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IUSTINA ALINA BOITAN

Bucharest University of Economic Studies, Romania

THOMAS PAULOVICI

Bucharest University of Economic Studies, Doctoral School of Finance , Romania

CENTRAL BANK DIGITAL CURRENCIES AND FINANCIAL INCLUSION IN DEVELOPING ECONOMIES: OPPORTUNITIES, CHALLENGES, AND LESSONS FROM EARLY ADOPTERS

Abstract:

The paper investigates the potential of Central Bank Digital Currencies (CBDCs) to enhance financial inclusion by improving access to digital financial services for unbanked populations, particularly in developing economies where the issue of financial exclusion and low access to financial services is endemic. Our analytical interest substantiates in the growing interest exhibited by central banks and international financial institutions regarding the emergence of this new type of state-backed digital currency. CBDCs represent digital forms of central bank money that may serve as complement to cash and other payment instruments in a secure, efficient, and accessible payment environment, unlike cryptocurrencies, which operate on decentralized networks. While CBDCs offer promising features such as cost efficiency, security, and accessibility, several challenges, including design deficits, digital and financial literacy barriers, and regulatory considerations must be addressed to ensure their effectiveness. Through a systematic review of existing academic literature, empirical evidence and case studies from some developing or emerging economies, this study examines positive impacts as well as the challenges of these CBDCs in promoting financial inclusion. In particular, it investigates the theoretical mechanisms through which CBDCs could enhance access to financial services, and the challenges that may hinder their effectiveness. Furthermore, the analysis draws on a series of case studies from some of the early CBDC adopters, to identify the real-world impact of CBDCs on financial inclusion. The findings suggest that while CBDCs have the potential to bridge financial gaps, their success depends on strategic design and implementation as well as on complementary policies. The paper further discusses policy recommendations for designing CBDCs that maximize their potential as an inclusion-enhancing tool.

Keywords:

Central Bank Digital Currencies, Central Banks, Financial Inclusion, Digital Payments, Developing Economies, eNaira, Sand Dollar

JEL Classification: E50

1 Introduction

Financial inclusion is widely recognized as a critical driver of economic development, poverty reduction, and financial stability, but remains a significant challenge in many developing and emerging economies, where access to affordable and reliable financial services is often constrained by geographic, economic, and institutional barriers. According to the World Bank (2021), financial inclusion ensures that individuals and businesses have access to useful and affordable financial products and services that meet their needs, including payments, savings, credit, and insurance. However, as of 2021, approximately 1.4 billion adults worldwide remain unbanked, lacking access to an account at a financial institution or through a mobile money provider (Demirgüç-Kunt et al., 2022). Addressing these disparities is a priority for policymakers, particularly in developing, emerging or low-income economies where financial exclusion is most pronounced.

The rapid digitalization of financial services has led to increased interest in Central Bank Digital Currencies (CBDCs) as a potential tool for promoting financial inclusion, particularly in these economies where traditional banking infrastructure is underdeveloped. CBDCs are digital forms of central bank money that can complement cash and existing payment systems while offering a secure, efficient, and accessible means of conducting transactions (Auer et al., 2021). Unlike cryptocurrencies, which operate on decentralized networks, CBDCs are state-backed and designed to function as legal tender. The 2022 Bank for International Settlements (BIS) survey found that 93 percent of central banks are actively exploring CBDCs, with 60 percent of central banks in emerging and developing economies identifying financial inclusion as a key motivation for their development (Kosse & Mattei, 2023).

Financial exclusion remains largely driven by barriers such as lack of access to banking infrastructure, high transaction costs, inadequate identification documents, and low digital literacy (IMF, 2023). In many developing economies, CBDCs are viewed as a means to overcome some of these key barriers. The Bahamas' Sand Dollar, launched in 2020, and Nigeria's eNaira, introduced in 2021, represent early examples of CBDC implementation in emerging markets, with financial inclusion as a primary objective (IMF, 2023). However, empirical evidence on their effectiveness remains mixed. While these initiatives have demonstrated potential in broadening access to financial services, their adoption has been hindered by challenges related to infrastructure constraints, digital literacy gaps, and public trust in government-backed digital currencies (Atlantic Council, 2023).

This paper seeks to explore the extent to which CBDCs can advance financial inclusion. It examines the theoretical mechanisms through which CBDCs could enhance access to financial services, and the challenges that may hinder their effectiveness. Furthermore, the analysis draws on case studies from some of the early CBDC adopters mentioned above, the Bahamas' Sand Dollar, Nigeria's eNaira, to examine the real-world impact of CBDCs on financial inclusion. The paper further discusses policy recommendations for designing CBDCs that maximize their potential as an inclusion-enhancing tool.

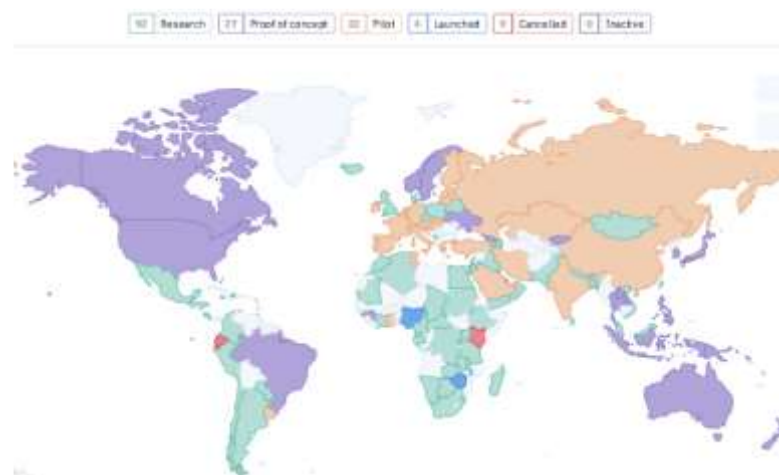
The next section reviews the literature on financial inclusion and CBDCs, looking at the theoretical arguments and mechanisms through which CBDCs may enhance financial inclusion in developing economies, including transaction cost reduction, accessibility in remote and underserved areas, and the role in government-to-person (G2P) transfers, as well as some potential challenges and limitations associated with CBDC deployment that may hinder inclusion, such as digital and financial literacy barriers, lack of ecosystem readiness, and low public awareness and privacy concerns. Furthermore, the paper looks at some empirical evidence and case studies of early adopters, namely the Bahamas and Nigeria, to explore their impact on financial inclusion as well as some of the challenges encountered, with the conclusion discussing

some of the policy recommendations for maximizing the financial inclusion potential of CBDCs and for overcoming some of the identified challenges.

2. Literature review

The empirical deployment of CBDCs remains in its infancy. Currently, no major jurisdiction has launched a CBDC (except for few developing countries such as the Bahamas, Jamaica, Zimbabwe or Nigeria – according to CBDC Tracker, updated in March 2025). However, the theoretical and conceptual discourse on their benefits and risks is evolving rapidly. Most central banks are still exploring this issue based on a theoretical or case study approach and “have not taken firm design and policy decisions related to the potential issuance of a domestic CBDC” (Bank for International Settlements, 2021b). As a result, academic literature on the inclusion enhancing potential of CBDCs remains relatively fragmented, spanning policy briefs, conceptual frameworks, case-based studies, and a small but growing body of formal modeling work.

Figure 1. Status of CBDCs implementation worldwide



Source: CBDC Tracker, database update: March 2025

Further research is of utmost importance for a comprehensive understanding of CBDCs impact, which is still under a wide debate due to the complexity of their design and the major implications for the financial ecosystem (Lannquist and Tan, 2023; Dionysopoulos et al. 2024). Against this background, the public acceptance and subsequent use of a new, innovative and digital form of domestic currency could be explained by relying on the theory of the innovation diffusion developed by Rogers (2003). He observed that many innovations featuring obvious benefits require a long period of time until being large-scale used and come with the solution of speeding up the diffusion rate of an innovation. Specifically, diffusion is defined as a process involving a special type of communication meant to create and share new ideas on a given topic, through various channels and by reaching a large audience. The scope of the communication is to reduce the uncertainty arising from lack of good quality, official information on a novel idea, by allowing a divergence or convergence process. This innovation adoption framework serves as the starting point for an analysis published by the United Nations Development Program (Wang, 2024) questioning about the stages of the successful design of a CBDC in order to meaningfully promote financial inclusion. The analysis conjectures that a key indicator of CBDCs accessibility is the increase of a CBDC adoption rate, including the acceptance by economic agents or public authorities of the payments made through this new payment instrument. Following Rogers' theory, an innovation has to meet five attributes to impact the adoption of it. Wang (2024)

explains each of these attributes and underlines the CBDCs design features associated with each of them that may also enable the level of financial inclusion:

- i) *relative advantage* means that CBDCs should be perceived as an innovation superior to the current payment instruments. Therefore, their design should ensure low-cost and safe electronic payment services and these features should be explained especially to unserved and underserved individuals;
- ii) *compatibility* suggests the extent to which an innovation such as the CBDCs succeeds to adapt and align with the values, needs and concerns (privacy, safety, the possible lack of technical preparedness) of a broad user base. Consequently, the CBDCs design should incorporate features of safety and resilience and should enable CBDCs to function smoothly in both online and offline scenarios.
- iii) *complexity* is the perceived difficulty to understand and use CBDCs. It is advocated for their careful design in terms of simplifying access of use, to prevent unintentional financial exclusion, given the financial literacy gaps.
- iv) *trialability* is associated with the possibility for ex-ante testing the use of a CBDC, that may range from pilots/demos to sandboxes, accompanied by the possibility for user feedback.
- v) *observability* consists of making visible the outcomes of an innovation, through transparent communication.

Other studies advocate for issuing a retail CBDC, claiming its importance in facilitating financial inclusion especially in developing and underdeveloped economies lacking robust and safe payment services (Kiff et al., 2020; Kosse and Mattei, 2023). Keister and Sanches (2021) further investigate this issue through a scenario approach related to the introduction of a CBDC in a competitive bank market. Findings show that if there is a strong public authorities' commitment for boosting financial inclusion, it is optimal to design a CBDC with a high degree of substitutability for cash, but not for deposits. A related attempt belongs to (Tan 2024) who reveal that the issuance of a CBDC is susceptible to increase financial inclusion (proxy by the share of the population holding bank accounts) if the CBDC acts as a more efficient means of payment compared to deposits, if it provides user anonymity of payments or it exposes the user to no liquidity risk that may be associated with possible CBDC remuneration. Generally, the emerging literature identifies three primary mechanisms through which CBDCs may advance financial inclusion in developing economies. First, by enabling direct, low-cost peer-to-peer transactions, CBDCs can reduce reliance on high-fee remittance channels and informal credit markets, while offering an accessible alternative to cash and underdeveloped digital finance ecosystems (Svoboda, 2024; Tan, 2023). Second, CBDCs can overcome geographic and institutional constraints that limit traditional banking outreach, particularly in remote or low-income areas (FSI Insights, 2022). Lastly, CBDCs hold significant potential to streamline G2P payments by facilitating real-time, traceable disbursements to eligible recipients, reducing leakage and delays while expanding access to complementary financial services. These characteristics position CBDCs as a potential instrument of inclusive digital public infrastructure - though, as the paper argues, their success hinges on complementary policy coordination.

3. Case study analysis of early CBDC adopters – lessons learned

3.1 The Nigerian eNaira

Launched in October 2021, Nigeria's eNaira was the first CBDC introduced in a major emerging economy. Its rollout by the Central Bank of Nigeria (CBN) was explicitly framed as part of a

broader digital finance strategy aimed at raising financial inclusion to 95% of adults by 2024 - up from approximately 68% in 2020 (CBN, 2021; Anyamele, 2024). With an estimated 38 million Nigerian adults lacking access to essential financial products and services, the eNaira was designed as a digitally-native, state-backed complement to cash, capable of reaching segments historically underserved by conventional banking.

The high cost of remittances, the prevalence of informal credit markets, and cumbersome onboarding for traditional bank accounts have long posed entry barriers for the unbanked in Nigeria. The eNaira sought to address these by allowing individuals to open digital wallets without requiring a bank account, relying instead on minimal-tier KYC using the national ID number. As part of its hybrid two-tier architecture, the CBN retained control over the ledger and issuance while leveraging existing financial institutions and payment service providers to manage user interaction and distribution. The system was designed to eliminate intermediary fees, allow real-time peer-to-peer payments, and reduce cash-handling costs. However, adoption has been far lower than anticipated - only 0.5% of Nigerians had used the eNaira as of early 2023, and more than 98% of downloaded wallets remained inactive (Anyamele, 2024; Adedipe, 2022). This outcome suggests that while cost-related barriers were addressed in principle, awareness, trust, and usability concerns outweighed perceived value.

The eNaira's design featured attributes that, on paper, make it highly compatible with low-connectivity and infrastructure-scarce environments. Offline functionality, enabled by NFC, allows the eNaira to be used in areas lacking consistent internet or electricity. Furthermore, its integration with Nigeria's Shared Agent Network Expansion Facility - a public-private platform focused on financial agent outreach - provided an institutional mechanism for last-mile deployment. In addition, the eNaira's account-based structure interfaced with national ID systems, providing a foundation for targeted inclusion of informal sector workers and residents of rural regions. Despite these design strengths, evidence from both academic evaluations and empirical adoption metrics indicates that uptake in remote areas has been marginal. As Ozili (2023) highlights, digital literacy gaps, insufficient agent incentives, and residual distrust in government-backed systems - especially in politically marginalized regions - have tempered enthusiasm. The availability of alternatives like mobile money (e.g., Opay, PalmPay) and cryptocurrencies further diverted attention from the eNaira, which has not yet clearly communicated its unique value proposition relative to existing tools.

In Nigeria's case, CBDC usage for G2P transfers remains largely aspirational. The CBN has promoted the eNaira as a future platform for disbursing social protection benefits, pensions, and public wages. Its integration with national identity systems enables precise targeting and accountability, and the eNaira ledger offers transparency not possible in cash-based systems. Nonetheless, to date, few large-scale G2P programs have been routed through the eNaira. Stakeholder reluctance, absence of enabling legal mandates, and coordination gaps across agencies have hindered execution. Anyamele (2024) and Adedipe (2022) note that strong incentives - such as mandating eNaira-based disbursements or offering tax rebates for merchants - have yet to be implemented at scale. Drawing on experiences from successful digital payment programs elsewhere, it is evident that leveraging G2P as a use case can catalyze network effects, but only when end-users clearly benefit and onboarding is seamless.

Nigeria's experience with the eNaira illustrates the tension between technical readiness and behavioral adoption. The CBN delivered a product with robust infrastructure, an innovative hybrid model, and meaningful financial inclusion design features, yet adoption has been weak.

Research by Ozili (2023) and the empirical findings from the CBN's own transaction data suggest that trust deficits, digital illiteracy, and perceived risks (including concerns about surveillance and account freezes) have undermined adoption. Misinformation about the eNaira's purpose, alongside skepticism about central bank intentions, has fueled user resistance. Furthermore, limited merchant integration and inadequate communication about the practical benefits of eNaira over cash or other mobile solutions have dampened incentives. The Nigerian case affirms the theoretical potential of CBDCs to promote inclusion, while underscoring that policy design, ecosystem incentives, and user engagement strategies are as crucial as technical architecture. Future adoption may depend on more ambitious policy integration—particularly by anchoring the eNaira in welfare schemes, education initiatives, and local government services.

3.2 The Bahamas' Sand Dollar

The Bahamas' Sand Dollar - the world's first fully launched retail CBDC - offers one of the most concrete test cases for evaluating how CBDCs can promote financial inclusion in practice.

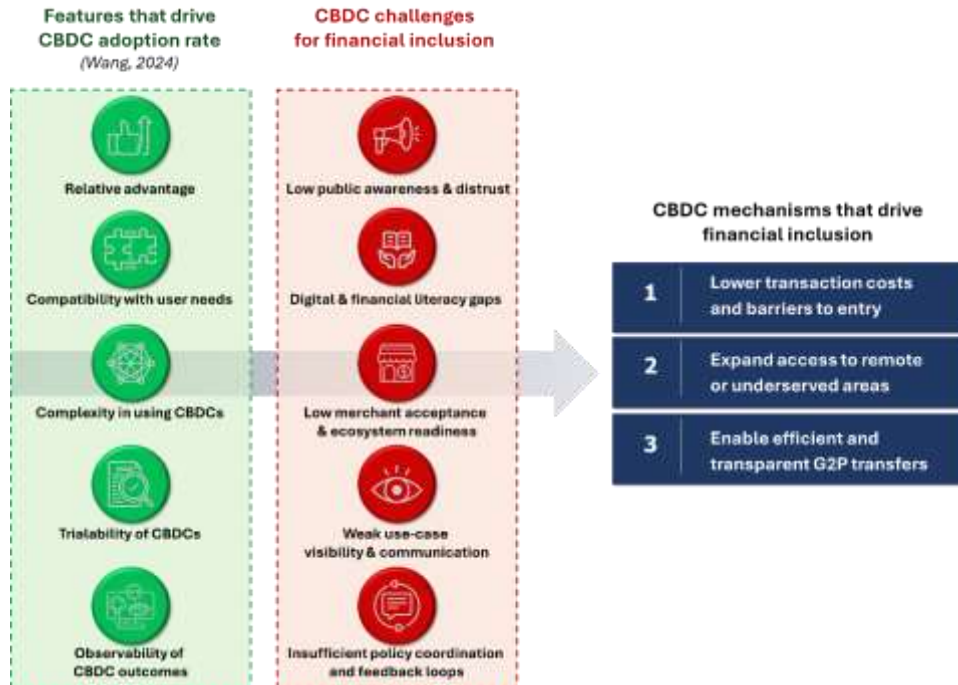
As mentioned, a core promise of CBDCs is their ability to reduce the cost of financial transactions, particularly for those currently excluded from the formal banking system. In the Bahamian context, these cost barriers are both monetary and administrative: commercial banking services have historically been expensive and cumbersome, especially for low-income individuals; moreover, opening a bank account requires extensive documentation, time, and travel, costs which are especially burdensome in a geographically fragmented country. The Sand Dollar was explicitly designed to address these constraints through a tiered wallet system with simplified KYC requirements, where individuals can access a basic Tier 1 wallet without providing any formal ID, enabling low-value transactions up to B\$1,500 per month. By allowing onboarding through regulated but decentralized financial service providers (i.e., authorized financial institutions), and by leveraging mobile devices for transfers, the Sand Dollar offers a low-cost alternative to cash and traditional banking. Though merchant acceptance and awareness remain challenges, the system enables near-instant peer-to-peer transfers with no intermediary fees, validating the theoretical claim that CBDCs can provide low-friction, inclusive financial rails (Tan, 2023; Svoboda, 2024).

Perhaps the most distinctive feature of the Sand Dollar initiative is its ambition to serve remote communities that commercial banks have long failed to reach. The geographic dispersion of The Bahamas -comprising over 700 islands - has historically rendered branch-based banking both logistically and financially unviable. The Sand Dollar was launched after a 2019 pilot in Exuma, where survey data revealed that although mobile phone penetration was nearly universal, trust in formal financial institutions and use of digital banking tools was limited. With a digital currency that can be accessed via smartphone and used offline (through NFC wallets), the Sand Dollar aimed to bridge the gap in digital finance. Offline functionality, a critical feature for resilience in disaster-prone zones, was also a response to the experience of Hurricane Dorian, which temporarily cut off entire communities from cash and payment systems. The system's interoperability with bank accounts and merchant networks reflects the principle that CBDCs can serve as public digital infrastructure, complementing rather than displacing existing providers. As Kosse and Mattei (2023) argue, such design features are key to reaching excluded populations, particularly in small states with challenging topographies.

Though not yet fully integrated into large-scale social protection systems, the Sand Dollar has the capacity to support efficient G2P payments - one of the most cited use cases for CBDCs in developing contexts. The Bahamas has identified digital welfare transfers as a medium-term application of the Sand Dollar, particularly for disaster relief and social support during emergencies. Lessons from the COVID-19 pandemic and the aftermath of Hurricane Dorian underscored the fragility of cash-based delivery systems, and the central bank has promoted the Sand Dollar as a mechanism for traceable, real-time disbursements. In this respect, the infrastructure built around the Sand Dollar- including its integration with digital identity checks and its transparent audit trails - could enable more targeted, efficient, and accountable G2P transfers in the future. This aligns with global arguments that CBDCs can improve both delivery and uptake of social programs, especially for low-income and undocumented groups who are often missed by conventional banking channels (Lannquist & Tan, 2023; IMF, 2023).

Despite its promise, the Sand Dollar has faced a number of implementation hurdles. As of early 2023, transaction volumes remained low, and Sand Dollars accounted for less than 1% of total currency in circulation. Constraints include limited merchant onboarding, low public awareness, and lingering concerns over cybersecurity and data privacy. Moreover, while mobile device penetration is high, not all users are comfortable with digital payments - particularly among older populations. As in the case of the eNaira, these point to a critical lesson: technological readiness is necessary but not sufficient for inclusive outcomes. Institutional trust, financial literacy, and incentives for merchant acceptance are essential for translating access into sustained usage. The case also highlights the importance of policy sequencing and that CBDC deployment must be part of a broader inclusion strategy.

Figure 2 – Key CBDC features and implementation challenges towards financial inclusion outcomes



Source: Authors' elaboration based on Wang (2024)

Conclusions and policy recommendations

The paper proposes an exploratory investigation of the potential of CBDCs to further financial inclusion. Through a review of the emerging literature, theoretical mechanisms, and empirical insights from early adopters - specifically The Bahamas' Sand Dollar and Nigeria's eNaira - it is evident that while CBDCs hold considerable promise, their real-world impact depends critically on policy design, user engagement, and the broader institutional ecosystem. Theoretically, CBDCs offer several pathways to inclusion: reducing transaction costs and frictions, expanding access in underserved regions through digital and offline channels, and improving the efficiency and transparency of G2P transfers; however, evidence suggests that these benefits are far from automatic. While CBDCs in The Bahamas and Nigeria were both designed with inclusion goals in mind, their limited adoption points to a series of shared and context-specific challenges, including weak merchant acceptance, digital and financial literacy gaps, low levels of public trust, and underutilization of G2P payment opportunities. Both cases reveal that design features - however well intentioned - must be embedded in broader financial, social, and regulatory ecosystems that support user uptake and sustained engagement. Without this, the transformative potential of CBDCs remains unrealized. The report draws a series of key lessons emerging as important to inform CBDC policy recommendations in order to advance financial inclusion are the following:

1. **Need to ensure a user-centric design** - CBDCs must be designed and communicated in ways that build confidence among users - particularly those who are financially or digitally marginalized. Privacy protections, clear user rights, and credible institutional governance are critical, as well as a user-centered design approach, with differentiated access tiers and functionality tailored to the needs of excluded groups, including those without formal ID or internet access.
2. **Financial and digital literacy must be addressed proactively** - without user education and support and investment in digital and financial literacy, the complexity of digital tools may actually reinforce exclusion. Inclusive rollout strategies should include targeted outreach including financial education campaigns and user training, as well as co-design with communities and robust grievance mechanisms, particularly in regions with low digital penetration.
3. **Interoperability and merchant integration are vital for utility and scale** - CBDCs should seamlessly connect with existing payment systems and commercial networks and be integrated across financial institutions, fintech providers, and merchant platforms to facilitate smooth integration and minimize friction.
4. **Policies should be carefully sequenced** - CBDCs should not be deployed as standalone solutions, but as part of broader digital public infrastructure strategies - coordinated with identity systems, social protection programs, and digital payment ecosystems.
5. **Demonstrating value is key to adoption** - Use cases such as G2P payments, remittances, and retail transactions must be made visible, seamless, and beneficial to the end user. Visibility, relevance, and incentives are critical in the early stages.

CBDCs can complement existing efforts to promote financial inclusion, particularly when embedded within a holistic policy framework. The experience of early adopters underscores the importance of moving beyond technological ambition toward inclusive policy design. As more countries explore CBDC issuance, the insights and lessons from these pioneering cases offer valuable guidance for achieving meaningful and sustainable financial inclusion outcomes.

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