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The International Centre for Tax and Development at the Institute of Development Studies, Brighton BN1 9RE, UK
Tel: +44 (0) 1273 606261 Fax: +44 (0) 1273 621202
E-mail: info@ictd.ac.uk
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Summary

This paper explores the potential benefits and risks to tax administrations of implementing central bank digital currencies (CBDCs), a digital version of national currencies that is gaining momentum worldwide. It outlines some of the key features of CBDCs and then considers their implications for tax administration in low- and middle-income countries (LMICs) generally. The emergence of CBDCs provides LMICs with a significant opportunity to improve financial inclusion, improve payment systems and increase tax collection. CBDCs provide greater transparency, security and traceability, which could help tax authorities track income and net worth, detect tax evasion and increase tax revenue. However, there are also complex combinations of risks associated with deploying CBDCs. The revenue authorities need to thoroughly assess how they should adapt to these challenges. Governments must also ensure that CBDCs are developed and implemented transparently, fairly and consistently with broader public policy goals. This will help maximise the potential benefits of CBDC adoption while mitigating the risks – which may be particularly significant in LMICs.

Keywords: central bank digital currencies, revenue authorities, developing countries

JEL Classification: E58, E42, O38, H26, H29

Moyo Arewa is the Programme Director at the Local Government Revenue Initiative (LoGRI) and a member of the International Centre for Tax and Development's Centre Management Team. His research has focused on understanding how digital technologies impact tax policy, administration and public service delivery. He has consulted with the World Bank's Innovations in Tax

Compliance (ITC) programme and has conducted extensive research on tax and technology, digital payment systems and digital identification for ICTD.

Celeste Scarpini is a Research Officer at the International Centre for Tax and Development and a PhD student at the Department of Economics, University of Sussex. Her main research interests relate to tax administration, from technology adoption to data management and revenue collection strategies in sub-Saharan Africa.

Kelbesa Megersa (PhD) is currently a Senior Public Finance Management expert and Programme Manager at Ecorys' International Development Unit. He specialises in tax policy and administration, PFM, development finance and private sector development in emerging economies. Previously, he worked as a researcher at various academic institutions and as a consultant for a wide range of international development partners and government ministries, offering policy support and facilitating knowledge management. He has published extensively on topics related to development finance, public finance and taxation.

Barry Cooper is a Technical Director at Cenfri, where he is in charge of the areas of payments and inclusive integrity. He has a particular interest in the development of digital payment instruments and currencies, with an emphasis on the impact of financial regulation on human rights. Barry started his career in the insurance industry before moving into banking. As Country Head of Consumer Bank Operations for a large global bank, he gained significant exposure to payment systems, wholesale and consumer banking. Barry is a legal advisor by profession.

Antonia Esser is a Senior Engagement Manager at Cenfri and she has conducted research on financial inclusion for over 12 years. Her work focuses on digital payments, with an emphasis on remittances and payment systems architecture. Her professional practice involves assisting payments stakeholders across Africa in making evidence-based decisions.

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Acronyms

AML-CFT	Anti-Money Laundering and Combating the Financing of Terrorism
API	Application Programming Interface
BIS	Bank for International Settlements
CBDC	Central Bank Digital Currency
CBOB	Central Bank of The Bahamas
Cenri	Centre for Financial Regulation and Inclusion
CICO	Cash In Cash Out
DCI	Digital Currency Institute
DFS	Digital Financial Services
DLT	Distributed Ledger Technology
ECB	European Central Bank
ECCB	Eastern Caribbean Central Bank
ECCU	Eastern Caribbean Currency Union
FSP	Financial Service Provider
GST	Goods and Services Tax
GSM	Global System for Mobile Communications
ICT	Information and Communication Technology
ICTD	International Centre for Tax and Development
ITC	Innovations in Tax Compliance
IMF	International Monetary Fund
ITAS	Integrated Tax Administration System
LMICs	Low- and Middle-Income Countries
LoGRI	Local Government Revenue Initiative
MCBDC	Multiple Central Bank Digital Currency
MIT	Massachusetts Institute Of Technology
ML/TF	Money Laundering and Terrorist Financing
MSMEs	Micro, Small and Medium Enterprises
NBER	National Bureau of Economic Research
NFC	Near-Field Communication
OECD	Organization for Economic Cooperation and Development
OMFIF	The Official Monetary and Financial Institutions Forum
PAYE	Pay As You Earn
PBOC	People's Bank of China
PII	Personally Identifiable Information
PIT	Personal Income Tax
POS	Point of Sale
PSP	Payment Service Provider
PwC	Pricewaterhousecoopers International Limited

RBI	Reserve Bank of India
RTGS	Real-Time Gross Settlement System
sCBDC	Synthetic CBDC
TAB	The Asian Banker
TRN	Taxpayer Registration Number
USSD	Unstructured Supplementary Service Data
VAT	Value-Added Tax
wCBDC	Wholesale CBDC

1. Introduction

Adopting and utilising central bank digital currencies (CBDCs) could significantly impact how revenue authorities administer various taxes and interact with taxpayers. These impacts can be positive, but not necessarily. The potential benefits of CBDCs – especially improved tax information flows – will only be realised if CBDCs are purposefully designed to accommodate revenue authorities' technical abilities. Effective upfront configuration is essential to minimise operational, privacy and compliance risks associated with implementing CBDCs. However, regrettably, CBDC-implementing agencies, primarily central banks, have largely overlooked the importance of consulting with revenue authorities while developing CBDCs.

To effectively prepare for the potential tax implications of adopting CBDCs, it is critical that revenue authorities comprehensively understand CBDCs and the key design features that could impact tax compliance. However, a significant gap exists in the current literature on CBDCs from a tax perspective. Some existing literature (Bordo and Levin 2017) has examined the features of CBDCs, finding that these digital currencies can improve monetary policy effectiveness and reduce transaction costs. Similar papers (Ahnert *et al.* 2022; Engert and Fung 2017) focus on the impact of CBDCs on the banking system, financial stability and payments – with few lessons to be drawn for tax-specific use cases. Other studies highlight the effects of CBDCs on financial inclusion (Tan 2023).

The literature on CBDCs is evidently dynamic, spanning a wide range of use cases and disciplines. This comes as no surprise, given the prevalence of CBDC pilots and studies in recent years. Despite this salience, there is insufficient evidence and analysis on the tax-specific implications of CBDCs. In reviewing their potential benefits, Allen *et al.* (2020) briefly mention that CBDCs could "broaden" the tax base, limit tax evasion and boost tax revenues by reducing the anonymity of transactions and making the tax-collection process more efficient. However, the evidence to back up these conclusions is thin, and the authors overlooked key challenges that limit the effects of digital technologies, especially in the context of tax administration.

Moreover, the literature on CBDCs is biased toward high-income countries despite there being several CBDC pilots in lower- and middle-income countries (LMICs). This paper will fill this analytical gap by assessing the tax-specific effects of CBDCs in developing countries. We will also seek to contribute to the theoretical knowledge of the role of digital technologies (Okunogbe and Santoro 2021) and third-party data sharing to improve the capacity of tax administrations

to enforce tax compliance. The studies speaking to this literature have explored the role of third-party data generated from government and public databases, bank accounts or credit cards (Brockmeyer *et al.* 2019; Eerola *et al.* 2019), but gains have resulted especially from value-added tax (VAT) (Ali, Fjeldstad and Sjursen 2021; Pomeranz 2015; Sung, Awasthi and Lee 2017). We contribute to this strand of the literature by assessing how CBDC-level data could be an additional source of information on economic activity with the potential to augment tax compliance efforts.

Beyond its academic context, this paper also has significant policy relevance. It aims to equip revenue authorities with the necessary information to engage in informed deliberations on CBDCs. Currently, about as many developing countries as developed countries are undergoing or considering CBDC pilots, and there is an urgent need for revenue authorities in these regions to join the conversation about the deployment of CBDCs and to present a view of the tax implications.[1] Feasibility studies for CBDCs play a critical role in shaping the specifications of prototypes and pilot testing, which ultimately guide broader CBDC trials and system installations. However, if tax authorities are not consulted early and frequently, their requirements may not be adequately accommodated.

The design process for CBDCs is gradual and iterative, requiring the balancing of various, sometimes competing, factors, as this paper will show. As a result, technical designers may find it more financially viable to shift the burden onto tax authorities rather than restart the feasibility modelling from scratch. Revenue authorities may consequently fail to realise potential tax system benefits or deal with a CBDC and digital payments ecosystem with new or increased risks for taxpayers.

Furthermore, while every revenue authority will likely experience challenges in successfully executing its mandate, revenue authorities in developing countries are often more constrained than their developed-country counterparts. They tend to face constraints regarding the strength of digital infrastructure and low compliance rates across various sectors, tax types and taxpayer categories.

CBDC design and related regulation should thus be carefully considered to ensure an effective barrier against abuse of CBDC value or personally identifiable information (PII) by authorities. Criminal and civil processes must also be adapted to sustain consumer trust in CBDC.

[1] While some might believe that CBDCs are a recent idea, they have actually existed (albeit mostly as a concept) for three decades. But with recent technological advances and the proliferation of digital payments, central banks globally have increased research efforts on CBDCs, seeking to understand their potential advantages, such as how they raise the effectiveness and security of payment systems (Stanley 2022).

This paper ultimately seeks to understand how CBDCs could alleviate some of the common challenges faced by revenue authorities in low- and middle-income countries while offering a preliminary assessment of the potential risks CBDCs could pose to tax systems in these countries. Specifically, this paper will:

- Examine what a CBDC entails, including its models and design features;
- Explore the possible benefits and risks of retail CBDC for revenue authorities, particularly those in developing countries; and
- Identify some of the prerequisites to unlocking the potential benefits of CBDCs and mitigating their possible risks.

The findings in this paper are based on desk research. The benefits and risks of CBDCs, as they pertain to tax administration, are primarily conceptual. Few countries have fully implemented a CBDC, although many are considering or piloting the deployment of CBDCs, and several are involved in detailed feasibility studies.

The potential benefits of CBDC need to be weighed against the benefits of other digital technologies at revenue authorities' disposal. We anticipate that knowledge of the implications of CBDC for revenue authorities will evolve as the use of this digital currency grows and the tax considerations become more apparent. Beyond the introduction of CBDCs, considerations regarding the programmability of money (a key feature of digital currencies) and users' anonymity will impact revenue authorities and tax systems at large.[2]

However, when discussing the advantages and drawbacks of CBDCs, it is essential to clarify that the goal of CBDCs is not to replace physical cash entirely. The two instruments have discrete use cases and will continue to coexist as long as their respective purposes are fulfilled.

Section 2 will introduce the main characteristics of CBDCs, while Section 3 will delve into the different models, design features and limitations of CBDCs. Then, we will present the challenges faced by tax administrations in developing countries in Section 4 and, in Section 5, explore the potential impacts and limitations of introducing CBDCs from a tax administration perspective. Section 6 will discuss the conditions that revenue authorities must meet to mitigate risks

[2] **Anonymity** refers to the extent to which national authorities, natural and juristic persons can view transactions and the identity of those transacting in CBDCs. A more detailed breakdown of this feature and its impact on the revenue collection process is provided in Section 2.2.4. **Programmability** refers to the ability to embed protocols within CBDC cryptography that can automate CBDC payments, tax restrictions, access and tax holdings upon specified rules and criteria being met – the implications for tax authorities are detailed at a later point in Section 2.2.1.

and leverage the potential benefits of CBDCs, and Section 7 will conclude.

2. Understanding CBDCs

The International Monetary Fund (IMF) defines a CBDC as a digital representation of a sovereign currency issued by and as a liability of a jurisdiction's central bank or monetary authority (Kiff *et al.* 2020). Retail CBDC refers to the digital version of notes and coins due to its ability to facilitate high-frequency, low-value payments. It can, therefore, be best understood in terms of the features it shares with cash (Cooper, Esser and Allen 2019).[3]

In Figure 2.1, we can observe the typical characteristics of CBDCs, which include central bank issuance, store of value, unit of account, fungibility and instantaneous settlement. These features indicate that CBDCs, in their retail form, differ from physical cash because they are digital and programmable, allowing for features that cannot be accommodated by paper-based currency. Furthermore, CBDCs are distinct from physical cash in several other ways:

1. They can be accessed more broadly than reserves;
2. They have functionality for retail transactions;
3. They can be interest-bearing (with a rate different from that on reserves); and
4. They have a separate operational structure relative to other forms of central bank money and operate via a direct account structure held at third-party intermediaries (Kumhof and Noone 2018).

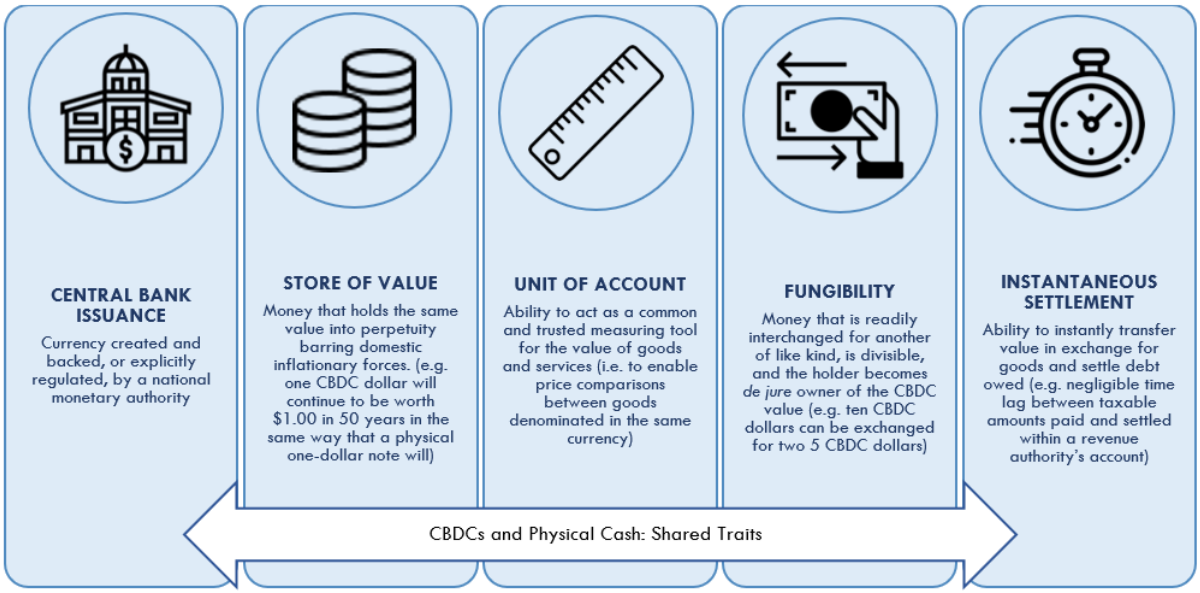
Since 2014, there has been a growing interest among authorities in researching, testing and implementing a CBDC within their national jurisdiction. Notably, in 2018, Christine Lagarde, the then IMF Managing Director, endorsed CBDCs with the potential to 'supply money to the digital economy'. Since then, authorities in developing and developed countries have increased their efforts to explore the usefulness of CBDCs in meeting various public policy goals (Lagarde 2018).

As of 2023, 114 countries are actively considering the potential deployment of a national CBDC, representing over 95 per cent of the world's GDP. Sixty of those countries are in the advanced phase of CBDC exploration, meaning they have

[3] CBDCs can also exist in a wholesale form, representing central bank money that is used to facilitate low-frequency, high-value wholesale interbank payments on national payment systems, such as the current real-time gross settlement system (RTGS) (Bech and Garret 2017). The application of wholesale CBDC to national payments in this sense would represent the attempt by central banks to update or rejuvenate outdated banking payment systems and, unlike retail CBDC, would rarely be engaged with by citizens or national institutions, such as revenue authorities, outside of the domestic banking sector (Cooper *et al.* 2019).

either developed, piloted or launched a CBDC (Atlantic Council 2024).

Figure 2.1 CBDC key characteristics



Source: Authors' own

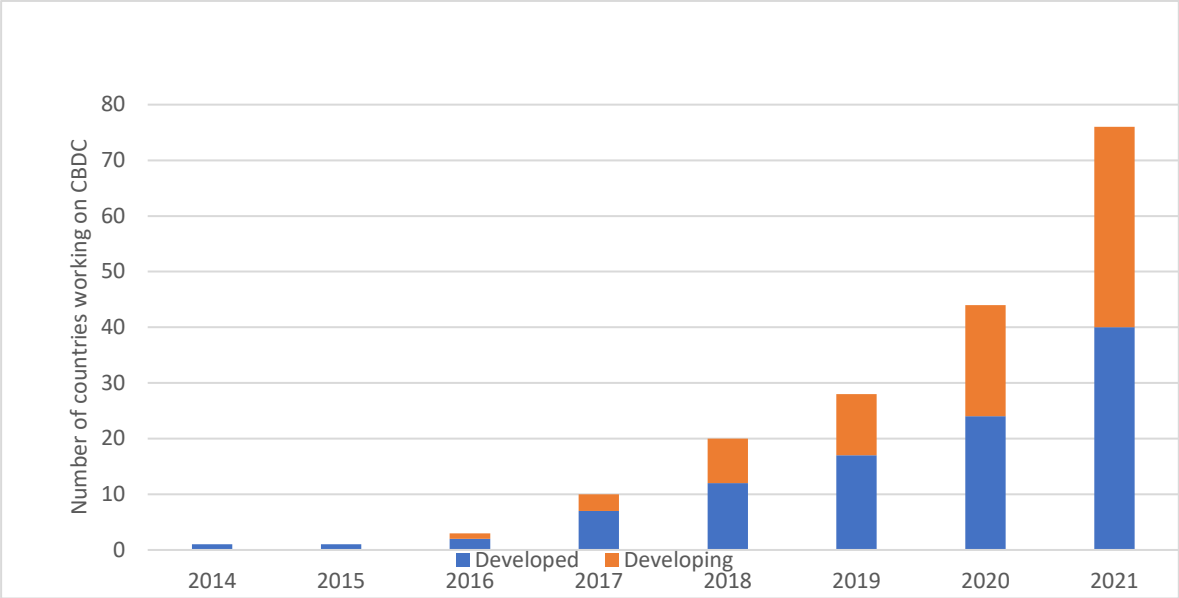
Figure 2.2 shows that developing countries have emerged as crucial frontrunners in practical experimentation and CBDC pilot testing, starting with Uruguay's e-Peso in 2017. This trend is particularly significant in the field of retail CBDC. According to a recent global CBDC index, four of the countries that are ranked in the top five on the retail CBDC maturity index are from the developing world, with the Bahamas, China and Ecuador as key leaders (PWC 2021).[4]

The interest in retail CBDC exploration suggests that its realisation is probable in several developing countries. Despite that, many CBDC projects fail to progress beyond the feasibility assessment stage, often because existing commercial infrastructure adequately delivers consumers' payment service needs. Additionally, CBDCs may pose complex, multi-jurisdictional risks to established currencies like the US dollar, GB pound and euro. Increased interest in and exploration of CBDCs does not necessarily correspond to a higher likelihood of deployment. While several central banks in developing countries are moving ahead with CBDC deployment, relevant revenue authorities must engage in its

[4] The primary variable driving the maturity index is the CBDC project status, indicating the current stage of project development. Two other variables capture the stance of the central bank based on published speeches and a public interest proxy (Google Trends or Baidu Index). This index is technologic agnostic; each country's design choices (infrastructure, technologies, etc.) have no impact on the scoring (PWC 2021).

design now to avoid facing adverse tax implications.

Figure 2.2 Number of countries with active CBDC projects, 2014–21



Source: Central Banking Digital Currency Tracker (CBDC Tracker 2023) (updated June 2023)

3. Models, design features and limitations of CBDCs

3.1 CBDC models

To comprehend and approach CBDC from a tax revenue standpoint, it is essential to acknowledge that there is no one-size-fits-all design or operational model to which CBDC should adhere. Depending on the priorities of national authorities, CBDC operating models may differ significantly in terms of distribution and management, mode of stakeholders' involvement, location of accounts, and access rights to identity and transaction data, among other vital considerations. Ultimately, the chosen operating model determines how CBDCs are issued and circulated and the respective roles of the central bank and private sector in implementation. Although there are no established standards for operating models, CBDCs tend to fit broadly into three models.

In the **unilateral** CBDC operating model (or single-tier), the central bank carries out all functions in the payments system, from issuing the CBDC to distributing it and interacting with end-users. These tasks include issuing or 'minting' CBDC, distributing it directly into the citizen/business/institution accounts at the central bank, facilitating the clearing and settlement of transactions between entities, as well as managing and governing transaction requests directly from citizens or authorities via a chosen user-payment device. Under a single-tier model, the central bank effectively assumes the role and functions of existing commercial banks or digital payment service providers within an economy (Kiff *et al.* 2020).

In the **intermediated** (or multi-tiered) model, the central bank still issues the CBDC, but private sector firms interact with end-users. The intermediary role can be filled by financial firms, payment service providers (PSPs) and mobile phone operators. Most would likely be privately-owned and for-profit firms, but state-owned intermediaries and cooperatives may also be involved. This second model requires the central bank to regulate and oversee other actors, which adds an extra layer of legal and operational complexity. Thus far, most retail CBDCs that have launched or piloted run-on intermediated operating models.[5]

In the **synthetic** CBDC (sCBDC) model, the CBDC is neither issued solely by the central bank nor by the central bank with private sector intermediaries. Instead,

[5] There is an increasing list of developing country central banks that have launched or are close to launching retail CBDC pilots, including Cambodia, Eastern Caribbean Central Bank, Ecuador, Thailand, Uruguay, Ukraine and South Africa (Auer *et al.* 2022)

private firms with e-money or stablecoin platforms issue the CBDC, with the central bank overseeing and setting instrument standards. The central bank also ultimately backs the CBDC via a guarantee or by holding scheme liabilities.

These conceptual models are not necessarily mutually exclusive. Some central banks are considering the intermediated CBDC model as their main operating model but also offering basic payment services through a unilateral model to ensure universal access and resilience. Likewise, an sCBDC could, for instance, be issued by private firms alongside or even backed by a standard CBDC.

From a tax collection and revenue perspective, the distinction between these models lies in where tax-liable amounts are held, where taxable transactions begin or end, and where necessary identification and transaction data can be accessed. Assuming the implementation of the more probable multi-tiered operating model, CBDC value would be stored within a bank application wallet structure or an e-money application used by citizens, businesses and revenue authorities. Similarly, under the current banking system, revenue authorities would be able to leverage data housed in financial and payment service providers to access or verify the tax profile of citizens and businesses under the multi-tiered model (Kiff *et al.* 2020).

However, having access to data alone does not ensure that revenue authorities can effectively leverage its value. This paper highlights some of the challenges associated with data usage in Section 4. Additionally, since financial institutions do not own or possess the CBDC value stored in a wallet, there may be a gap in their financial and tax reporting obligations. They may also face complications when monitoring a private citizen's digital cash activity in which they have no direct interest.

Offline CBDC transactions can further raise reporting mandate issues, especially concerning the audit trail during offline periods. How revenue authorities handle payments, assign responsibility for monitoring and reporting on transactions, and assess and verify taxpayers depends critically on the chosen operating model and its adjustments for national objectives.

3.2 Characteristics, benefits and limitations of CBDCs

In addition to the three categories of operating models, CBDCs can also be classified according to five broad design typologies: programmability, availability, ledger centralisation, anonymity and the extent to which they are interest-bearing. National authorities use these features to achieve their unique policy goals and mitigate associated risks.

3.2.1 Programmability

This feature refers to the ability to embed protocols within CBDC cryptography that can automate CBDC payments and access and tax transactions based on specified rules and criteria being met.[6] Using the same principles as smart contracts and automated protocols, authorities can design CBDC protocols to self-execute tax claims and transfers and also enforce specific tax procedures.[7]

For example, if VAT is programmed at the source as a protocol, the tax could be automatically deducted each time a CBDC is spent on goods at a store. Failure to adequately provide for programmability upfront could lead to difficulties in identifying and tracking taxable transactions and to the development of methods for managing continuous flows of massive data and tax deduction at source. Lack of specification or delayed addition of programmability between wallet classes and CBDC instruments could pose a system stability risk to the entire CBDC system or result in limited tax information capabilities, potentially leading to the migration of taxable entities out of the banking system. Thus, programmability for tax purposes could potentially hinder the adoption of CBDC wallets.

3.2.2 Availability

Authorities can place restrictions on the amount that CBDC users can hold and the volume they can transact based on their risk profile or other predetermined factors. Moreover, the accessibility and usage of CBDC can be modified during 'offline' periods, such as power outages or during periods of limited connectivity. Additionally, the clearance and settlement of transactions can occur instantly, regardless of the operational hours of commercial banks (Kiff *et al.* 2020). This feature would, for example, enable targeting of social transfers to vulnerable or remote populations even in the absence of internet connectivity, by allowing CBDC to be transacted via traditional channels like Unstructured Supplementary Service Data (USSD).[8]

Several varieties of CBDCs are designed to facilitate different types of

[6] For more information on cryptography, see Feign (2023).

[7] Smart contracts are programmes stored on a distributed or centralised ledger that run when predetermined conditions are met. Typically, they are used to automate the execution of an agreement so that all participants can be immediately certain of the outcome, without any intermediary's involvement or time loss. They can also automate a workflow, triggering the next action when conditions are met (IBM n.d.).

[8] USSD would need to be adapted through security and cryptography installations in order to be used in conjunction with CBDC. There is a general reluctance on the part of financial service providers and authorities to make secure instruments available over insecure channels. As such, it is also possible to accomplish the use of USSD with e-money. That is, transactions with e-money stay on USSD but can use an exchange to buy and sell CBDC, either inside or outside of the e-money system (AFI 2022).

transactions. Some can be used for offline transactions, while others require at least one party to be online, and still others only function when both parties are online. The mode of access for certain CBDC instruments may vary based on contextual factors and wallet-class parameters. These modes may include USSD, thin SIM, smart card or NFC (near-field communication) tags. However, though relying on USSD could guarantee accessibility, additional cryptography measures would be necessary to guarantee security. Additionally, if tax authority requirements are not considered during the planning phase, CBDC schemes may be inadequately specified, resulting in limited consumer utility or limit the legibility of the digital economy for tax purposes.

3.2.3 Ledger centralisation

CBDCs are underpinned by one of three technology architectures: a centralised ledger system, a decentralised ledger system and distributed ledger technology.[9] These technologies vary in terms of who verifies, validates and distributes CBDC payments among users, as well as who has permission to access specific information on the ledger, such as public versus private access and permission-based or permissionless ledgers (Auer, Cornelli and Frost 2020).

Each technology architecture has discrete effects on participants' ability to program CBDCs and view the real-time transactions of others. It will benefit of tax authorities if the ledger technology's type and structure, implementation approach, and ability to link with individual and corporate digital identities do not hinder their mandate and powers to engage appropriately.

3.2.4 Anonymity

CBDCs are implemented with varying degrees of visibility over transactions and user data. The degree of anonymity users enjoy is contingent on the delicate balance between consumer data privacy, effective consumer protection and legitimate risks of illicit financial flows – with implications for tax systems.

Countries may opt for pseudo-anonymity, where consumers retain ownership and control over their transaction data, except for cases where certain institutions are granted explicit access.[10] To guarantee individual privacy and prevent broader societal and security risks, much work should be done to understand and refine the implementation of pseudo-anonymous systems. Each jurisdiction must weigh key trade-offs when determining how much CBDC should resemble physical cash

[9] For more information on the technology and infrastructure options for CBDC deployment, see Allen *et al.* 2020.

[10] For more information on pseudonymity, see Australian Government (n.d.).

and how many new modalities it should unlock that were impossible with commercial money instruments.

In turn, tax authorities must carefully consider how to balance consumer data privacy with the need for legitimate use of transactions and user data to enforce tax compliance and detect non-compliance.

3.2.5 Interest-bearing

This feature refers to the ability to apply interest rates on CBDCs to moderate their demand to spend and to incentivise citizens or businesses to save in the form of a CBDC. Consideration should be given to the tax implications and programmability of any interest functionality, particularly on the aggregation of data and accountability for reporting.

Understanding the importance of the five design features above and how to adjust them accordingly is critical for any national authority to ensure a country's CBDC produces more positive outcomes than risks for financial stability, efficiency and inclusion.

3.3 Limitations of CBDCs

Although detailed case studies on the initial roll-out of CBDCs across developing countries are not yet available due to the infancy of these projects, there are notable limitations that should be acknowledged.

The most common limitations of CBDCs, evidenced by existing pilots and rollouts, are related to technical malfunctions that reduce the usability of the CBDC platform or result in frequent shutdowns. For instance, the Eastern Caribbean Currency Union's CBDC platform, Dcash, experienced a shutdown in early 2022, leading to an interruption in service that impacted all users where no transactions could be conducted for about two weeks (FInextra 2022). The consequences of such system crashes are likely to be severe and long-lasting, reducing citizens' trust in the CBDC platform.

Similarly, the roll-out of the eNaira (Nigerian CBDC) in 2021 highlighted the importance of considering the country-specific context in which a CBDC is being launched. Although not characterised by technical limitations as mentioned above, the initial roll-out of eNaira faced challenges partly due to the limited information and communication technology (ICT) infrastructure in rural areas and the low levels of trust in the government and central bank – factors that have impeded the initial roll-out efforts.

4. Tax system challenges in developing countries

Understanding the effects of any technology innovation – like CBDCs – on developing country tax systems requires an understanding of the dynamics of tax administration in these countries. There are several common contextual factors that typically inhibit the operational efficiency of revenue authorities in developing countries. These challenges broadly relate to the economic environment in developing countries, as well as the administrative and infrastructural barriers within revenue authorities. This section does not exhaustively cover the myriad challenges revenue authorities face, nor does it attempt to differentiate between the dynamics in less mature tax systems relative to more mature ones. As such, this section should be taken as only a primer to situate our ensuing analysis on the likely effects of CBDCs on developing country tax systems.

4.1 Small tax base

In numerous developing countries, the informal sector is marked by many micro and small-scale enterprises that produce low turnover, and a substantial amount of subsistence agriculture (Anyidoho *et al.* 2022; Alfonso, Kamin and Zampolli 2022). Many of these enterprises and individuals conduct business outside of the formal tax system, which presents a distinct challenge to revenue authorities. Due to the unregulated nature of these activities, it becomes difficult for authorities to register, record and monitor taxable individuals and entities without incurring significant administrative expenses. As a result, revenue authorities have implemented several digital tools to formalise and bring informal sector firms under the tax umbrella. However, these efforts often yield mixed or negative results, particularly for less productive micro and small firms.[11]

[11] In 2017, India introduced a digitally-administered harmonised goods and services tax (GST) with the goal of unifying disparate sales tax regimes across states and bringing informal sector firms into the formal tax net. In part due to the efficiency of the GST digital platform, less than two years after its introduction, the number of registered firms doubled. Despite this, for many micro, small and medium enterprises (MSMEs), the costs of compliance were prohibitively high relative both to their annual turnover and GST tax liabilities. In this example, formalisation via digital technology was perhaps premature and the costs imposed on MSMEs counterproductive for improving tax compliance (Roy and Khan 2021). The dilemma for revenue authorities is thus about balancing efforts to expand their tax base against the possibility that such efforts could result in adverse outcomes both for firms' survival and the putative objectives of improving tax compliance and revenue performance.

According to Allen *et al.* (2020), CBDCs could potentially aid revenue authorities' efforts to meaningfully expand their tax bases while offering broader efficiency gains across various tax administration functions. The authors suggest that, by increasing the legibility of economic activities, CBDCs may be a catalyst for reduced tax evasion and increased revenue collection. Theoretically, they contend that the traceability of digital transactions will prevent CBDCs from being used for illegal activities like money laundering and financing terrorism.

Notwithstanding the perceived necessity of formalisation interventions – be they focused on registration drives or novel technology solutions – these interventions are often rooted in conceptual misunderstandings about the economies of developing countries. Specifically, these misconceptions underestimate the complexity of informal economic actors and overestimate the potential for formalisation to plug revenue gaps (Gallien and van den Boogaard 2023). Until these broader misconceptions about economic actors in developing countries are reconsidered, broad claims about how novel technologies, including CBDCs, can help formalise the informal economy, expand the tax base or plug other efficiency gaps should be considered with some scepticism.

4.2 Prevalence of cash and tax evasion

Revenue authorities face significant challenges monitoring economic activity in predominantly cash-based systems, and collecting taxes from taxpayers is often a cumbersome process in these contexts (Kwon, Lee and Park 2022; Wang 2020). Despite sustained growth in the use of digital financial services in the developing world, most day-to-day payments still rely heavily on cash (Bech *et al.* 2018).

While digital payment alternatives may be cheaper, some taxpayers prefer physical cash due to factors such as unfamiliarity with electronic payment channels or a desire to maintain in-person relationships with tax officials (Wasunna and Frydrych 2017; Yilmaz and Coolidge 2013; Okunogbe and Pouliquen 2022; Mascagni *et al.* 2023). Relatedly, Bernard *et al.* (2023) show that cash is king in Rwanda, despite government efforts to channel payments to mobile money in response to the pandemic. The authors find that the prevalence of cash is due to the costs of digital transactions, like levies, and, to a smaller extent, know-how and awareness. With regard to the ICT readiness of potential adopters, research in Nigeria has widely shown that taxpayer education, age and technology readiness are determinants of electronic filing uptake (Efobi *et al.* 2019; Mas'ud 2019). However, the use of cash poses critical risks, particularly in the absence of a cash monitoring infrastructure, as it can enable under-reporting, tax evasion and illicit financial flows.

Theoretically, CBDCs have the potential to address these risks more directly than a non-sovereign or commercial digital payment instrument could. While a CBDC would not replace physical cash, its transactions would be fully traceable, reducing opportunities for evasion and subject to adoption rates, due process and judicial oversight.

4.3 Emerging digital infrastructure

While developing country revenue authorities have made progress in the adoption of digital technology over the past two decades, there are still underlying gaps in their ability to reap the full benefits of these technologies (AFI 2022; Arewa and Santoro 2022). There is, however, some heterogeneity in developing countries', and African countries' especially, degree of success in adopting technological solutions, as shown in Occhiali, Akol and Kargbo (2022). Gaps in success are due to both infrastructural and human resource deficits.[12] The foundational ICT infrastructure required to make a CBDC operational and prevalent is largely fledgling. This includes core functions and capabilities like robust foundational ID systems, high-quality internet, and the reliability and affordability of electricity, computers and smartphones.[13] Revenue authorities encounter substantial obstacles when attempting to leverage the enormous amount of data generated by digital technologies. This is due to insufficient integration between different digital systems and a shortage of skilled system integrators or analysts capable of managing data proficiently. While CBDCs can potentially offer real-time, trackable data within an integrated reporting system linked to unique identifiers, their effectiveness in achieving tax administration outcomes – such as enforcement and audit efficiency – relies on more extensive investments in foundational digital infrastructure and human resources (Moore, Prichard and Fjeldstad 2018; Ndung'u 2019; Soutter, Ferguson and Neubert 2019).

[12] The digital infrastructure required for e-filing and e-payment of taxes is being increasingly invested in by national tax administrations in LMICs. A dependable payment infrastructure and sufficient investment in human capital are among the prerequisites for realising the full potential of electronic filing and electronic payment systems (Arewa and Santoro 2022).

[13] Poor electricity coverage, the accessibility and affordability of devices that support CBDC, and a dearth of infrastructure for cash-in and cash-out transactions can be barriers to CBDC use, as evidenced by the experience of DCash (Eastern Caribbean Central Bank). Hence, CBDC design must consider access restrictions that can impact digital financial services. Because of its unique capacity to create digital identity proxies and enable offline functionality while being device agnostic, retail CBDC, for example, can be designed to reduce identity gaps, mobile phone and digital access divides, and other technical issues (AFI 2022).

Taken together, these three factors — a small tax base, the predominance of cash and limited digital infrastructure — present both challenges and opportunities for the development of CBDCs. CBDCs will be useful to tax administration only to the extent that they can potentially address these factors.

5. Potential impact of retail CBDC on tax systems in developing countries

The following section explores some of the impacts CBDCs could have on revenue authorities but also the risks associated with the calibration of certain CBDC features. The core lesson, based on existing evidence about technology and taxation, is that improvements to tax administration functions or the taxpayer experience require more than just novel technology tools, and the effects of these technologies may not necessarily be welfare-improving, especially for highly marginalised or impoverished populations.

5.1 CBDCs from taxpayers' perspective

Depending on how CBDCs are configured, consumers' everyday digital habits may not be significantly disrupted, except for upgrading their wallet application, SIM, NFC tag or smart card. Merchants may also need to update or upgrade their point-of-sale (POS) equipment or digital systems.

Where CBDCs are widely accepted and uptake is high, taxpayers could potentially benefit from integrating CBDC wallets with their bank accounts and other financial services. These transactions would be immediate, specific, and possibly offline, depending on the configuration of the CBDC. However, where CBDCs are not widely accepted or trust in the currency is low, the effects for taxpayers will either be negligible or negative.

5.2 Potential benefits of CBDC adoption for revenue authorities in developing countries

In evaluating the potential benefits of CBDCs for revenue authorities, this paper highlights five potential ways CBDCs could benefit revenue authorities:

1. Expanding revenue authorities' enforcement capacity;
2. Freeing up of capacity and enhanced oversight through increased automation;
3. Efficiency gains that allow for the better focus of tax resources;
4. Increased liquidity for revenue authorities through near real-time and increased ease of tax payments;
5. Improved taxpayer experience by reducing tax compliance costs.

5.2.1 Expanding revenue authorities' enforcement capacity

CBDCs and physical cash inherently have disparate use cases but can coexist insofar as their respective use cases remain relevant. For CBDC data to be useful to tax authorities, at least in the medium term, revenue authorities will need the legal, operational and analytical capacity to examine users' transactional histories.

The extent to which historical transaction analysis can be conducted will depend on the legal privacy frameworks in each country and the degree to which they permit revenue authorities to analyse this data at a trends or anomaly level, as opposed to transactional histories linked to broad taxpayer personal data.

Granular records of CBDC transaction flows offer revenue authorities the opportunity to combat certain types of tax-evasive activities and better quantify the overall tax base.[14] For example, transactions level CBDC data could address the underreporting of taxable income and improve the automation and efficacy of audit selection and management.

By analysing historical transaction data, tax authorities could compare reported gross income amounts with actual turnover amounts at individual and aggregated levels. Any discrepancies could then be flagged and investigated, potentially facilitating compliance and enforcement accuracy. This approach could also tackle the under-reporting of VAT or similar indirect taxes by vendors who may collect VAT from consumers but fail to report the total amount of sales.

The relevant literature on the use of third-party data to improve developing countries' domestic revenue mobilisation presents some lessons. Initiatives in Chile, Costa Rica and Ecuador have effectively increased the utilisation of third-party data, but the impact on compliance has been variable and contingent upon the broader institutional context. For instance, Carrillo, Pomeranz and Singhal (2017) conducted an assessment of a policy intervention in Ecuador that informed companies about the disparities between their corporate income tax filings and third-party data information from several sources, requesting that they file amended returns. Many firms anticipated the limited enforcement capacity of the tax authority and did not take action in response to the intervention.

Other evidence comes from India, where Delhi-based firms were mandated in

[14] Several studies argue that tax evasion is closely related to the use of cash as a payment instrument (Rogoff 2017; Wang 2020; Kwon *et al.* 2022). In the US, for instance, the loss in tax revenue due to tax evasion is estimated to amount to 14.2 per cent of federal tax revenue and 2.4 per cent of GDP from 2011 to 2013. Cash-intensive small businesses accounted for nearly half of the loss in tax revenue in the US (Johnson and Rose 2019). Furthermore, according to Rogoff (2017), the relatively larger size of the informal economy makes tax evasion in some European countries worse than that of the United States.

2021 to report all their transactions with other companies, making it easier for tax authorities to identify discrepancies. This led to a notable increase of 29 per cent in tax remittances by wholesalers (Mittal and Mahajan 2017). Another successful example comes from China, where the implementation of the Golden Tax Project III, which integrated the VAT invoice system, resulted in a significant reduction in corporate income tax evasion (Li, Wang and Wu 2020).

A study in Pakistan paints a less optimistic picture. Best (2014) finds that the impact of third-party information is lower in Pakistan, with 19 per cent of workers unilaterally underreporting their wages. This discrepancy underscores how limited tax authority capacity can hinder the effectiveness of third-party reporting. Looking at Africa, Mascagni, Mukama and Santoro (2019), who examined discrepancies in taxpayers' VAT declarations in Rwanda, demonstrate that widespread discrepancies persist despite the Rwandan Revenue Authorities' best efforts to enforce VAT, including the adoption of electronic billing machines and refund validation procedures.

While some of these experiences show that using CBDC wallets could help identify discrepancies, thereby enhancing the effectiveness of tax enforcement efforts, others underscore the reality that relying solely on third-party data is insufficient for ensuring compliance without the presence of effective enforcement mechanisms.

5.2.2 Freeing up of capacity and effective governance through increased automation

The design specifications of each country's CBDC will ultimately determine how or if automation will result in improved efficiency and capacity for revenue authorities and other fiscal and financial agencies. These specifications encompass various factors, such as the degree of programmability, wallet standards, wallet class structures, cross-border spillovers and international processing. Additionally, the technical requirements must be suitable for processing speeds and tolerances, particularly for current distributed-ledger-technology-based (DLT) systems.[15]

Regarding governance, the technical capabilities of a CBDC must operate within a regulatory environment that can accommodate the necessary changes,

[15] Experts from the Massachusetts Institute of Technology (MIT) have begun designing and testing technical research (known as Project Hamilton) in collaboration with a team at the Federal Reserve Bank of Boston. Through Project Hamilton, the researchers are examining the performance of CBDC in the United States. The MIT group tested factors such as transaction volume and speed, as well as system resilience in general, in a process that required significant design flexibility. For more information, see Sethaput and Innet (2023) and Dizikes (2022).

oversight and safeguards that come with innovation. Tax authorities would have to engage with the CBDC technical specifications to enable the automation of multiple tax functions, such as registration, verification, payment and dispute resolution. The transaction flows recorded within taxpayer CBDC wallets could be leveraged to enhance the automation of various tax administrative processes. Smart contracts can be programmed to draw on CBDC wallet transaction data to determine whether a vendor's or individual's income has crossed the taxable threshold, providing revenue authorities with the ability to build real-time taxpayer registration databases.

Furthermore, the granularity of transaction data could enable a swift verification process of taxable income as reported by the taxpayer, including VAT and personal income tax (PIT). For VAT, the relevant transaction flows of the two parties could be analysed and a comparison made so that the transaction value of both parties equates.

To verify income taxes, transaction data between an employer and employees could be used to confirm whether the appropriate income tax amount had been submitted. Employers are often required to assess an employee's earnings, deductions and non-taxable payments. This can be costly if outsourced.

With careful regulation and configuration of a CBDC system, there is much potential to reduce the compliance costs and administrative burdens associated with direct taxes like PIT and withholding taxes. Depending on how a wallet or bank account is set up through CBDC, basic minimum Pay as You Earn (PAYE) taxes and contractor withholding tax can automatically be deducted from payments between the designated employer and commercial enterprise wallets and taxpayer wallets. Subject to the structure of PAYE or the withholding tax, it can become a liability, not requiring any further administration or a mechanism to ensure immediate payment across the bulk of PAYE and withholding tax deductions from employers and other commercial enterprises.

Automation of these various tax administrative processes could free up capacity for resource-constrained revenue authorities.[16] With increased automation, it may become less necessary for tax officials to register taxpayers, assess their liabilities or enforce compliance in person – ultimately reducing collusive opportunities. Additionally, such measures may help minimise the risk of taxpayers being extorted by tax officials. These benefits are contingent on

[16] In their study of ICT and tax administration in sub-Saharan Africa, Occhiali *et al.* (2022) observed that the widespread automation of tax administration was seen as a key solution to establish consistency in service delivery across tax departments (e.g. in Uganda). Research on the potentials and constraints of IT systems for tax mobilisation (see Okunogbe and Santoro 2021) emphasises the need for complementary automation to strengthen internal tax administration processes.

adequately-designed and locale-appropriate CBDC systems, as well as the overall digital maturity and administrative readiness of the relevant countries and their respective agencies.

5.2.3 Increased liquidity for revenue authorities through near-real-time tax payment settlement

The mechanisms inherent in the CBDC instrument and wallet design make it possible to reconfigure taxes such as VAT and income tax on a transaction basis, and therefore, reconciliations and related processes can potentially be eliminated. In practice, this could allow for the collection of VAT in real-time, as well as the payment of tax rebates into individuals' and vendors' accounts. Such near-real-time collection of taxes would provide revenue authorities with instant liquidity, as opposed to current practices where the collection of payments is at the discretion of the scheduling of the tax cycle.

Depending on the robustness of the payment system, VAT would either be levied on a transaction-by-transaction basis or via the aggregation of transactions over a defined period directly from a vendor's CBDC wallet to a wallet held at the revenue authority.[17] A revenue authority wallet would ideally be a specific wallet class similar for banks and large institutions, which can accommodate high volume and high-value transactions with added security layers, given the higher risk to value and personal information. Typically, bank technical inputs require these high-value wallets to deposit dynamically with their central bank account to reduce ‘digital M0’ (base money) on hand, and revenue authorities may decide to do the same. Depending on payment configurations, payments by way of the CBDC instrument could eliminate the reconciliation costs associated with clearing and settlement – representing a saving to both taxpayers and revenue authorities.

5.2.4 Improved experience for taxpayers through reduced compliance cost

On paper, the widespread use of CBDC wallets for person-to-government and business-to-government payments could lower tax compliance costs for

[17] The potential US dollar CBDC should be intermediated, according to US Federal Reserve (2022). That is, the private sector would provide accounts or digital wallets to facilitate the management of CBDC holdings and payments under an intermediated model. An intermediated model would make it easier to use existing privacy and identity-management frameworks in the private sector. Furthermore, the Bank of England, which is looking for a third-party supplier to create a mobile wallet for a potential CBDC, has also stated that it will not provide public CBDC wallets even if the CBDC is issued. But it launched the tender to learn more about the ‘end-to-end user journey’ and ‘sharpen functional requirements for both the bank and the private sector’ (CBN 2022).

taxpayers and improve their overall experience when interacting with their tax authority. For instance, the administration of VAT may be simplified with CBDCs so that merchants would not have to manually determine and reconcile VAT liabilities. VAT compliance could benefit from the streamlining of VAT processes using CBDCs or other technology advancements, such as mobile money (Alexander 2022; Sogaard 2021).[18]

CBDCs could also reduce tax compliance costs by enabling tax authorities to issue pre-populated forms and returns. Revenue authorities, as opposed to taxpayers, produce and issue tax forms for taxpayers to register and file for taxes. These forms and the processes underpinning them are often tedious and convoluted, posing a substantial administrative burden to taxpayers. With appropriate CBDC instrument protocols, tax authorities may have the opportunity to access transaction and taxpayer data with the degree of accuracy, timeliness and frequency that permits the production and distribution of pre-populated tax forms.[19]

Revenue authorities will require significant resource and technical support to avail themselves of the benefits of CBDCs. Success will also require designers of digital currencies to configure design elements to meet bespoke tax system objectives. However, achieving this requires a high degree of government-wide collaboration and can be resource intensive and technically taxing (Syarifuddin 2023; Assenmacher *et al.* 2021).

5.3 Potential risks of CBDC adoption for revenue authorities in developing economies

There are always inherent risks associated with the adoption of novel technologies, and CBDCs are not exceptional in this regard. The adoption of CBDCs could pose various risks for revenue authorities, including a backlash in favour of cash, cybercrime and other general operational risks.

5.3.1 Citizens may opt for cash to retain anonymity

A CBDC designed with a low degree of anonymity may deter the uptake of CBDC in favour of cash. In turn, this may negate the extent to which the CBDC might

[18] However, some studies (e.g. Kakebayashi *et al.* 2023) caution that charging fees for CBDC transactions may disincentivise CBDC adoption.

[19] Kohn and Tansel (2018) point out that, unlike traditional tax returns (which are filed annually), CBDC transactions would be instantly and permanently recorded. In practice, however, record aggregations have proven to be extremely difficult to analyse for cryptocurrencies and it is likely the same for CBDCs.

improve the legibility of the economic activity. Policymakers must remain conscious of the potential for considerable sensitivities around the gathering of comprehensive individual and business information. Specifically, real-time data collection of transactional information on people and businesses for tax purposes is likely to spark concerns about the handling and use of such information, particularly in low-trust societies and in relation to low-trust institutions.

Where CBDCs are introduced in a low-trust environment or without substantive safeguards and oversight over the privacy and anonymity of transactions, citizens may decide to use alternative methods of transacting, where revenue authorities have limited oversight – including cash or private cryptocurrencies. The level of anonymity, pseudo-anonymity or ostensible anonymity can significantly impact revenue authorities' potential benefits within their regulatory framework.

In a fully anonymous system, it is feasible to uniquely identify an individual's digital presence and behaviour by using a wallet structure as a proxy and undergoing digital identity proofing without any personal identifiers or names. Additionally, taxes can still be collected in compliance with each country's regulatory framework, much like extracting sales tax from cash purchases. In order to encourage user uptake, especially in low-trust contexts, the level of anonymity for CBDCs must be suitably adapted to take user preferences into consideration. To avoid any potential abuse, safeguarding citizen data is essential in any situation.

If CBDCs are less anonymous than physical cash, they could serve as a tool to prevent tax evasion. However, if CBDCs are designed to offer a high level of anonymity, as is the case with cash, they may exacerbate the issue of tax evasion, particularly in a low-interest-rate environment (Wang 2020). On the other hand, if CBDCs are completely anonymous, they could facilitate money laundering, terrorist financing and tax evasion, making it difficult to track illicit activities (Partz 2022).

It is important to note that determining the appropriate level of anonymity for a given country is not straightforward and depends on various factors, such as public trust in the central bank and other public institutions, perceptions of corruption and tax morale. These factors could influence the public's willingness to comply with tax laws and use CBDCs as a legitimate means of payment. The OMFIF (2020) suggests that central banks are well-positioned to issue CBDCs, with surveyed respondents in both developing and developed countries indicating that they would feel most confident in CBDCs issued by the domestic monetary authority. However, these views vary widely based on income and education levels, age and nationality (Patel and Ortlieb 2020).

5.3.2 Target for cybercrime

Cybersecurity threats have become more sophisticated and pose a significant risk to CBDCs at various levels, particularly when digital currency is integrated with tax systems. The sensitive and valuable nature of tax data further exacerbates this. To mitigate these risks, central banks must collaborate with revenue authorities to ensure that CBDCs are designed, constructed and operated securely across all components and integrations with underlying tax systems.

A key security risk associated with CBDCs is the potential for flawed smart contract programming, which can introduce new vulnerabilities.[20] Attacks could potentially freeze the use of CBDC and lead to significant disruption of economic activity, directly affecting related tax information systems (OECD 2020). Although several CBDC pilots use a decentralised architecture, a number of these have ultimately proved suboptimal. At the time of writing, no CBDC proposals currently suggest the use of a fully decentralised or distributed ledger framework. Authorities have long been familiar with the threat of cybercrime to central banks and various centralised database-holding institutions. Early CBDC pilots have resulted in the development of improved safety measures. These measures involve using specific types of digital wallets with varying levels of programmability. Additionally, secure and reliable cryptographic tools are being used both online and offline. These advancements aim to greatly decrease the inherent risks associated with a retail CBDC system, particularly when used in offline scenarios.

5.3.3 Operational risks

Given the constraints of limited capacity and finite resources, revenue authorities should be aware of the potential risks when transitioning to the new ICT infrastructure and systems required for CBDC operations and consider the disruption resulting from inadequate technology used in operating CBDCs.[21]

[20] A recent example of such insecurities by virtue of flawed smart contracts includes the US$600 million worth of cryptocurrency stolen from the Poly Network, a decentralised finance platform, where a hacker detected flaws in the highly complex, convoluted smart contracts used on the platform (The Record 2021). While this security breach was limited to investors in the cryptocurrency markets, there remains a risk that similar problems could occur in the environment of a CBDC.

[21] While documenting the experiences of Sierra Leone's National Revenue Authority with ICT systems, Occhiali *et al.* (2022) reveal the difficulty of developing and adopting new ICT systems. They highlight the difficulties associated with the lack of ICT skills, as well as the risks associated with implementing untested ICT systems.

During these processes, there is a risk of system failure when transitioning to a new system. This can occur if there is a lack of expertise and skills to create a detailed plan that guides the specialist operator in effectively managing and implementing the necessary processes and systems. This risk becomes even more significant when considering that the development of CBDC platforms may be outsourced to third-party developers. In such cases, regulators must have the ability to comprehend the programming code of the CBDC and ensure that the CBDC platforms operate with an understanding of their internal workings.

In order to make it easier to create and manage different wallets for revenue authorities, a hybrid system could be used with a CBDC processing node. This system would involve connecting the CBDC system to application programming interfaces (APIs), as well as connecting a node to the core revenue systems and/or data warehouses. Additionally, there may be a need for connections to identity databases and legal entity registers. To test and implement protocols for various types of CBDC wallets, revenue authorities would need to work together with central banks and system operators to develop tax specifications and code for CBDC instruments.

6. Positioning revenue authorities to mitigate risks and leverage potential benefits of CBDCs

Before implementing CBDCs, revenue authorities must meet certain requirements to fully benefit from CBDC adoption and reduce associated risks. Currently, due to the lack of real-world case studies, there are no standardised approaches or set rules that guarantee the successful issuance of CBDCs for central banks or revenue authorities. To assist revenue authorities in identifying and addressing any gaps or deficiencies in their infrastructure, supervisory frameworks, governance and risk management and capacity structures, the following factors are important to consider. It is also crucial to consider the costs involved in establishing these foundational aspects and explore alternative approaches to digitalising tax administration that may offer similar advantages.

6.1 Integration with current tax systems and legacy systems

Ideally, CBDC platforms should be interoperable with existing tax systems, including e-filing, e-payments and overall integrated tax information systems. Without this, costly system upgrades may be required.[22] Some of the key areas of integration would be:

- Access control hierarchy for CBDC-related systems and tracking of all personal consumer data, particularly where there is access to any integrated tax module within the CBDC system or where the tax authority houses a processing node;
- Where possible, dynamic links between taxpayer registers, population registers, legal registers and vendor wallets and the ability to recognise and on-board new taxpayers and VAT vendors would be a priority;
- The near real-time matching of VAT receipts with registered vendor accounts would be key to ensuring that the CBDC and commercial instrument positions and receipts can be dynamically reconciled. Any manual reconciliation

[22] While researching the adoption of new systems, such as the integrated tax administration system (ITAS), in Uganda, Occhiali *et al.* (2022) discovered that manual and rudimentary legacy systems made data migration to a new system nearly impossible – often because of poorer data quality on legacy systems.

process would need to be addressed and tested long before any VAT functionality should be activated, as this could involve multiple years of outstanding returns and claims;

- A system and/or secure data warehouse would need to be in place for suspicious transaction streams, taxpayer analysis and for tax and broader business intelligence,
- Controlled access to the CBDC data warehouse audit trails and the ability to de-anonymise data subject to due process controls would be necessary.

6.2 Capacity and training programmes

Revenue authorities must ensure that they have the necessary expertise to operate and integrate CBDC and tax systems. Any knowledge gaps should be addressed by providing training to current staff. However, resource constraints may pose a challenge, and revenue authorities would require adequate fiscal support to ensure a smooth transition to the new systems. Failure to do so may lead to delayed implementation or system failure, which could ultimately undermine taxpayer morale and trust.

It is advisable for revenue authorities to engage in pilot testing and sandboxes, working alongside a select group of VAT vendors and taxpayers. This collaborative effort helps gain a deeper understanding of and plan for the operational aspects of implementing a full-scale CBDC. The knowledge and insights acquired through this prototyping process would be highly valuable for all revenue authorities involved.

6.3 Coordination between revenue authorities, central banks and government ministries

To ensure that a CBDC can result in tax-related efficiencies, it is essential for revenue authorities to be actively involved in the design phase of the CBDC. While central banks typically operate independently from fiscal and tax authorities, it is ideal for revenue authorities to have the opportunity to provide input on the configuration of the CBDC before its implementation. However, issuing a CBDC is a complex national project that requires collaboration among various stakeholders. These stakeholders include public agencies like financial intelligence units, capital market and statistical agencies, as well as supervisors, consumer protection agencies and private sector participants, such as merchants and users.

Although involving various government ministries and institutions in the design phase of a CBDC may ensure its benefits can be reaped across the government, it may also bring its own challenges. For example, while central banks might prioritise minimal visibility over transactions and the anonymity of those transacting in CBDCs, revenue authorities and security agencies may see significant benefits in reducing anonymity. Therefore, it is important to carefully balance the incentives and objectives of all stakeholders to ensure the successful implementation and adoption of a CBDC (Lane and Skingsley 2020).

6.4 Security of CBDCs and revenue authority data

Due to the sensitive nature of the data typically stored by revenue authorities and central banks, which includes income records and personally identifiable information like taxpayers' names, addresses and social security numbers, it is essential to ensure that robust and current cybersecurity protection measures are implemented before the roll-out of any CBDC takes place. Both the CBDC system along with the corresponding tax system needs to ensure security through the following:

1. Support via the underlying technology and design;
2. Ensuring regulators have the capacity to efficiently oversee CBDC operations, gather cybersecurity intelligence, pre-empt risks and coordinate recovery efforts in case of a cyber-incident;
3. Assisting CBDC users to understand how to use the relevant technology and curtail its risks (Didenko and Buckley 2021);
4. Adopting CBDC data security policies across all spheres of government, thereby mitigating the risks associated with personal or legal identifiers being aggregated with currency and live behavioural data, including legal due process and criminal sanctions.

6.5 Privacy and data-sharing agreements

To enable revenue authorities to benefit from the automatic calculation of taxable liabilities and direct payment of taxes from taxpayer or vendor accounts, it is necessary to establish data-sharing agreements with the entities holding this data. In a hybrid CBDC operational model, CBDC wallets would be managed by central banks at third-party financial service providers (FSPs). Depending on the jurisdiction's legal framework, this may require legislative measures or adjustments to tax policies and regulatory frameworks, allowing revenue authorities to access the necessary data. Moreover, in countries with stricter data

privacy regulations, central banks and revenue authorities may need taxpayers' permission to transfer transactional data.

According to Biber (2010), in most countries, the tax authority's ability to use indirect methods is derived from their authority to administer tax laws, which includes assessing and collecting taxes owed. While indirect methods are often not explicitly stated in legislation, lawmakers imply that the tax administration can use suitable methods to determine the tax amount by granting them the power to make estimated assessments without specifying the specific methods. Striking a balance between safeguarding citizens' personal information (particularly with evolving data protection laws) and enabling revenue authorities and other government institutions to leverage transactional information will necessitate thoughtful consideration and coordination in the future.

In addition to considering factors that are within the purview of revenue authorities, foundational issues that need to be considered but are outside the purview of revenue authorities are discussed in the following sections.

6.6 Widely accessible digital infrastructure

Effective implementation of a CBDC depends on the availability of the required infrastructure for individual taxpayers as well as revenue authorities. Electricity and internet access are prerequisites for usage, and the absence of this infrastructure in rural or remote areas will directly impact the financial inclusiveness of the currency.[23]

The level of digital inclusion is a crucial consideration when implementing CBDCs. Remote areas may have limited connectivity, and complying with CBDC accessibility requirements may be costly for some individuals. In regions with high digital exclusion, governments should be able to educate and provide resources to individuals who do not meet the digital requirements for CBDC access and usage. When CBDCs are used for tax collection, revenue authorities must ensure that taxpayers can still settle their tax liabilities outside the CBDC system. Governments need to maintain traditional paper-based filing or establish a network of accessible tax agents who can file taxes on behalf of taxpayers. However, achieving universal access to CBDC support services in remote rural

[23] Depending on the technology employed, offline and non-phone-enabled instruments would require lower levels of electricity/internet access and service standards, as these can be required only where core processors and ICT infrastructure are located. Value can circulate offline for protracted periods of time. These types of technology are aimed at areas where there are limited ICT and electricity connections, and where smart cards and/or phones can only intermittently link to online processes. It is worth noting that individuals using the internet were just 19 per cent of the total population in low-income countries as of 2020 (World Bank n.d.).

areas may be impossible in several developing countries.

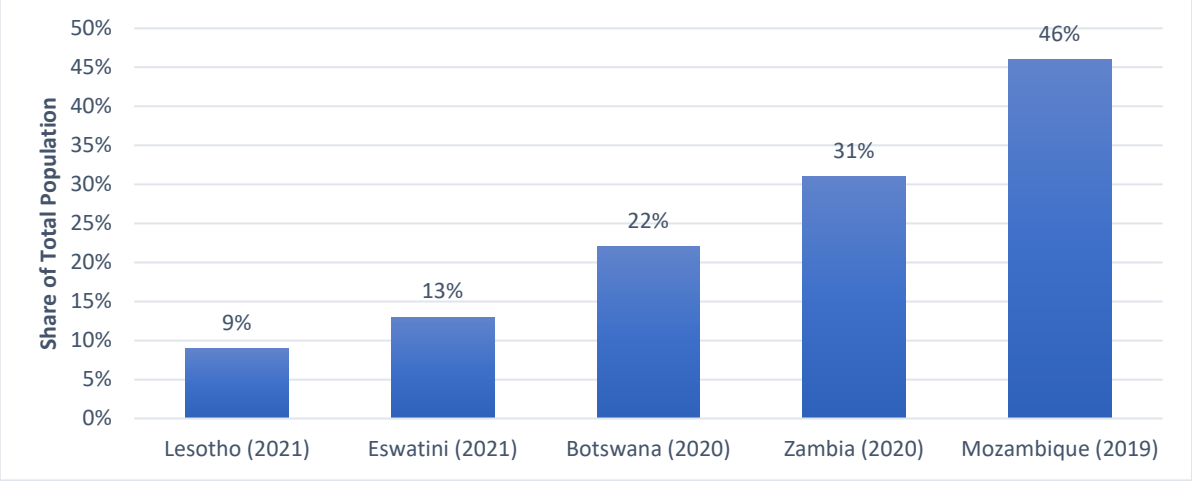
6.7 Means of identity verification

To engage in digital financial transactions, people must have a legal identity or a unique identifier for operating online. Depending on national regulations, a basic requirement is to digitally identify and verify individuals. When a national identity system is not available, alternative methods like foundational proxy identities or digital identifiers can be used to detect individuals within a data system. In practice, having a phone/SIM card or Smart Card can serve as sufficient identification, as long as there are proper security measures in place on the backend.

6.8 High degree of financial inclusion

In the context of implementing a multi-tiered operating model for a CBDC, individuals' CBDC value would be stored in a wallet provided by third-party financial intermediaries. To ensure widespread accessibility of a CBDC, it is crucial to prioritise financial inclusion. This can be achieved by establishing a robust network of financial intermediaries and facilitating access to identity documentation, allowing individuals to open CBDC accounts. Additionally, it is important for individuals to be well-versed in using digital financial services (DFS) for their income and expense transactions, moving away from relying solely on cash-in-cash-out (CICO) transactions. By leveraging these existing transactional flows, revenue authorities can effectively implement CBDC instruments. However, the adoption of DFS may pose challenges for developing countries where universal financial inclusion remains a primary goal.

Figure 6.8.1 Share of individuals excluded from formal financial services in select developing countries (survey year indicated in brackets)



Source: FinMark Trust (2021)

6.9 Understanding the potential degree of uptake and usage

Having a population with high smartphone adoption, widespread digital infrastructure and strong financial inclusion does not automatically guarantee the adoption and usage of a CBDC by the wider population. To determine if a CBDC will be utilised, it is essential to understand the specific factors that drive user behaviour in a given context. Trust (both in DFS and the government), demand and end-users' literacy levels are crucial in deciding whether a CBDC is likely to be adopted and used. It is also important to note that there might be differences in consumer behaviour when it comes to using traditional bank accounts compared to CBDC wallets.[24]

[24] A recent survey noted that only 54 per cent of respondents said they would trust a digital currency issued by their government or central bank (The Economist 2021).

6.10 Degree of money laundering risk, de-risking and illicit financial flows

Before implementing a CBDC, jurisdictions must assess the risks associated with money laundering, terrorism financing and illicit financial flows. It is important to evaluate the extent to which the CBDC can be structured to effectively reduce these risks without inadvertently creating new avenues for potential risks. While the primary motivation for CBDC issuance is not anti-money laundering and combating the financing of terrorism (AML-CFT) requirements, CBDCs are still expected to comply with such requirements, as well as other regulatory and disclosure laws. By following risk-based approaches and considering concepts of financial exclusion risk, any level of anonymity in CBDC transactions should be proportional to the risks it poses, the risks it mitigates and the societal interests in economic inclusion.

The economic environment in which revenue authorities' function is influenced by several factors beyond their direct control, such as the state of a country's digital infrastructure, the level of financial inclusion and the drivers of informality. Nevertheless, these fundamental issues must be taken into account, as they play a significant role in determining the feasibility of taxpayers leveraging CBDCs for simplifying payment procedures and automating various tax liability submission steps. Where accessibility or an individual's preference to remain anonymous is ignored, it may ultimately lead to the exclusion of certain population groups and risk widening the digital divide.[25]

[25] An analysis of the adoption and effects of e-tax services in Rwanda by Santoro et *al.* (forthcoming) demonstrates the existence of a 'digital divide' in taxpayer knowledge – where female and/or less-educated taxpayers and those operating less sophisticated firms are much less aware of e-tax services. When discussing the adoption of e-tax services, the authors also raise the issue of a secondary digital divide in which female taxpayers and those who are less educated have lower adoption rates of these digital services.

7. Conclusion

CBDCs are expected to play a significant role in shaping the future of money, payments and finance, influencing how governments, businesses and individuals transact. CBDCs are effectively digital versions of central-bank-issued sovereign currency. They are analogous to cash in several ways: they are fungible, a store of value, a unit of account and provide instantaneous settlement.

In recent years, developing countries have emerged as forerunners in retail CBDC experimentation and piloting, and it is conceivable that many will formally adopt CBDCs. This will inevitably have implications for tax systems. Depending on their operating model and design features, CBDCs could improve tax authorities' ability to track income and net worth, detect tax avoidance and evasion, and improve administrative performance by providing greater transparency, security and traceability.

Although CBDCs can be operationalised in several ways, the core operating models are single-tier, intermediated and synthetic. Furthermore, national authorities can use various design features to tailor a CBDC to achieve specific public policy goals and mitigate specific risks. These characteristics relate to the programmability, availability, ledger centralisation, anonymity and the degree to which they bear interest. Authorities, for example, can design CBDC protocols to self-execute tax claims and transfers, as well as to enforce specific tax procedures. These design features could allow authorities to embed protocols within CBDC cryptography that can automate CBDC payments, tax restrictions, access and tax holdings upon the fulfilment of specified rules and criteria.

The potential for CBDC to automate tax administrative processes is significant, but careful consideration of technical specifications and an enabling regulatory environment are required. CBDC wallets could be used to improve tax functions such as registration, verification and dispute resolution, with smart contracts calculating taxable income and building real-time taxpayer registration databases based on transaction data. Granular transaction data could also allow for faster verification of taxable income, potentially reducing the need for taxpayers to interact in person with tax officials. CBDC wallets have the potential to improve revenue authorities' tax planning, revenue projections, fiscal budgets and taxpayer targeting by providing valuable transaction data that can be used to model and test specific tax rates.

CBDCs have the potential to streamline the VAT process, significantly reduce the compliance burden for taxpayers and vendors and provide revenue authorities

with near-real-time liquidity access. However, several prerequisites must be in place for CBDC adoption to maximise the potential benefits and mitigate the associated risks – including cybersecurity and the erosion of privacy rights. Operations risks and challenges include the expected difficulty of integrating CBDCs with existing and legacy tax systems, near real-time matching of VAT receipts with registered vendor accounts and capacity limitations.

The risks and challenges associated with CBDC implementation will necessarily vary by jurisdiction. However, to mitigate these risks, revenue authorities will benefit from evaluating a set of prerequisites for effective CBDC integration. These include a secure data warehouse, capacity and training programs, fiscal support, intergovernmental coordination, cybersecurity mechanisms, privacy protection and data-sharing agreements. With careful planning and a coordinated approach, CBDC adoption can provide significant benefits to both revenue authorities and taxpayers.

Revenue authorities in developing countries may also face several contextual challenges that limit their operational efficiency, including a small tax base, a cash prevalence, significant tax evasion and a lack of digital infrastructure. If these constraints (particularly digital infrastructure and capacity constraints) are not adequately addressed, any potential benefits of CBDC adoption will be undermined.

Although revenue authorities' primary concern is often tax collection and the efficiency of tax processes, they should ideally prioritise the inclusiveness of the tax system as well. CBDC has the potential to reduce tax compliance costs and increase the proportion of taxpayers who file and pay taxes on time; however, this is only likely if citizens can and are comfortable transacting digitally and if they already have a high degree of trust in their tax authority.

Like all novel technologies, CBDCs are neither a panacea nor a one-size-fits-all solution for the many challenges that beset tax systems in LICs. Determining which features are relatively more important in a developing country context is critical to appropriately tailoring its design. For example, in countries where trust in the government is low, a CBDC may result in the increased use of cash or a preference for private digital currencies (for example, if the CBDC is designed for maximum traceability with limited anonymity). As a result, governments must collaborate with industry stakeholders, academics and civil society organisations to develop and implement CBDCs in ways that are transparent, fair and consistent with broader public policy goals.

Revenue authorities must also consider whether the benefits of a CBDC outweigh the benefits of existing tax administration digitalisation approaches. If a CBDC is implemented without due consideration of the issues raised, existing challenges

faced by revenue authorities in developing economies, such as informality and tax evasion, may be worsened. To avoid problems, revenue authorities should make these implications clear to central banks and closely monitor developments involving CBDCs.

The impact of CBDCs on tax administration processes will be determined by how revenue authorities evaluate and mitigate risks, as well as their ability to provide input on the CBDC's configuration and further upgrading. Successful tax-related adaptation in a CBDC environment will necessitate coordination among government entities and seamless integration with legacy systems and databases. Such coordination could ultimately improve the chances that CBDCs will have a positive influence on users rather than become a burden that exacerbates public mistrust.

Appendices

Appendix 1 Mapping key CBDCs and their implications for taxation

This section lists some key CBDC projects (launched or currently being developed) for use by individual national economies, monetary unions or collaborative cross-border use. Their implication to taxation is also briefly explored. Some of these CBDCs have already been launched (e.g. Sand Dollar, ENaira, JAM-DEX and DCash), while the rest are either in advanced pilot testing (e.g. Digital Yuan and Rupee) or exploratory stages (Digital Euro and several cross-border CBDCs).

A1 National CBDC projects

A1.1 Sand Dollar

On 20 October 2020, The Bahamas became the first country to introduce a state-wide CBDC, the Sand Dollar. The Central Bank of the Bahamas (CBOB) initially tested a digital version of the Bahamian dollar in the Exuma area on 27 December 2019 before expanding it to the Abacos a few months later (Wenker 2022; CBB 2019).

The Sand Dollar aims to be as convenient and similar to cash as possible to reduce service delivery costs, increase transactional efficiency and enhance financial inclusion. However, there is currently limited data on its uptake and usage. The Sand Dollar currently has ‘limited channels’ and accounts for less than 0.1 per cent of all in-circulation currency. According to the CBOB, ongoing efforts are needed to improve the Sand Dollar's security and system resilience and protect financial integrity (IMF 2022; Zamora-Perez, Coschignano and Barreiro 2022).

The introduction of the Sand Dollar in The Bahamas, an offshore tax haven, presents a unique case regarding taxation issues, especially tax evasion. Specifically, the Sand Dollar demonstrates that regulatory frameworks for CBDCs may need to incorporate limits and caps (e.g. on transfers and account balances per holder) to avoid bank disintermediation (Wenker 2022).

To enhance tax administration, the Bahamas Sand Dollar CBDC forgoes

anonymity (CBB 2019). The CBDC enables financial institutions to thoroughly observe the identities of both parties (IMF 2020; Syarifuddin and Bakhtiar 2021).[26]

A1.2 eNaira

The Central Bank of Nigeria launched the 'eNaira' on 25 October 2021, aiming to improve the country's payments ecosystem, increase financial inclusion and boost income and tax collection (Zamora-Perez *et al.* 2022). To use the eNaira, consumers need to log in to the eNaira wallet app on their phones. Since its release, approximately 500,000 users have downloaded the digital wallet, and users exchanged around €130,000 worth of the virtual currency in the first three weeks (Zamora-Perez *et al.* 2022; Onu 2021). As of August 2022, the governor of the Central Bank of Nigeria reported that the eNaira app had been downloaded over 840,000 times, with around 270,000 active wallets used to conduct transactions worth less than US$10 million. This indicates that nearly a year after its launch, each eNaira wallet had an average transaction value of under US$11, and less than 0.15 per cent of Nigerian individuals were actively using the wallets (Zamora-Perez *et al.* 2022; Crawley 2022).

According to Ozili (2022), the eNaira's traceability to a unique ID for the originator of transactions reduces the risk of money laundering and fraud while preventing money from being transferred and hidden outside the banking system. Ozili (2022) also suggests that the eNaira's use in paying for products and services will reduce tax avoidance in Nigeria, potentially increasing tax revenue for the government by making taxable assets traceable and enforcing transparency in the taxation system. Additionally, the eNaira will make diaspora payments more affordable and secure. More evidence is needed to draw firmer conclusions about the effects of eNaira on financial inclusion and payment system efficiency.

A1.3 JAM-DEX

In July 2022, the Central Bank of Jamaica launched its digital currency, JAM-DEX. To conduct transactions using this CBDC, Jamaicans rely solely on the Lynk app, a digital wallet platform (JO 2022). To create a Lynk wallet, users are required to upload identification documents, such as their driver's license, voter's ID or passport and a copy of their Taxpayer Registration Number (TRN).

[26] Beyond The Bahamas, Sweden uses an underpinning register on the electronic krona to record the transaction and safeguard the owner's rights, thus making transactions traceable. Conversely, China intends to employ controlled anonymity in their CBDC, which means that the transaction will be traceable if its value is high and anonymous otherwise (Syarifuddin and Bakhtiar 2021). Overall, to stop illegal activities like money laundering and terrorism financing, the majority of central banks disagree with CBDCs' complete anonymity (Kaminska 2021).

Furthermore, the Lynk app collects biometric data to ensure enhanced security and prevent unauthorised access to users' funds.

The Jamaican government plans to use Jam-Dex for most of its payments, allowing government agencies and supporting organisations, such as the tax office, to accept payments through Lynk or digitally through the mobile wallet. 'Jam-Dex' has already facilitated government payments to seasonal employees in Jamaica. These experiences with Jam-Dex could provide valuable insights for public servants worldwide seeking to understand and implement CBDCs to improve financial inclusion (Hall 2023).

A1.4 Digital yuan (e-CNY)

In April 2020, the People's Bank of China (PBOC) became the first central bank of a significant global economy to launch a pilot CBDC. The digital yuan was initially tested in various parts of the nation, with users selected through a lottery system. The primary goal of the e-CNY is to promote financial inclusion and maintain monetary sovereignty by offering a secure and straightforward retail payment system (Zamora-Perez *et al.* 2022).

As of the end of 2021, the e-CNY app had more than 260 million users and had processed transactions worth around US$12.5 billion, with most transactions being under US$50 per wallet. However, several researchers found that most wallets had a balance of less than US$0.5 and were not actively utilised for transactions as of October 2021 (Zamora-Perez *et al.* 2022; Kumar 2022).

The e-CNY is supported entirely by the PBOC and is implemented by payment service providers, allowing for greater anonymity and better protection of personal information. However, enough records are kept to track illicit actions like money laundering and tax evasion (Deutsche Bank 2021).

Since April 2022, Chinese citizens in the Zhejiang province have been testing digital yuan payments for PITs and social security contributions. The Zhejiang Provincial Taxation Bureau has been working with the PBOC since March 2022 to explore various ways of using the digital yuan to pay taxes (Tost 2022).

A1.5 Digital Rupee (e-Rupee)

On 1 December 2022, the Reserve Bank of India (RBI) began the first retail digital rupee (e-Rupee) pilot. The pilot would first focus on four cities before expanding to nine. The pilot's scope may be gradually expanded to cover other banks, users and locations in the future (Kulkarni 2023).

Loans and deposits over ₹20,000 (about US$242) made or returned in cash are disclosed in tax audit reports to assess penalties. Similar tax charges are

imposed under the Income Tax Act for receiving a total of at least ₹200,000 (about US$2421) from a person in a single day for transactions about a single event or occasion (Mohanka 2023).

A2 Monetary Union CBDC projects

A2.1 DCash

In March 2021, the Eastern Caribbean Currency Union (ECCU) member states launched their CBDC called 'DCash', making it the first-ever blockchain-based currency introduced by a currency union. Previously, CBDCs had only been explored by individual nations (ENN 2022; ECCB 2022). The Eastern Caribbean Central Bank (ECCB) stated that the introduction of the DCash CBDC aligns with its goal of achieving financial inclusion, improving payment system efficiency and enhancing member states' economic resilience and competitiveness (ECCB 2022).

Users without bank accounts but with a smartphone can use a downloadable app to make payments using a QR code. Those without bank accounts can visit a pre-approved agent or non-banking financial institution that verifies their details and creates a DCash wallet (ENN 2022). DCash also offers a solution to Caribbean citizens and residents, who can use it to settle taxes, pay utility bills, make purchases and contribute to retirement funds (Immigrantinvest 2021). Moreover, customers who do not have a Caribbean bank account can still use DCash to transfer money and make purchases from other countries.

Although the launch of DCash has been widely applauded in the Eastern Caribbean, some experts have raised concerns that smaller nations' CBDCs, like Dcash, could be used for illegal activities, such as money laundering and financing terrorism (ENN 2021). However, the IMF noted that DCash could reduce the vulnerability to money laundering and terrorist financing (ML/TF), as the ECCB owns the DCash platform, and transactions are only available to registered participants who have obtained a Dwallet (IMF 2021).

Recently, DCash experienced a protracted outage between January and March 2022 due to an issue with the system's operational management procedures for digital certificates. The outage interfered with new transactions and the onboarding of new users, while maintaining the DLT and existing data and transactions (Soderberg *et al.* 2022).

A2.2 Digital Euro

On 20 July 2021, the European Central Bank (ECB) declared the commencement

of the digital euro project within the Eurosystem, as per a press release. The project's development will consider user preferences and technical input from merchants and intermediaries. The ECB also revealed that the investigation phase of the digital euro project would continue for two years before its full launch. Furthermore, it was highlighted that no technical hurdles were encountered during the initial experimentation phase (ECB 2021).

It was noted that payments to and from the government – such as paying taxes or receiving welfare payments – are the most significant potential use of the digital euro (ECB 2022).

A3 Cross-border CBDC projects

A3.1 Multiple CBDC Bridge (mBridge)

The mBridge project aims to build a prototype for a multiple central bank digital currency (mCBDC) platform for cross-border payments. Initial versions of mBridge have shown that using a CBDC arrangement for cross-border payments can be cheaper, faster and more transparent than today's systems (BIS, IMF and World Bank Group 2022).

The mBridge project initiative involves the Hong Kong Monetary Authority, the People's Bank of China's Digital Currency Institute (DCI), the Central Bank of the United Arab Emirates, the Bank of Thailand and private sector partners. It is also supported by the BIS Innovation Hub Centre in Hong Kong SAR (BIS, IMF and World Bank Group 2022; Atlantic Council 2024).

A3.2 Project Dunbar

Project Dunbar has facilitated the issuance of multiple CBDCs by different central banks through a shared platform for international settlements (BIS, IMF and World Bank Group 2022). This initiative has successfully prompted the central banks of Australia, Singapore, Malaysia and South Africa to explore a common platform for international settlements, creating two prototypes by March 2022 that enable settlements across various CBDCs (Atlantic Council 2024).

Transactions among participants in this shared CBDC platform are conducted using standard functions, specifically smart contracts on DLT. Under this CBDC model, non-local banks hold CBDCs directly accountable to the central banks that issue them. 'Sponsoring' banks, which provide direct access and are relied upon by indirect participants, undertake customer due diligence procedures on foreign banks and operate under regional laws (BIS, IMF and World Bank Group 2022).

The primary advantages of these cross-border CBDCs (such as mBridge, Dunbar

and others) are efficiency, lower transaction costs, faster processing times and greater transparency. However, the BIS's Innovation Hub emphasises that cross-border CBDCs (such as Project Dunbar) can also have innovative use cases, such as facilitating real-time direct government-to-citizen payments for services such as healthcare support, tax refunds, childcare funding and stimulus payments (BIS 2022). Another benefit of cross-border CBDCs (e.g. mBridge) is that they can help financial institutions in the network comply with legally mandated safeguards to combat tax evasion, money laundering and terrorism financing (TAB 2023).

A3.3 Other cross-border CBDCs

Beyond mBridge and Project Dunbar, various central banks and monetary authorities are considering or piloting cross-border retail and wholesale CBDCs to enhance collaboration. These include:

- Onyx/Multiple wCBDC: a wholesale CBDC involving France and Singapore (Ledger Insights 2021);
- Project Aber: a wholesale bilateral CBDC pilot project involving Saudi Arabia and the UAE (SAMA and CBUAE n.d.);
- Project Aurum: both retail and wholesale CBDC involving Hong Kong and BIS (BIS n.d. a);
- Project Helvetia: a wholesale CBDC involving Switzerland and the BIS (BIS n.d. b);
- Project Icebreaker: a retail CBDC involving Israel, Norway, Sweden and the BIS (Ledger Insights 2023);
- Project Jasper: a wholesale CBDC involving Canada, the UK and Singapore (Chapman *et al.* 2017);
- Project Jura: a wholesale CBDC involving France and Switzerland (BIS n.d. c);
- Project Mariana: a wholesale CBDC involving France, Switzerland, Singapore and the BIS (BIS 2023);[27]
- Project Rosalind: a retail CBDC involving the United Kingdom and the BIS (BIS n.d. d).

[27] This project particularly explores using automated market makers to enable exchange between the Swiss franc, euro and Singapore dollar (Atlantic Council 2024). See also Ledger Insights (2022).

It is noteworthy that several nations are considering alternative payment methods that are not reliant on the dollar, especially in response to the heavy financial sanctions against Russia. Cross-border CBDCs have since emerged as an alternative monetary regime for cross-border settlements. As of early 2023, nine wholesale and seven retail cross-border CBDCs were being tested. The number of cross-border CBDCs being tested has doubled between 2021 and 2023 (Atlantic Council 2024). Furthermore, in response to the proliferation of CBDC projects globally, the IMF is currently seeking to develop a global CBDC platform to ensure a harmonised approach to global CBDC development and exchange. The IMF is also pushing to establish a common regulatory framework for CBDCs to maximise their potential and allow global interoperability.[28]

[28] For more, see (Eljechtimi 2023).

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