollout of the e-CNY occurred within a highly developed digital payment ecosystem. However, adoption has progressed more gradually than anticipated, largely due to strong network externalities created by dominant private platforms. This aligns with Auer, Cornelli, and Frost (2020), who argue that retail CBDCs must offer clear functional advantages over existing payment systems to gain traction.

Similarly, Kosse and Mattei (2023) demonstrate that payment behaviour is shaped by convenience, habit persistence, and network effects. In such environments, switching costs can limit CBDC uptake even when technological infrastructure is advanced. Therefore, the Chinese experience indicates that technological sophistication alone is



insufficient; a CBDC must provide a distinct and perceivable value proposition.

The Swedish experience further reinforces this interpretation. Sveriges Riksbank has framed the e-Krona as a complement to cash rather than a substitute for the existing financial architecture. This gradual and precautionary approach reflects concerns regarding financial stability and banking sector intermediation. Brunnermeier and Niepelt (2019) show that the macroeconomic impact of CBDCs depends fundamentally on their design and on their interaction with commercial bank balance sheets. Consequently, institutional alignment and regulatory clarity appear central to sustainable implementation.

3.2- Financial Inclusion: Structural Opportunities and Practical Constraints

In developing economies, CBDCs are frequently justified as instruments for enhancing financial inclusion. The Bahamian Sand Dollar and Nigeria's e-Naira were both introduced with explicit inclusion objectives. The theoretical link between digital finance and inclusion is well established. Ozili (2023) finds that digital financial innovations can reduce transaction costs and expand formal financial participation in emerging markets.

However, practical implementation reveals structural constraints. Adoption levels in The Bahamas and Nigeria have remained below expectations, reflecting challenges related to digital literacy, trust, and infrastructural limitations. Frost et al. (2020) emphasise that digital financial inclusion requires both supply-side innovation and demand-side readiness. Without adequate user incentives and institutional trust, technological deployment may not translate into widespread adoption.

These findings suggest that CBDCs can improve structural access to digital finance, yet their transformative impact depends on complementary investments in digital identity frameworks, financial education, and consumer protection mechanisms.

3.3- Strategic and Cross-Border Dimensions

Beyond domestic objectives, CBDCs increasingly carry strategic and geopolitical implications. The e-CNY, for instance, has been interpreted as part of a broader strategy to strengthen monetary

sovereignty and potentially expand the international use of the renminbi. Auer, Haene, and Holden (2021) argue that multi-CBDC platforms may reduce cross-border settlement frictions while maintaining central bank oversight of liquidity conditions.

Regional experiments such as Project Aber illustrate the role of wholesale CBDCs in enhancing cross-border efficiency. BIS research on multi-CBDC arrangements suggests that distributed ledger-based platforms can significantly reduce transaction time and operational complexity in cross-border settlements (Auer et al., 2021). These developments indicate that the long-term systemic importance of CBDCs may lie as much in interoperability and monetary coordination as in retail payment reform.

3.4- Common Determinants and Persistent Challenges

Across all examined cases, several shared determinants of CBDC effectiveness emerge:

- a. Digital infrastructure maturity and high connectivity penetration;
- b. Reliable digital identity and compliance frameworks;
- c. Clear regulatory governance structures;
- d. A tangible value proposition relative to private alternatives;
- e. Institutional trust in the issuing authority.

At the same time, persistent challenges remain evident. These include limited user adoption despite technical readiness, operational and infrastructure costs, cybersecurity risks, and privacy concerns. Carstens (2021) emphasises that CBDC design must preserve the fundamental principles of monetary trust and financial stability.

Conclusion

The rapid evolution of central bank digital currencies (CBDCs) represents a structural transformation in contemporary monetary systems. As sovereign digital instruments, CBDCs reflect a strategic reconfiguration of payment infrastructures, monetary governance, and financial inclusion policies within an increasingly digitalised global economy.

The comparative analysis of advanced economies, developing countries, and regional initiatives demonstrates that the success of CBDC implementation depends not solely on technological sophistication, but on systemic coherence. While distributed ledger



technology (DLT) and related digital innovations enhance operational capacity, international experiences confirm that infrastructure readiness, regulatory clarity, institutional trust, and behavioural acceptance constitute the decisive determinants of long-term viability.

Evidence from advanced economies such as China and Sweden underscores the importance of interoperability and complementarity with existing financial systems. CBDCs that are positioned as institutional safeguards-rather than abrupt substitutes-are more likely to preserve financial stability and public confidence. In developing economies, including The Bahamas and Nigeria, CBDCs reveal considerable potential to expand financial access; however, their impact remains contingent upon digital identity integration, infrastructural reliability, and sustained user engagement.

These findings imply that effective CBDC design should prioritise digital infrastructure development, seamless integration with conventional banking systems, and the establishment of robust legal and governance frameworks capable of safeguarding privacy, cybersecurity, and regulatory compliance. In emerging markets in particular, strengthening digital literacy and embedding CBDCs within broader financial inclusion strategies appear essential for enhancing adoption and trust. Furthermore, the cross-border dimension of wholesale CBDC initiatives highlights the importance of regulatory coordination and interoperability in fostering efficient regional and international payment ecosystems.

Ultimately, the evidence suggests that CBDCs should be conceptualised not merely as technological payment tools, but as socio-institutional monetary frameworks requiring continuous evaluation and adaptive governance. Their sustainable success will depend on balancing innovation with financial stability, digital efficiency with public trust, and national monetary objectives with global interoperability. When embedded within coherent institutional strategies, CBDCs hold the capacity to contribute meaningfully to resilient, inclusive, and digitally integrated financial systems worldwide.

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