

Enhancing financial inclusion in developing countries: the potential of Drex, the Brazilian CBDC

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Abstract

This paper explores how Central Bank Digital Currencies (CBDCs) can enhance financial inclusion in developing and emerging economies. Globally, central banks are actively working on creating their own CBDCs. Although the concept is still emerging on the global stage, existing literature and official reports have already highlighted the potential benefits of CBDCs for unbanked and underserved populations, along with the challenges that financial regulators need to address. The paper provides a literature review on the topic and presents a case study of Drex, the Brazilian CBDC currently being developed by the Central Bank of Brazil, which has not yet been implemented. The Central Bank highlights financial inclusion as one of its benefits, particularly due to the intention to implement an offline feature for Drex. Poor populations of remote rural areas and underserved riverside communities, which lack adequate internet infrastructure, are expected to be the primary beneficiaries of this feature. In this context, we examine the potential of Drex to promote financial inclusion in Brazil and assess the obstacles that must be overcome to achieve this goal. As Drex has not yet been launched, no data is available to analyze its outcomes. Therefore, this research relies on the regulatory framework and official reports by the Central Bank for Drex's implementation and operation, as well as data on the Brazilian population's access to financial services. We argue that Drex has the potential for enhancing financial inclusion. However the Central Bank of Brazil should prioritize financial inclusion in the design of Drex and collaborate with other Brazilian regulators to address existing social issues. This approach could help prevent Drex from exacerbating the digital divide in Brazilian society and foster a scenario of financial inclusion rather than exclusion.

1 Introduction

Central Bank Digital Currency (CBDC) represents a significant trend in the ongoing digital transformation of the financial ecosystem. In May 2020, 35 countries and regions were

exploring CBDC initiatives. Just over four years later, by July 2024, this number escalated to 134, with countries at varying stages of development (Atlantic Council, 2024).

CBDC offer several potential benefits, such as domestic payments efficiency (both domestic and cross-border), enhanced financial stability, better monetary policy implementation, and greater financial inclusion (Engert and Fung, 2017; Boar et al., 2020; BIS, 2020a, 2020b; Auer et al., 2021; Van Roosebeke and Defina, 2021). This research will focus specifically on financial inclusion, which is one of the most important goals of CBDC initiatives in emerging and developing economies¹ (Boar et al., 2020, BIS, 2022a; AFI, 2022a), such as Brazil (CBB, 2023c).

This paper has two main objectives. First, it aims to explore how CBDCs can enhance financial inclusion in developing and emerging economies. Second, it presents a case study of Drex², the CBDC currently being developed by the Central Bank of Brazil (CBB). The paper examines Drex's potential to promote financial inclusion in Brazil and assesses the key challenges to achieve this goal, drawing on the literature and Brazil's socioeconomic characteristics.

The paper presents a narrative literature review, highlighting the potential benefits and barriers of implementing a CBDC in developing and emerging economies in relation to financial inclusion. For the case study, since Drex has not yet been launched, there is no available data to evaluate its impact. Therefore, the analysis relies on the regulatory framework and official reports from the CBB on Drex's implementation and operation, along with the literature presented in the first part of the paper.

The research highlights that Drex has a potential for enhancing financial inclusion. However, the CBB should prioritize financial inclusion in its design and collaborate with other Brazilian regulators to address existing social issues, in order to prevent the Brazilian CBDC from worsening the digital divide in Brazil and to promote a scenario of financial inclusion rather than exclusion.

The literature on CBDCs and financial inclusion is still in its early stages, which is why this paper has the intention to contribute to this ongoing research field and to encourage further

¹ For developing and emerging economies, besides financial, inclusion, payments efficiency and payments safety were the main motivation in creating a CBDC. For advanced economies, payments safety was the main one (Boar et al., 2020).

² The Brazilian CBDC was originally called "Real Digital" (because "Real" is the name of the official currency). However, in August 2023, the CBB changed the name to "Drex". The explanation for this change is as follows (CBB, 2023d): "The combination of letters forms a word with a strong and modern sound: the 'd' and 'r' allude to Real Digital; the 'e' represents electronic, and the 'x' conveys the idea of modernity and connection, reflecting the use of Distributed Ledger Technology (DLT), which is adopted for Drex, continuing the family of solutions initiated by the Central Bank with Pix [the Brazilian instant payment system]".

studies on the topic. Additionally, it seeks to enrich the literature specifically on Drex and financial inclusion, as there is currently limited material available in both English and Portuguese.

This paper is divided into four sections. Following this introduction (section 1), section 2 presents a literature review on financial inclusion and CBDCs. Section 3 examines the case of Drex, analyzing its potential benefits to enhance financial inclusion as well as the challenges that must be addressed to achieve this goal. Section 4 concludes with final considerations on the subject.

2 CBDCs, financial inclusion, and financial exclusion

CBDC does not have a single and unified definition³. Nevertheless, in simple terms it can be defined as “a digital payment instrument, denominated in the national unit of account, that is a direct liability of the central bank” (BIS, 2020a, p. 3). Instead of being issued as physical notes and coins, this currency is created and managed electronically by a central bank, which guarantees their value in the same way it does with physical currency⁴.

Research on CBDCs has been continuously growing over the last years (Auer et al., 2021; Ozili, 2022a;), driven by several reasons, such as innovations in digital finance, the increasing use of blockchain-enabled distributed ledger technologies (LDT), and the prominence of cryptocurrencies in the digital currency landscape (Ozili, 2022a).

The motivations for implementing a CBDC vary across countries. To list some: preserve and improve financial stability (Engert and Fung, 2017; Ozili, 2022b; BIS, 2020a); for monetary policy implementation (Boar et al., 2020; BIS, 2020a); improve payment efficiency (Engert and Fung, 2017; Boar et al., 2020; BIS, 2020a); inhibit criminal activity (Engert and Fung, 2017); enhance cross-border payments (Boar et al., 2020; BIS, 2020a; Auer et al., 2021; Van Roosebeke and Defina, 2021) and boost financial inclusion (Engert and Fung,

³ According to the Bank for International Settlements (2018, p. 3), “CBDC is not a well-defined term. It is used to refer to a number of concepts. However, it is envisioned by most to be a new form of central bank money”.

⁴ We can find in the literature several variations of the definition of CBDC. Kumhof and Noone (2018, p. 4) define CBDC “as electronic central bank money that (i) can be accessed more broadly than reserves, (ii) potentially has much greater functionality for retail transactions than cash, (iii) has a separate operational structure to other forms of central bank money, allowing it to potentially serve a different core purpose, and (iv) can be interest bearing, under realistic assumptions paying a rate that would be different to the rate on reserves”. Ward and Rochemont (2019, p. 3) define CBDC appointing what it is not, stating that “CBDC is a digital form of central bank money that is different from balances in traditional reserve or settlement accounts”. Kiff et al. (2020, p. 9) adopts the following definition: “CBDC as a digital representation of a sovereign currency issued by and as a liability of a jurisdiction’s central bank or other monetary authority”.

2017; Boar et al., 2020; AFI; 2022a; Ozili, 2022b). The focus of this paper will be on the last motivation: boosting financial inclusion..

Financial inclusion can be defined as the means for individuals and businesses to have access to financial products and services - such as transactions, payments, savings, credit, and insurance - that are both affordable and tailored to their needs, while being provided in a responsible and sustainable manner (World Bank Group, 2022a).

Financial inclusion is considered essential for reducing global extreme poverty and is recognized as a key tool in achieving twelve of the seventeen Sustainable Development Goals (SDGs) outlined in the 2030 Agenda⁵. It is also perceived as an important driver of economic growth (Sethi and Acharya, 2018; Huang et al., 2021).

While financial inclusion refers to a scenario where all adults have access to traditional financial services⁶ in an efficient manner that meets their needs (Mandira, 2012; GPFI, 2022; World Bank Group, 2022a), financial exclusion represents the opposite: a situation where individuals either have no access to financial services or have only restricted access (Sinclair, 2001).

It is possible to identify five key causes of financial exclusion (Carbó et al., 2005): (1) exclusion from access to financial services, where individuals are considered high-risk customers due to their poverty, as they lack assets to offer as collateral in case of non-payment; (2) exclusion due to service and products features, which occurs when the conditions for obtaining financial products or services do not meet the needs of certain individuals; (3) price exclusion, where individuals are unable to afford the cost of financial products and services available in the market; (4) exclusionary advertising, where marketing campaigns fail to target or include specific groups as potential consumers; and (5) self-exclusion, where individuals choose not to apply for financial products or services because they believe their request will be denied.

As mentioned earlier, for central banks in developing and emerging economies, promoting financial inclusion (and, consequently, reducing or eliminating financial exclusion) is one of the main drivers behind implementing a CBDC (Boar et al., 2020; BIS, 2020a).

⁵ The twelve SDGs are: no poverty (SDG 1); zero hunger (SDG 2); good health and well-being (SDG 3); quality education (SDG 4); gender equality (SDG 5); clean water and sanitation (SDG 6); affordable and clean energy (SDG 7); industry, innovation and infrastructure (SDG 9); reduced inequalities (SDG 10); sustainable cities and communities (SDG 11); climate action (SDG 13); peace, justice and strong institutions (SDG 16). Regarding the topic, see: Ferrata (2019); UNSGSA et al. (2023).

⁶ Account ownership is a first step toward financial inclusion, but it is not the only one. Therefore, for a country to consider its population financially included, it cannot rely solely on the number of adults with bank accounts; it must also take into account other factors, such as a basic understanding of financial products and services, responsible usage of these products and services, and more.

Each country has its own specific characteristics, which is why the design of their respective CBDCs will vary, even though the goal to boost financial inclusion remains the same. Therefore, understanding the potential benefits and challenges of a CBDC for financial inclusion is necessary to avoid achieving the opposite result, financial exclusion.

The next section will analyze this potential benefits and possible barriers, as indicated by the literature.

2.1 Literature on CBDCs and financial inclusion

For this study, a narrative literature review on financial inclusion and CBDCs in developing and emerging economies is presented to describe and discuss the current state of the art on the topic (Rother, 2007, p. xvii) and provide a foundation for the case study of Drex, the Brazilian CBDC (Section 3). The analysis will not focus on any specific country but will take a broad approach, considering developing and emerging economies as a whole.

This section is divided into two parts: the first addresses the potential benefits of CBDCs for promoting financial inclusion, while the second highlights the possible barriers.

2.1.1 Potential benefits

The literature highlights five arguments for why CBDC could help enhance financial inclusion in a developing and emerging economy: (1) low transaction costs; (2) improve access to digital financial services; (3) enhance efficiency of digital payments; (4) can be offered offline; (5) incentivise the digitization of the value chains.

These advantages may not necessarily be present in every CBDC project within developing or emerging economies. The list reflects potential benefits identified in the literature, which will only be realized depending on the specific design chosen by the central bank for its CBDC implementation.

(1) Low transaction costs

CBDCs have the potential to reduce transaction costs for digital payments and transfers, which can lower the fees associated with digital transactions (Cooper et al., 2019; Raghuveera, 2020; Ozili, 2021; Didenko and Buckley, 2021). As a result, CBDCs can offer a more cost-effective option for digital financial services, making it easier for more people to participate in

the financial system, thus promoting financial inclusion. Lower transaction costs can also increase competition among banks and other payment service providers (Ozili, 2021; Raghuvveera, 2020), which benefits consumers by driving competition and the provision of more services at better prices.

(2) Improve access to digital financial services

CBDCs can boost access to digital financial services (Ozili, 2021; Didenko and Buckley, 2021). Since CBDCs can be accessed via digital devices, they offer a solution in areas with limited banking infrastructure, such as rural or remote areas, where physical bank branches are scarce.

With CBDCs, individuals can access a wide range of digital financial products and services that may be difficult to obtain when relying solely on cash and physical branch locations. Users can easily make payments for goods and services through their digital devices, enhancing the convenience and efficiency of everyday transactions (Ozili, 2021).

Low-income individuals who rely exclusively on cash are often excluded from the formal economy, as it becomes costly for banks and other institutions to serve them (Lannquist and Tan, 2023). If these services are digitalized, the digital divide can be reduced or even eliminated, allowing these individuals to be included in the financial system.

(3) Enhance efficiency of digital payments

CBDCs can improve the efficiency of digital payments by offering a faster, more widely accessible, and lower-cost electronic payment method for general use, particularly in countries lacking efficient payment systems (Engert and Fung, 2017; Ozili, 2021; Didenko and Buckley, 2021; Infante et al., 2022). By increasing the efficiency of digital payments, CBDCs can encourage financial inclusion for individuals who previously preferred cash due to the lack of practical and reliable digital payment options in their country.

(4) Can be offered offline

CBDC can be designed with offline features, allowing users to access and use this digital currency even without an internet connection (Ozili, 2021; BIS, 2020a; AFI, 2022a; Lannquist and Tan, 2023). This feature is crucial for promoting financial inclusion, as it enables

individuals in remote areas with limited or no internet access to use CBDCs (Ozili, 2021; Lannquist and Tan, 2023)⁷.

(5) Digitization of the value chains in the economy

CBDCs can incentivise or help accelerate the digitization of value chains within the economy (Cooper et al., 2019; Ozili, 2021, 2024; Didenko and Buckley, 2021). By utilizing CBDCs, businesses can be encouraged to integrate their operations into the digital financial system. This shift can offer two key benefits. First, it enhances financial inclusion by making it easier for businesses to access and participate in the financial system. Second, it creates greater transparency across the entire business process, providing visibility into financial transactions related to production, distribution, sales, and post-sales activities. This can be particularly important for smallholder farmers involved in agricultural value chains, whether through the digitization of payments to these farmers or through the digital disbursement of government subsidies granted to them (Cooper et al., 2019; Raithatha, 2020).

2.1.2 Barriers

Despite the intention to promote financial inclusion, CBDCs may fail to achieve this goal for different reasons. Below are nine potential barriers that could prevent a CBDC from achieving this goal in a developing and emerging economy: (1) the high cost of digital devices and network data plans for poor and low-income individuals; (2) non-interest-bearing CBDCs may limit their appeal for financial inclusion; (3) a preference for cash over digital currency among the population; (4) regulatory requirements for CBDC identification can act as a barrier to the financial inclusion of individuals who lack official ID; (5) low transaction costs alone are not sufficient to ensure financial inclusion; (6) high levels of digital exclusion can undermine financial inclusion; (7) a lack of trust in financial institutions; (8) CBDC design may not prioritize financial inclusion; and (9) digital and financial illiteracy.

⁷ Regarding the feature of the CBDC being offered offline, it is important to highlight some considerations. According to the AFI (2022a, p. 26, footnote 136): “The level of offline functionality is dependent on a number of factors including the overall scheme cryptography and design, instrument design and protocols, wallet and wallet class structure specifications, and then the specific and proportionate mitigation measures required for the CBDC system as specified, to operate within the national context. It should be noted that offline transactions are not a given, and without finding a secure solution, CBDCs could open themselves up to digital counterfeiting”.

These barriers highlight the complexity of using CBDCs to foster inclusion and emphasize the need for careful planning and consideration in their implementation.

(1) The high cost of digital devices and network data plans for low-income people

The use of CBDCs requires access to a digital device, such as a smartphone, tablet, computer, etc⁸. However, due to the high costs of these devices, low-income individuals may lack the financial means to purchase them. As a result, they may be unable to utilize CBDCs (Ozili, 2021). The same issue arises if the costs associated with obtaining internet access are high. Even if individuals can purchase digital devices, they still need to be able to afford data plans (Ozili, 2023).

(2) Non-interest bearing CBDCs limit financial inclusion

One feature that has been discussed by central banks is whether their CBDCs should be interest-bearing or not, with the majority focusing on the latter option (Tan, 2023; Bibi and Canelli, 2024; Bindseil and Senner, 2024). The rationale behind this preference is to ensure that CBDCs possess similar properties to cash.

Offering interest on CBDC deposits could attract new participants to the formal financial sector, particularly unbanked adults who seek the savings benefits of interest-bearing options (Ozili, 2021). If a central bank launches a non-interest bearing CBDC, unbanked individuals may lack incentive to hold substantial amounts of this currency or use it for transactions, potentially leading to decreased financial inclusion (Ozili, 2021).

(3) A preference for cash over digital currency among the population

The preference for cash can inhibit the adoption of CBDCs, and there is no evidence showing that people would prefer a CBDC over cash, particularly if this digital currency does

⁸The Central Bank of Ecuador implemented a CBDC project between 2014 and 2018, called “dinero electrónico”, which allowed citizens to conduct instant financial transactions. In this case, only an official identity document and a mobile phone were required, which did not have to be a smartphone (Arauz et al., 2021). This is a crucial design detail for a CBDC that could enable greater financial inclusion for poor or low-income individuals who may not be able to afford more expensive digital devices. As a matter of curiosity and information, the project ultimately did not succeed for various reasons, such as its inability to be used for international payments and criticisms that it could facilitate criminal activities (Arauz et al., 2021).

not provide benefits compared to traditional cash usage (Ozili, 2021; Nocciola and Zamora-Pérez, 2024).

(4) Regulatory requirements for CBDC identification can act as a barrier to the financial inclusion of individuals who lack official ID

The use of a CBDC may require users to provide proof of identification, a measure designed to prevent, for example, illegal activities, such as money laundering and terrorism financing. This creates a challenge for individuals adults who do not possess a legal form of identification. According to the World Bank, it is estimated that approximately 850 million people worldwide lack an official ID (Clark et al., 2023)⁹.

If the process for obtaining an official ID is lengthy, difficult, and onerous, there will be little or no incentive for undocumented individuals to acquire such documentation. However, without an ID, they won't be able to use CBDCs, which can hinder financial inclusion (Ozili, 2021; Van Roosebeke and Defina, 2021).

(5) Low transaction costs it's not enough to make individuals financial included

If there are costs associated with the use of CBDCs, individuals are likely to avoid making payments or transfers with this digital currency and instead conduct transactions in cash (Ozili, 2021; Infante et al., 2022). Another consideration is defining what constitutes "low costs". What regulators consider "low" may not actually be perceived as such by low-income individuals (Ozili, 2021). Therefore, to effectively promote financial inclusion through CBDCs, one possibility would be to make transactions using this digital currency free of charge (Ozili, 2021; Infante et al., 2022).

(6) A high level of digital exclusion can undermine financial inclusion

A high level of digital inclusion is essential for the success of a CBDC. The use of this digital currency requires digital devices, which typically need to be connected to the internet (unless the CBDC has offline features). This also demands adequate infrastructure to provide

⁹ The individuals most affected by the lack of an official identity document primarily reside in low- and lower-middle-income economies in Sub-Saharan Africa and South Asia (Clark et al., 2023).

both internet connectivity and electricity. Consequently, individuals who are digitally excluded - whether due to a lack of digital devices or limited internet access - will face significant challenges in making use of CBDCs (Maniff, 2020a; Raghuvvera, 2020; Ozili, 2021; Infante et al., 2022; Didenko and Buckley, 2021), hindering the achievement of financial inclusion. Therefore, infrastructure that ensures reliable access to electricity and internet for these individuals can be considered important enablers of CBDCs projects aimed to enhance financial inclusion (Didenko and Buckley, 2021).

(7) Lack of trust in financial institutions

A lack of trust in financial institutions, including central banks, is a key reason why many individuals do not have bank accounts. This implies that even if CBDCs offer low fees or no fees at all, unbanked individuals may still choose to remain outside the formal financial system (Maniff, 2020a; Didenko and Buckley, 2021; Van Roosebeke and Defina, 2021; Infante et al., 2022).

(8) CBDC design may not prioritize financial inclusion

Central banks may prioritize features other than financial inclusion, such as monetary and financial stability. However, if financial inclusion is not a priority, the CBDC may fail to achieve this goal (Ozili, 2021; Maniff, 2020a, 2020b).

For instance, advanced economies do not prioritize financial inclusion through the implementation of a CBDC, as these countries already have high levels of financial inclusion (Engert and Fung, 2017; Boar et al., 2020). However, this is not the case in developing and emerging economies. Therefore, the design of CBDCs in these countries should prioritize financial inclusion as a primary objective; otherwise, it may be overlooked and not effectively achieved if treated as a secondary concern.

(9) Digital and financial illiteracy

Digital literacy is the capability to independently read and navigate digital content, as well as the skills and knowledge to access and utilize digital products and services like mobile phones, tablets, or the internet (AFI, 2021).

Financial education refers to the awareness and understanding of financial concepts and products necessary for managing personal finances, taking into account an individual's economic and social circumstances. It also includes knowledge of the risks associated with using financial products and services, along with the ability, motivation, and confidence to apply this knowledge when making financial decisions (AFI, 2022b; OECD, 2022).

When individuals lack both digital and financial knowledge, it creates a situation marked by digital illiteracy and financial illiteracy. People who do not possess a basic understanding of digital tools and financial concepts are unlikely to comprehend how to use a CBDC (Raghuveera, 2020; Ozili, 2021; Didenko and Buckley, 2021; Van Roosebeke and Defina, 2021). Consequently, this digital currency will not contribute to their financial inclusion. Therefore, initiatives aimed at improving the digital and financial literacy of the population are essential for the success of a CBDC (Infante et al., 2022; Auer et al., 2022).

Numerous central banks emphasize the importance of financial literacy campaigns and initiatives in promoting the adoption and use of CBDCs (Auer et al., 2022). Some of these institutions have already implemented financial education programs, such as the Central Bank of Nigeria (CBN) (Auer et al., 2022) and the Central Bank of Brazil (CBB, 2024b).

3 Drex, the Brazilian CBDC

Drex is the Brazilian digital currency, initially known as "Real Digital"¹⁰. As a typical CBDC, Drex functions as the official currency in a digital format, possessing the same value and acceptance as the traditional real.

Regulated and issued by the Central Bank of Brazil, Drex carries the same guarantees and security as the physical Brazilian currency (called real) and requires a bank or another institution regulated by the Central Bank to serve as a financial intermediary. This intermediary is responsible for transferring funds deposited in an account to the Drex digital wallet, enabling the depositor to securely conduct transactions with digital assets (CBB, 2023b).

The CBB will issue both wholesale Drex and retail Drex. The wholesale Drex will be used solely among financial and payment institutions and will be backed by the Central Bank. In contrast, retail Drex will be a tokenized version of the real, backed by bank deposits or wholesale Drex, and will also carry the Central Bank's guarantee. Unlike wholesale Drex, retail Drex will be utilized by individuals and businesses to conduct transactions using this CBDC,

¹⁰ See footnote 2.

always with the intermediation of financial or payment institutions (CBB, 2023a). All of this will occur within the Drex Platform (see Figure 1, Section 3.1), which is currently being developed by the CBB.

As of now, Drex has not yet been launched, and no concrete data is available. Therefore, this analysis will focus on the regulatory framework and official reports published to date regarding Drex by the CBB, with an emphasis on the dimension of financial inclusion, rather than on actual data, since none exists at this time.

To better introduce the topic, the next section provides an overview of the development process of Drex (Section 3.1). Following that, the paper discusses Drex from the perspective of financial inclusion, drawing on the literature regarding potential benefits and challenges, considering the Brazilian context (Section 3.2).

3.1 Development process of Drex

The Central Bank of Brazil began researching digital currencies in 2018 with the aim of promoting the digital evolution of the Brazilian economy (CBB, 2023a). According to the CBB, the intention behind creating a CBDC is to "establish a market infrastructure under the governance and regulation of the Central Bank, where technologies such as programmable money and smart contracts will be available to foster the development of new business models" (CBB, 2023a, p. 153).

In August 2020, the CBB established a Work Group to study the implementation of Drex, specifically to identify risks and opportunities associated with its launch (CBB, 2020a; CBB, 2023b). In 2023, this group outlined nine guidelines for the Brazilian CBDC (CBB, 2023b, 2023f)¹¹:

¹¹ In 2021, the Work Group established ten guidelines (CBB, 2021a, 2021b): (1) emphasis on the potential for developing innovative models through technological advancements, such as smart contracts, the Internet of Things (IoT), and programmable money; (2) provision for use in retail payments; (3) capability to conduct online operations and, eventually, offline operations; (4) issuance by the CBB as an extension of physical currency, with distribution to the public intermediated by custodians of the National Financial System (SFN) and the Brazilian Payment System (SPB); (5) absence of remuneration; (6) assurance of legal security in its operations; (7) adherence to all principles and rules of privacy and security determined, particularly by the Bank Secrecy Law (Law No. 105/2001) and the Brazilian General Personal Data Protection Law (Law No 13,709/2018); (8) technological design that fully complies with international recommendations and legal standards for preventing money laundering, terrorism financing, and the proliferation of weapons of mass destruction, including compliance with court orders to trace illicit operations; (9) adoption of a solution that allows for interoperability and integration aimed at facilitating cross-border payments; and (10) adoption of resilience and cybersecurity standards equivalent to those applicable to critical financial market infrastructures. In 2023, these guidelines were updated to incorporate everything that had been discussed and debated up to that point. These new guidelines are the ones reflected in the current text.

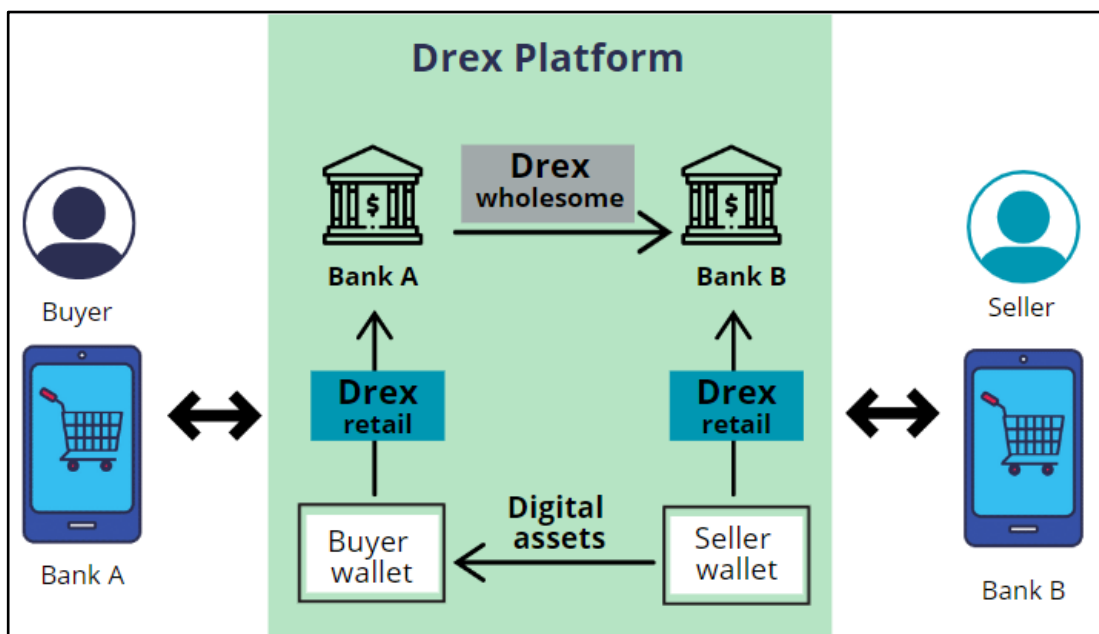
1. Emphasis on developing innovative models that incorporate technologies such as smart contracts and programmable money;
2. Focus on developing online applications while also considering the potential for enabling offline payments;
3. Issuance of wholesale Drex by the Central Bank as a payment method to facilitate the provision of retail financial services settled through retail Drex;
4. Application of existing norms and regulations to operations conducted on the Drex platform to avoid regulatory asymmetries¹²;
5. Assurance of legal certainty for transactions carried out on the Drex platform;
6. Guarantee of privacy and security principles in accordance with Brazilian legislation, particularly the Bank Secrecy Law (Law No. 105/2001) and the Brazilian General Personal Data Protection Law (Law No 13,709/2018);
7. Technological design that ensures full compliance with international recommendations and legal standards aimed at preventing money laundering, terrorism financing, and the proliferation of weapons of mass destruction, including adherence to court orders for tracking illicit activities;
8. Implementation of a technology solution based on Distributed Ledger Technology (DLT) that facilitates: (a) the initial registration of various types of assets; (b) decentralization in delivering products and services; (c) interoperability with legacy domestic systems and with other systems for data registration and transfer, as well as trading of regulated digital assets; and (d) integration with systems in other jurisdictions to enable cross-border payments;
9. Implementation of resilience and cybersecurity standards comparable to those applied to critical financial market infrastructures.

According to the CBB (2023b, p. 4), “these guidelines aim to design a more open financial system that can bring new services and technologies to a broader segment of the population, promoting a greater level of financial inclusion through the democratic availability of investment, credit, and insurance tools, among others”.

¹² This guideline refers to the possibility of remuneration for Drex. As will be explained in Section 3.2.2.2, Drex was initially intended to be non-interest-bearing, but the CBB decided that the presence or absence of interest will depend on the purpose of Drex. In practice, the goal is to achieve parity with the current system in Brazil to avoid causing asymmetries.

As mentioned in the eight guideline, Drex will have its own platform, called “Platform Drex”, which will be issued and operated by the Central Bank, utilizing Distributed Ledger Technology (DLT). Within this platform, Drex will enable various types of secure financial transactions with digital assets and smart contracts (CBB, 2023b). It is also expected that this platform will enhance the efficiency of financial service delivery (CBB, 2023a).

Figure 1. Drex Platform



Source: based on CBB (n.d.(b)).

In November 2021, the Central Bank of Brazil, in partnership with the National Federation of Central Bank Employees' Associations (Fenasbac), launched the "LIFT Challenge Real Digital"¹³ to initiate the "Proof of Concept" (PoC) phase of the Brazilian CBDC project. The purpose of this initiative was to promote technological innovation through research projects focused on the financial industry, aiming to evaluate use cases for the Brazilian CBDC and assess its technological feasibility (Fenasbac and CBB, n.d.).

This initiative involved the participation of banks, payment institutions, and fintechs to develop a minimally viable product (MVP) that addresses different features for Drex and

¹³ This initiative took place within the framework of the "Laboratory of Financial and Technological Innovations" (LIFT), a joint initiative between the Central Bank and Fenasbac, created in 2018. The goal of LIFT is to foster innovation in the National Financial System by encouraging the creation of technological solution prototypes for the National Financial System (CBB, n.d.(a)). The "LIFT Challenge" is a special edition of LIFT that focuses on a specific topic. Currently, this specific topic is Drex (formerly known as Real Digital). Therefore, the current project for the "LIFT Challenge" is called "LIFT Challenge Real Digital."

propose innovative solutions that benefit both the National Financial System and the Brazilian population (Fenasbac and CBB, n.d.).¹⁴⁻¹⁵.

A total of 47 proposals were submitted, of which 9 were selected¹⁶. While all selected proposals are relevant to the development of the Brazilian CBDC, the proposal from the company Giesecke + Devrient stands out in terms of financial inclusion, considering that its focus was on the development of dual offline payments (enabling both payer and receiver to transact without internet access) using CBDC (CBB, 2022).

Following the Proof of Concept phase, in 2023 the CBB initiated the pilot phase of its CBDC. This new phase aims to effectively test operations using Drex, with the goal of “validating the use of a DLT platform solution by assessing programmability with financial assets and ensuring compliance with legal and regulatory requirements regarding the privacy of information for individuals and other parties involved in transactions on this platform” (CBB, 2023b, p. 6)¹⁷.

The pilot phase of Drex includes three types of participants: (1) financial institutions and payment institutions¹⁸; (2) simulated end users who will conduct retail transactions through Drex; and (3) the National Treasury Secretariat (STN), which will issue Federal Public

¹⁴ Here, a brief explanation of the process for the LIFT Challenge Real Digital is warranted (Fenasbac and CBB, n.d.). First, the CBB presents a topic (the so-called challenge) for the development of a minimally viable product (MVP). Interested parties looking to develop an MVP must submit proposals. Next, the CBB and Fenasbac select the best proposals. Over four months, there are frequent meetings between the CBB and Fenasbac to discuss, evaluate, and monitor the development of the projects. Finally, the last stage involves presenting the results to the public.

¹⁵ As a point of further detail, the LIFT Challenge Real Digital prioritized projects addressing the following themes (Fenasbac and CBB, n.d.): (1) Delivery versus Payment (DvP): Focused on the settlement of transactions involving digital assets, whether they are native to the digital environment or tokenized; (2) Payment versus Payment (PvP): Aimed at facilitating exchanges between currencies; (3) Internet of Things (IoT): Targeting direct settlements through algorithms or machine-to-machine interactions; (4) Decentralized Finance (DeFi): Concentrating on defining protocols for settlement based on a CBDC, as well as compliance and supervisory requirements established in the regulation.

¹⁶ Regarding the other eight selected proposals and their respective proponents (CBB, (n.d.(b)), 2022): (1) Mercado Bitcoin, Bitrust and CPqD, project focused on Delivery versus Payment (DvP) for digital assets, emphasizing cryptocurrencies; (2) Febraban, project centered on DvP of financial assets; (3) Itaú Unibanco, B3 and R3, project aimed at cross-border payments, using the payment versus payment (PvP) method with Colombia; (4) Banco Santander Brasil, project involving DvP and tokenization of vehicles and real estate; (5) Tecban and Capital, project that offers a logistics solution for e-commerce based on Internet of Things (IoT) techniques; (6) VERT, Digital Assets and Oliver Wyman, project focused on rural financing based on a programmable stablecoin pegged to the Real Digital; (7) Aave, project centered on a liquidity pool with a focus on lending and compliance based on decentralized finance (DeFi) tools; (8) Visa do Brasil, Consensy and Microsoft, project aimed at financing for small and medium-sized enterprises based on a DeFi solution.

¹⁷ One of the primary concerns the Central Bank of Brazil has sought to address is how user privacy would be safeguarded with the use of the CBDC. Brazil has a comprehensive regulatory framework regarding individual privacy rights and the transparency of public authorities. Therefore, the infrastructure of Drex within a DLT network must ensure that this framework is not violated (CBB, 2023b).

¹⁸ Interested institutions were required to submit proposals demonstrating their interest in participating in the Pilot Project (over 100 proposals were submitted). The CBB selected 14 interested institutions and intends to gradually include more institutions in the Pilot Project (CBB, 2023e).

Securities and settle transactions involving these securities using Delivery versus Payment at the end-client level (CBB, 2024c). When the Central Bank determines that the pilot project has reached an adequate level of maturity, it will advance this testing phase to also include the general population (CBB, 2024c).

During the development of Drex, the CBB also established the "Drex Forum" and conducted workshops. The aim of these initiatives is to facilitate regular communication with the public, enabling consultations and information exchanges regarding the Brazilian CBDC (CBB, 2023b).

As for the potential benefits, the CBB identifies five main positive outcomes expected from the Brazilian CBDC (CBB, 2023a, 2023c). First, it aims to enhance the efficiency and security of financial transactions through the Drex Platform. Second, it seeks to reduce transaction and operational costs associated with the creation and management of financial products and services, thereby enabling these products and services to be offered at lower prices to individuals and businesses. Third, to promote competition among financial service providers. Fourth, to enhance access for small businesses to the capital markets. Last but not least, to advance financial inclusion. Since this is the focal point of this paper, the next section (3.2) will be dedicated to discussing this topic.

3.2 Drex and financial inclusion

The CBB identifies financial inclusion as one of the primary goals of the Brazilian CBDC (CBB, 2023c). According to the Central Bank, “Drex contributes to financial inclusion in Brazil by democratizing the population's access to services such as investments, financing, and insurance. The platform will operate with digital assets and smart contracts, among other functionalities, facilitating the provision of more efficient and secure financial services and products” (CBB, 2024b, p. 98).

With Drex, the CBB aims to create a more open and democratic financial system that incorporates new technologies and services, enabling a broader segment of the population to participate in it (CBB, 2023a).

One of the main approaches the CBB has adopted to achieve this goal is the incorporation of financial transactions and “tokenized” assets through the implementation of a decentralized finance (DeFi) ecosystem (CBB, 2023a). According to the CBB (2023a), the DeFi model facilitates the standardization and interoperability of the system, leading to a reduction in costs associated with the creation and management of financial products and

services. Additionally, the model allows for a high degree of auditability, traceability, and transparency, ensuring proper oversight and regulation by the CBB (including measures to prevent crimes such as money laundering and terrorism financing) (CBB, 2023a).

Another important aspect of financial inclusion is to test the use of CBDC in an offline mode. While there is currently no information on how this feature will operate, it is on the CBB's agenda, as noted on the third guideline of Drex (“focus on developing online applications while also considering the potential for enabling offline payments”) (CBB, 2023b) and was even subject to testing during the PoC phase (CBB, 2022), as previously highlighted.

Although the CBB considers financial inclusion to be one of the objectives of its CBDC, it is an ambitious project with several other goals in mind. Furthermore, as Drex is still in the development phase, it remains unclear whether the expected outcomes will be realized in practice. Currently there is no in-depth analysis from the CBB regarding the impact of Drex on the financial inclusion of the population.

In the literature, the situation is similar. Drex and financial inclusion is still an incipient topic, with only a few works highlighting financial inclusion as a potential benefit of Drex (Barroso, 2023; Nóbrega and Rodrigues, 2023; Lopes, 2024), while others provide slightly more insight into the subject (Sanchez and Diniz, 2024; Souza et al., 2024).

Before delving into the discussion of the potential benefits and challenges related to Drex and financial inclusion, it is important to present a brief overview of the Brazilian context (Section 3.2.1) to provide a foundation for the subsequent analysis of whether and how Drex can contribute to the financial inclusion of the Brazilian population, as well as the challenges in achieving this goal (Section 3.2.2).

3.2.1 A brief overview of the Brazilian context

Brazil has a population of 212.6 million people (Agência IBGE, 2024)¹⁹, making it the 7th most populous country in the world²⁰ (Worldometers, 2024). It is a federal country, composed of a federal government (referred to as the Union), 26 states (plus the Federal District), and more than 5,500 municipalities, spread across a territory of 8.5 million km² (World Bank Group, 2024)²¹.

¹⁹ Data as of July 2024.

²⁰ The country is only ranked behind: (1) India; (2) China; (3) the United States; (4) Indonesia; (5) Pakistan; and (6) Nigeria (Worldometers, 2024).

²¹ As a comparison, Brazil is almost twice the size of the area of the European Union, which totals approximately 4.25 million km² (World Bank Group, 2023).

The country is marked by significant social inequalities. In 2022 (the year for which the most recent official data is available), there were 67.8 million people living in poverty and 12.7 million in extreme poverty (Agência IBGE, 2023). Furthermore, in 2023, the wealthiest 1% of the population had a per capita monthly income that was 31.2 times higher than that of the poorest 50% (CEBRAP and ABCD, 2024, p. 4).

Regarding internet access, a recent study reveals that 84% of the population uses the internet, while 16% have no access at all (CGI.br, 2024, p. 21). This may seem like a small percentage, but considering Brazil's large population, this proportion represents around 34 million people, which is roughly three times the population of Portugal (Worldometers, 2024).

Moreover, of the 84% who have internet access, 56% lack the minimum conditions for adequate connectivity, such as sufficient speed, availability of devices, reliable connections, regular usage, digital skills, and other critical aspects (CGI.br, 2024, p. 20). Therefore, access to the internet is far from universal.

Comparing urban and rural areas in terms of connectivity, 54% of the population living in rural areas has limited or no access, while 30% of the urban population faces similar issues (CGI.br, 2024, p. 107).

Despite the country's socio-economic inequality, Brazil has a high number of individuals with bank accounts. In 2021, 84% of adults held accounts for financial transactions. This rate is close to that of developed countries, where at least 89% of the population has transactions accounts (Demirgüç-Kunt et al., 2021, p. 15), and is above the global average of 76% (Findev Gateway, 2021) and the Latin America and Caribbean average of 73% (Findev Gateway, 2021).

This high rate of account ownership in Brazil is largely due to the digitalization of the financial ecosystem, driven by Brazilian financial regulators, particularly the Central Bank. Key initiatives include the creation of the instant payment system, called Pix²², in 2020; and the implementation of open finance (former open banking) in 2021.

With this brief overview of the Brazilian landscape, the next section will present the main analysis of this paper: Drex and financial inclusion.

²² Pix has been the biggest driver of the increase in the number of account holders, as it quickly became extremely popular among Brazilians (CBB, 2023a). Section 3.2.2.1 provides more details about this instant payment system.

3.2.2 Drex: Bridging the Gap in Financial Inclusion or Widening the Divide?

The analysis of whether Drex has the potential to promote financial inclusion in Brazil will be based on the potential benefits and possible barriers outlined in Section 2. This analysis will also take into account the characteristics of the Brazilian context.

3.2.2.1 Drex and financial inclusion: potential benefits

In Section 2.1.1, five potential benefits highlighted by the literature on CBDCs for improving financial inclusion were listed: (1) low transaction costs; (2) improve access to digital financial services; (3) enhance efficiency of digital payments; (4) possibility to be offered offline; (5) incentivise the digitization of the value chains.

In the following paragraphs, an analysis will be conducted to explore if and how these potential advantages might manifest in the Brazilian context, based on current knowledge of the Brazilian CBDC.

First, low transaction costs. One of Drex's primary goals is to reduce transaction costs. The CBB's intention to create the "Drex Platform" using Distributed Ledger Technology is specifically aimed at automating processes to achieve this. The CBB expects that the reduction in transaction costs will lead to more affordable financial services for the population (2023c).

It is also worth noting that, according to the CBB (2024a), Drex will have costs, but these are expected to be lower than those currently practiced in the market. However, the CBB has not yet released any specific information about the amount of these costs or how they will be calculated. Therefore, it will be necessary to wait for Drex's implementation to determine whether the cost reduction will indeed be an advantage that contributes to financial inclusion, or if, on the contrary, it will become an obstacle.

Second, improving access to digital financial services. As mentioned earlier, Brazil has been actively promoting the digitalization of its financial ecosystem. One of the most successful initiatives has been Pix²³, the instant payment system launched by the CBB in 2020, which allows cost-free²⁴ transactions between individuals, businesses, and government entities

²³ For more about Pix, see: CBB (n.d.(c)); BRICS (2021); World Bank Group (2022b); IMF (2023).

²⁴ The rule of no costs for conducting transactions with Pix has two exceptions (CBB, 2020b): (1) for businesses when they use Pix; and (2) if a natural person receives more than 30 Pix transactions per month, from the 31st transaction onward, a fee may apply, as it will be considered that the individual is engaging in commercial activities and thus equated to a legal entity (subject to fee charges), rather than being classified as a mere consumer.

at any time, including weekends and holidays (CBB, 2020b). The CBB serves as both the regulator and overseer of Pix.

Pix has made digital payments quick, easy, and cost-free, which is why it has become extremely popular since its launch and helped to increase the number of account ownership in Brazil (CBB, 2024d, p. 84)²⁵. As a result, it has facilitated greater access for Brazilians to digital financial services.

In light of this, regarding the potential benefit of improving access to digital financial services, Drex will be introduced into a scenario where the majority of Brazilians already own a transaction account and, in theory, can have greater access to digital financial services. This will probably facilitates one of Drex's key objectives to further expand and simplify access to these services, by using DLT, smart contracts, and promoting Drex's interoperability feature with other systems. The goal is to foster the development of new business models and promote the use of smart contracts (CBB, 2024a). This could not only simplify and enhance public access to financial services but also expand the range of digital financial services currently offered, while making them more secure.

Third, enhancing the efficiency of digital payments. This is a common feature of CBDCs, whether in advanced or emerging economies, and refers to the efficiency of both domestic and cross-border payments (Boar et al., 2020). In this case, considering the focus on financial inclusion in the Brazilian context, the analysis will focus on the domestic payment dimension.

For this topic, it is important to revisit the discussion on Pix. When Brazil introduced this instant payment system, there was a noticeable improvement in the efficiency of digital payments. Transactions became instant and free of charge²⁶, and it also helped reduce the concentration within the banking system, increasing market competition (BIS, 2022b; World Bank Group, 2022b; IMF, 2023).

Therefore, it is worth reiterating what was mentioned before about the potential benefit of enhancing digital financial services: Drex will be introduced into a scenario where the efficiency of digital payments has already been observed due to Pix. It will be necessary to wait and see if the CBDC will receive the same positive reception from the Brazilian population as

²⁵ According to the CBB (2024d, p. 84), “The number of active users grew by 103.2% from June 2018 to December 2023. The number of individual customers increased from 77.2 million (46.8% of the adult population) to 152.0 million (87.7% of the adult population), representing a 97.0% increase in the customer base. Among legal entities, which include individual micro-entrepreneurs, there was an expansion from 3.4 million to 11.6 million customers, translating to a growth rate of 244.5% during this period”.

²⁶ See footnote 24.

Pix did, and how the interoperability between the two systems will function. This seems essential for Drex's widespread acceptance and is a stated goal of the Central Bank of Brazil.

With the goal of increasing the Brazilian population's receptiveness and creating a favorable environment for the introduction of Drex, it is worth noting that the CBB has been actively communicating with the public about what CBDC is, how it differs from Pix, how Pix and Drex can be interoperable, and how this new digital currency can make life easier for citizens and bring greater security to financial transactions. This has been done through educational and informative videos as well as on the CBB's official website (CBB, n.d.(b), 2023c).

Fourth, CBDCs can be offered offline. The CBB intends to provide an offline feature for Drex, though this is not expected to be available at the time of its implementation (CBB, 2024a). This aspect has been under discussion and was one of the projects in the Proof of Concept phase, presented by Giesecke + Devrient, focusing on developing dual offline payments (as detailed in Section 3.1).

Considering Brazil's vast size, the country's social inequality, and the lack or poor quality of internet in rural and remote areas (see Section 3.2.1), this should be a priority for the Central Bank, especially to ensure financial inclusion for the population living in these areas.

Fifth, the digitization of the value chains in the economy. The CBB does not explicitly address this possibility (at least not in these terms). However, the ability to carry out programmable transactions through smart contracts, the interoperability, and the cost reductions promised by the Drex project could incentivize small businesses and farmers to digitize their value chains in order to take advantage of these benefits.

If Drex does indeed encourage this digitization, there is the potential for reduced logistics costs, increased revenues, and even easier access to financial services aimed at business growth. However, for this digitization to be feasible and contribute to the financial inclusion of these small businesses, it is crucial to ensure access to the internet, along with financial and digital literacy, especially for small businesses located in rural and remote areas.

3.2.2.2 Drex and financial inclusion: potential barriers

In Section 2.1.2, nine possible barriers were listed as reasons why a CBDC may not promote financial inclusion: (1) the high cost of digital devices and data plans for poor and low-income individuals; (2) non-interest-bearing CBDCs; (3) a preference for cash over digital currency; (4) regulatory requirements for CBDC identification; (5) low transaction costs

(compared to no costs at all); (6) high levels of digital exclusion; (7) lack of trust in financial institutions; (8) CBDCs designs that do not prioritize financial inclusion; and (9) digital and financial illiteracy.

This section focuses on discussing whether these possible barriers may arise when the CBB launches the Brazilian CBDC. As in the previous section, the barriers will be analyzed in light of the Brazilian context and what the Central Bank of Brazil (CBB) has planned for Drex.

First, the high cost of digital devices and internet services for poor and low-income people. A recent 2024 study by the Getulio Vargas Foundation (FGV) indicates that Brazil has 480 million devices in use (both corporate and personal), averaging 2.2 digital devices per person (Meirelles, 2024, p. 9). Of these devices, 54% are smartphones, and 46% are computers (including tablets, notebooks, and desktops) (Meirelles, 2024, p. 9). The study also notes that Brazil has more smartphones than inhabitants, with 1.8 smartphones per Brazilian (Meirelles, 2024, p. 143 and 155).

These data indicate that smartphone ownership are indeed widespread in Brazil. However, these figures must be considered alongside statistics that reveal the other side of the story. In 2023, 88% of the Brazilian population owned at least one mobile phone (Nic.br, 2024), meaning that 12% of the population had no mobile phone at all. When broken down by social class, 94.6% of the population in middle and high-income groups owned at least one phone (Nic.br, 2024), while 78% of the low-income population had a mobile phone (Nic.br, 2024).

Another issue is the cost of internet access in Brazil. For 80% of the population, the cost of an internet connection at home exceeds 2% of their household income (CGI.br, 2024, p. 102). For low-income households, internet access can be a significant burden on the monthly budget. From an individual perspective, 75% of the low-income population uses prepaid mobile plans, which are generally cheaper but provide limited internet data packages (CGI.br, 2024, p. 22).

As previously mentioned (Section 3.2.1), 84% of the population uses the internet, while 16% have no access at all (CGI.br, 2024, p. 21). Was also noted that of this 84%, 56% lack the minimum conditions for adequate connectivity (CGI.br, 2024, p. 20), meaning that internet access in Brazil is far from universal. However, to use CBDCs, individuals need an internet connection (if there is no offline feature). Consequently, this may be an issue for the full use of Drex, especially in remote and rural areas where the quality of the connection is poorer.

Therefore, considering the Brazilian context, the cost of electronic devices does not appear to be a significant barrier for the general population; the issue of cost is more prominent when it comes to the price of network services needed to access the internet.

Second, non-interest-bearing CBDCs can limit financial inclusion. In 2021, when the CBB released the first set of guidelines for Drex²⁷, it was initially projected to be a non-interest-bearing CBDC (CBB, 2023b), following the trend of most CBDC projects in development (Tan, 2023; Bibi and Canelli, 2024; Bindseil and Senner, 2024).

However, the current guidelines for the Brazilian CBDC (see section 3.1) have changed this initial plan (CBB, 2023b; 2023c). The CBB now proposes that Drex may or may not bear interest, depending on the role it is designed to perform. For instance, if Drex functions as an voluntary reserve, it will accrue interest. On the other hand, if Drex is used as part of mandatory reserve for deposits, the currently rule would applied, i.e., it will not be remunerated²⁸ (CBB, 2023b). The justification for this change is to allow flexibility in accommodating different uses of the CBDC (CBB, 2023b).

Additionally, the CBB intends to maintain the intermediation in its CBDC project, ensuring that financial and payment institutions continue to act as intermediaries between consumers and the Central Bank. As a result, there would be no significant changes to the current system in place in Brazil. The CBB argues that this arrangement could alleviate potential concerns about disintermediation, while also ensuring space for innovation and the continuation of the current partnership between the Central Bank and regulated institutions in providing liquidity to the economy (CBB, 2024a).

Third, people prefer cash over digital currency. Currently, cash is not the preferred payment method for Brazilians. In this regard, Pix, the country's instant payment system, is worth mentioning again. According to research from the CBB, since the introduction of Pix, Brazilians have been using less and less cash (CBB, 2023a, p. 129-135). Therefore, in the Brazilian context, this barrier is unlikely to hinder the introduction of Drex. The exception to this scenario is in areas with little or no connectivity, where the use of digital or electronic payment methods is not possible. This underscores, once again, the importance of an offline feature for Drex.

Fourth, regulatory requirements regarding CBDC identification can be a barrier to the financial inclusion of some individuals. The exact number of people without civil registration

²⁷ See footnote 11.

²⁸ Compulsory deposits are a monetary policy instrument used by the CBB to control the liquidity of the financial system and its capacity for credit expansion. This instrument involves establishing a percentage of deposits that each bank must maintain at the Central Bank relative to the deposits it collects. Compulsory deposits, when derived from demand deposits, do not earn interest for the depositing bank. In addition to controlling the liquidity of the system, another objective of compulsory deposits is to create a mandatory liquidity cushion for banks, ensuring that they do not face cash shortages during atypical withdrawals by their depositors (Senado Federal, n.d.).

in Brazil is unclear, but it is estimated that, between 2015 and 2021, at least 552,000 children were not registered (IBGE, 2022, p. 4). These "invisible people" go unregistered for various reasons - poverty, social exclusion, the distance between the place of birth and the civil registry office (especially given Brazil's vast size), or the costs associated with completing the registration process (Netto, 2018).

Although it represents a small portion of the Brazilian population - especially considering the global total of 850 million people (Clark et al., 2023) -, the lack of official ID is an issue in the country. These individuals need to be included not only in the financial system but in society as a whole. This is a problem that requires actions beyond the scope of a financial regulator's work in implementing a CBDC, as it involves various other sectors of society that must collaborate to ensure these individuals are properly registered²⁹. Thus, the lack of identity is a barrier for these people in accessing Drex³⁰.

Fifth, low transaction costs may not be enough to ensure financial inclusion. According to the CBB, Drex will incur costs, but these will be lower than those currently practiced in the market (CBB, 2024a). In Brazil, the issue of costs and payment methods has a particular nuance. The implementation of Pix has significantly increased the number of account owners in the country (CBB, 2024d, p. 84). Therefore, if Brazilians can already transfer funds via Pix without incurring any transaction fees, why would they choose to use Drex?

If Drex is integrated with Pix, it would mean that this CBDC could be transferred through the Pix system (since Pix is a payment method). This integration aligns with the CBB's intentions to enable interoperability between the Brazilian CBDC and existing payment methods available to the population (CBB, 2024a). Therefore, it is reasonable to assume that this type of transaction, combining Pix and Drex, will incur no costs (since, as mentioned earlier, users currently do not pay to make a transaction with Pix). However, the CBB has not yet clarified whether this cost-free arrangement will remain with the integration of Pix and Drex.

Despite the possibility of Drex being cost-free when integrated with Pix, other potential uses of Drex may incur costs. For example, one feature planned for Drex is its utilization in conjunction with smart contracts, which allow financial transactions to be completed only when all conditions of the agreement are met, providing security for all parties involved (CBB,

²⁹ Different Brazilian institutions have been addressing this issue for some time, which is evident in the decreasing number of unregistered individuals over the years (IBGE, 2019).

³⁰ Although the lack of identity can impede or hinder access to the CBDC, it is important to recognize that the absence of an official ID creates far more serious problems than merely being unable to use a CBDC.

2023c). This system could be used for purchasing vehicles or real estate with Drex. However, since these costs have not yet been defined, it remains uncertain whether such costs (even if lower than those currently practiced in the market) will indeed pose a barrier to the population's adoption of Drex and, consequently, to financial inclusion.

Sixth, a high level of digital exclusion can limit the goal of financial inclusion. This barrier is evident in the Brazilian context. As mentioned earlier, although 84% of the Brazilian population can access the internet, 56% of this total do not have adequate access due to a lack of suitable conditions such as speed, device availability, and reliable connectivity (Nic.br, 2024, p. 20). Furthermore, 16% of the population has no internet access, representing 34 million digitally excluded Brazilians (CGI.br, 2024, p. 21).

Thus, digital exclusion is an issue that must be addressed for Drex to genuinely facilitate financial inclusion for those who are currently digitally excluded.

Seventh, lack of trust in financial institutions. This does not appear to be a prominent barrier in Brazil. A survey conducted in 2022 by the Brazilian Federation of Banks (Febraban) indicated that 57% of the population trusted banks, while 35% did not (8% had no opinion on the matter) (Febraban, 2022, p. 23). Regarding fintechs, 55% of the population expressed trust in these types of companies, compared to 34% who did not (11% had no opinion) (Febraban, 2022, p. 23). Additionally, a 2023 survey by Edelman Trust across 28 countries found that 71% of the Brazilian population trusts the banking sector (Edelman Trust, 2024, p. 23).

Another survey conducted in 2023 indicates a significant level of trust among the Brazilian population in the Central Bank, with 33% expressing high confidence in this financial regulator, while 40% have some degree of trust; 11% reported having very little trust, and 13% stated they have no trust at all (IPEC, 2024, p. 4). This means that 73% of the population has some degree of trust in the CBB.

These numbers suggest that the lack of trust in financial institutions may not be a barrier to the adoption of Drex for Brazilians. On the contrary, they appear to indicate a potentially positive scenario for the launch of the Brazilian CBDC.

Eighth, the design of CBDCs might not prioritize financial inclusion. As presented in Section 3.1, the CBB has several objectives for the implementation of Drex, one of which is financial inclusion. However, based on the material provided by the CBB regarding Drex, it does not currently seem possible to ascertain whether this is a priority compared to other objectives. Since this digital currency has yet to be implemented, it is necessary to wait and see if the final design adopted by the CBB truly incorporates financial inclusion as a priority.

The ninth barrier (and last one of the list) to financial inclusion is the digital and

financial illiteracy of the population. This is a significant issue, and the CBB is aware of it. A survey conducted by the CBB in 2023 found that the average financial literacy level of the Brazilian population is 59.6% (CBB and FGC, 2023, p. 101). When breaking down this figure by gender, age, and income, the results are even worse among women, the elderly, and low-income individuals³¹ (CBB and FGC, 2023, p. 101).

In terms of digital financial literacy, the average for the population is 62.9%, a figure that also varies when comparing income, gender, and age of the respondents³² (CBB and FGC, 2023, p. 108-109).

The CBB concludes in this research on financial and digital literacy that there is a need to address different aspects of the population's financial education to enhance their financial well-being, particularly concerning specific groups such as women, the elderly, and low-income individuals (CBB and FGC, 2023).

Indeed, the CBB has developed measures aimed at improving the financial education of the population, such as the "Aprender Valor" project, which seeks to provide financial education to students in public schools. It also offers personal finance management courses on its official website and collaborates with other financial institutions to encourage them to implement financial education initiatives for their clients (CBB, 2024b, p. 33). However, there is still insufficient data to determine whether the initiatives implemented so far are adequate to increase the level of digital and financial literacy among the Brazilian population.

Only after the implementation of Drex will it be possible to assess whether these financial education initiatives are effective and whether they will enable Brazilians to use the Brazilian CBDC appropriately.

4 Conclusion

This paper aimed to explore how CBDCs could enhance financial inclusion in developing and emerging economies and to conduct a case analysis of Drex, the Brazilian CBDC. The intention of this case study was to evaluate Drex's potential to promote financial

³¹ When comparing financial literacy levels between men and women, the figures show that women have a score of 57.8% compared to 61.8% for men. Additionally, examining financial literacy by age reveals a level of 53.6% for individuals over 60 years old and 64.2% for those aged 16 to 34. Regarding income, the financial literacy level for individuals earning up to two minimum wages is 56%, while those earning more than five minimum wages have a score of 64.3% (CBB and FGC, 2023, p. 101).

³² Regarding the level of financial literacy, the following disparities are observed: women (62.4%) vs. men (63.5%); individuals over 60 years old (55.5%) vs. individuals aged 16 to 34 (66.75%); and individuals earning up to two minimum wages (60.1%) vs. those earning more than five minimum wages (66.3%) (CBB and FGC, 2023, p. 101).

inclusion in Brazil, considering the potential benefits and challenges associated with a CBDC designed for this purpose.

Regarding the potential benefits identified in the literature (low transaction costs, improved access to digital financial services, enhanced efficiency of digital payments, the possibility of being offered offline, and incentivizing the digitization of value chains), the analysis concluded that the Drex project currently under development has a strong likelihood of realizing these benefits. One contributing factor is that the Brazilian population is widely using Pix, an extremely popular instant payment tool in Brazil (CBB, 2024d). This tool has played a significant role in reducing the use of cash among the Brazilian population and has contributed to increase access to account ownership in Brazil (CBB, 2024d). For those reasons, Drex will find a favorable environment for its introduction.

However, Brazil continues to be a country marked by socioeconomic inequalities. In this context, several barriers that may hinder a CBDC's ability to contribute to financial inclusion could also apply to Drex. Notably, in the case of this Brazilian CBDC, these include the high cost of internet plans, the lack of civil identification, a significant level of digital exclusion, and the absence of digital and financial literacy.

Drex has not yet been launched, and there is no set date for its release. This means that there is currently no data available to categorically confirm or refute the analyses conducted. Overall, it seems reasonable to believe that Drex, like Pix, will be implemented within a receptive ecosystem for this digital financial innovation. However, those barriers to financial inclusion for Brazilians were not addressed with Pix, and so far, it does not appear that they will be resolved by Drex. It is true that these actions require the involvement of not only the CBB but also other governmental institutions to ensure that, ideally, all Brazilians have access to adequate connectivity, improved financial and digital literacy, and civil registration.

If a central bank intends for its CBDC to effectively enhance financial inclusion, it is crucial to address the causes of exclusion (BIS, 2020a; Maniff, 2020a). In this regard, it is important for regulators to (Raghuveera, 2020): comprehend how CBDCs can meet the needs of unbanked and underbanked individuals; identify and address the underlying causes of financial exclusion; and develop an inclusive CBDC design focused on the financial needs of the population rather than those of institutions.

Considering Brazil's continental dimensions and the significant level of social inequality, there are significant barriers to improve financial inclusion with Drex. Therefore, it is essential that financial inclusion is prioritized in the design of Drex, and that Brazilian regulators (not just financial regulators like the CBB) work together to address existing social

issues (in particular towards vulnerable groups, such as low-income individuals, women, and the elderly), to prevent Drex from exacerbating the digital divide in Brazilian society and to foster a scenario of financial inclusion rather than exclusion.

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