

CENTRAL BANK DIGITAL CURRENCY - AN OPPORTUNITY FOR FINANCIAL INCLUSION IN DEVELOPING AND EMERGING ECONOMIES?



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EXECUTIVE SUMMARY

Digital innovations on the rise. Over the last decade, digital payment innovations have accelerated the cashless movement in developing and emerging countries. Mobile money¹, FinTechs and, more recently, private cryptocurrencies and stablecoins, are offering individuals and merchants² new ways to meet their financial needs and, in the process, contribute to financial inclusion.

However, while significant gains have been made, particularly through mobile money, there is still a need to deliberate on how new innovations can meet needs. This is because many adults³, in developing and emerging countries remain underserved or excluded from digital payment ecosystems, continuing to live their financial lives in cash. Further, these new innovations have also brought new risks⁴ to individuals, merchants and the broader financial system such as online fraud and theft, mis-selling and data breaches.

Central Bank Digital Currencies. Recognizing the importance of digital payments to contribute to financial inclusion, central banks are increasingly looking to expand their regulatory toolbox to address the outstanding payment needs of citizens by leveraging digital payment innovations while also addressing these potential risks. Central bank digital currencies (CBDC) are one such tool that has been increasing in popularity over the last few years. At its simplest, a CBDC is cash but in digital form. Similar to physical cash, it is issued by the central bank and guaranteed as a claim on the central bank reserves, can be accepted broadly, and results in instant transfer of value. However, unlike cash, it is digital in nature, meaning that with the right infrastructure, a population with the adequate set of skills⁵ can use it to interact seamlessly with other digital instruments and tools.

Financial inclusion a prime motivation for developing and emerging countries. Motivations for implementing a CBDC by central banks include enhancing financial stability and monetary policy, improving payment systems, and contributing to financial inclusion.⁶ Developing and emerging countries in particular are considering a retail CBDC, while still exploring its wholesale counterpart as a means to extend the benefits of digital payments and support financial inclusion⁷.

New lens for exploring CBDC. AFI members have been at the forefront of exploring CBDC in developing and emerging countries and have identified three use cases to prioritize. Namely, domestic remittances (P2P), merchant payments (P2B) and government person payments (G2P), all of which have a particular significance for the financial inclusion of vulnerable groups. By exploring these use cases in more detail, central banks in developing and emerging countries can identify financial inclusion barriers and drivers to better inform CBDC design choices and policies in line with their market context and risks.

Can CBDC expectations match reality? While these choices will be informed by the current market context and risks and are likely to differ across jurisdictions and regions, there are common questions emerging from central banks when considering the practical design and policy implications of a CBDC. For example, how could a CBDC be designed in a way that enhances trust with individuals and merchants instead of reducing it? Could CBDC be designed in a way that is secure and accessible, while reaching those with low levels of digital and financial literacy? How does CBDC avoid reinforcing existing digital divides and/or gender disparities? Is CBDC suited to the task of alleviating financial inclusion barriers?

1 Including mobile money.

2 Merchants in this report refer to micro, small and medium-sized enterprises.

3 This is especially those from vulnerable communities such as women, the forcibly displaced, those living with a disability and those living in remote or rural areas in developing and emerging countries.

4 New risks consistently emerge as criminal enterprises and unethical entities identify new ways of exploiting regulatory loopholes and cybersecurity gaps (See: Shetty, Nishanth S. 2022. Demystify Mobile Money Risks and Money Laundering with Better Monitoring Controls. Subex. 11 February. Accessed 5 June 2022. <https://www.subex.com/blog/demystify-mobile-money-risks-and-money-laundering-with-better-monitoring-controls/> and Trozze, Arianna, Josh Kamps, Eray Arda Akartuna, Florian J. Hetzel, and Bennett Kleinberg. 2022. Cryptocurrencies and future financial crime. Accessed 5 June 2022. <https://crimesciencejournal.biomedcentral.com/track/pdf/10.1186/s40163-021-00163-8.pdf>).

5 Digitally and financially literacy skills.

6 Boar, Codruta and Wehrli, Andreas. 2021. Ready, steady, go? - Results of the third BID survey on central bank digital currency. BIS Papers 114. Basel. Bank of International Settlements. Accessed 14 March 2022. <https://www.bis.org/publ/bppdf/bispap114.pdf>

7 There are two types of CBDC: retail and wholesale. The former is preferred for financial inclusion because its payment properties for end users as well as the potential for central banks to directly make transfers to the previously unbanked population as long as they have adopted the CBDC wallet (See 22. Auer, Raphael. Holti Banka. Nana Yaa Boakye-Adjiei. Ahmed Faragallah. Frost, Jon. Harish Nataraja. and Jermy Prenio. 2022. Central bank digital currencies: a new tool in the financial inclusion toolkit? April. Accessed 28 April 2022. <https://www.bis.org/fsi/publ/insights41.pdf> and 95. Fatah, Iftin. 2022. Are Central Bank Digital Currencies the Key to Unlocking Financial Inclusion in Africa? 03 March. Accessed 28 April 2022. <https://www.cnbcfrica.com/2022/are-central-bank-digital-currencies-the-key-to-unlocking-financial-inclusion-in-africa/>).

AFI Special Report. This special report on CBDC and financial inclusion aims to unpack these considerations for developing and emerging countries by evaluating the extent to which CBDC can advance financial inclusion.

It provides an overview of the landscape of CBDC in developing and emerging countries and the specific motivations for AFI members to pursue one.

It looks at the current state of financial inclusion across different developing and emerging countries and regions, and identifies the main use cases CBDC can contribute to.

It identifies the relevant barriers to these use cases and the unique CBDC features that address them. It introduces the potential risks and unintended consequences for consumers, central banks, and payment service providers before setting out a framework and roadmap to assist central banks on their CBDC journey from exploration to implementation.



Key report findings. Through a series of in-depth key informant interviews with central banks, international organizations and technical platform providers, as well as robust desktop research and analysis, six key insights have emerged from this report:

- 1 Digital and financial inclusion has been enabled by key drivers while entrenched obstacles remain.** Financial inclusion among excluded and underserved segments in developing and emerging countries have enjoyed significant improvements over the past decade due to key infrastructural, policy and technology-related drivers. These include enhanced digital connectivity, more accessible point-of-sale (POS) devices to ease transactions such as near-field communication (NFC), and simplified know-your-customer (KYC) frameworks among others. Yet despite these advancements, notable access and usage barriers remain, such as the remoteness of populations and a lack of basic forms of identity.
- 2 CBDC design can address specific access constraints that currently affect digital financial services (DFS):** Retail CBDC can be designed to alleviate identity gaps, and mobile phone and digital access divides through its unique ability to generate digital identity proxies and enable offline capabilities while being device agnostic. CBDC, however, is likely to remain limited by poor electricity coverage, access to (and affordability of) CBDC-enabled devices and limited cash-in and cash-out infrastructure. This last factor is a key prerequisite for driving the adoption of digital payment instruments.⁸ The recent prolonged unavailability of the ECCB's DCash is a notable illustration of the bounded potential of CBDC due to outages.⁹

⁸ These barriers are more pronounced for women and other vulnerable groups.

⁹ According to the ECCB, the temporary downtime of DCash resulted from an expired certificate that needed to be reinstalled while the CBDC was offline (Margulies, B. 2022. Pilot CBDC outage due to expired certificate, ECCB says. 17 February. Central Banking. <https://www.centralbanking.com/central-banks/currency/digital-currencies/7926696/eccb-says-pilot-cbdc-failure-due-to-expired-certificate>). While this suggests a technical hiccup to the DCash pilot, it does highlight the lack of immunity of even a CBDC to access and availability challenges.

- 3 Convenience affordability and security of CBDC can drive inclusive consumer adoption:** Across all use cases, a key aspect of CBDC's value proposition is its tested ability to drive interoperability¹⁰ and channel ubiquity for users by providing convenient payments across any provider - via any device, to any provider - as a universal instrument. This status as a general-purpose or universal instrument is a key distinction from other digital instruments like electronic (e)-money or electronic money transfers (EFTs) which can assume appropriate claims on central bank money guaranteed but not guaranteed in the same way as cash, thus limiting its ability to interact with all types of value. Furthermore, through a more decentralized design, CBDC can also help to increase payment speed and reduce settlement costs for providers via numerous third-party intermediaries, and potentially transfer those reduced costs to consumers. With the backing of the central bank and strengthening through security protocols, CBDC can also offer users one of the most secure and trustworthy payment instruments on the market.
- 4 CBDC potential for financial inclusion exists but its design must be careful to avoid risks and worsening exclusion.** Research findings highlight that CBDC could offer substantial benefits for financial inclusion in developing and emerging countries within three key use cases. However, care should be taken by developing and emerging countries to not consider CBDC a panacea for financial inclusion. CBDC will not automatically advance financial inclusion, and if not designed appropriately, could reinforce existing barriers. Specifically, the perceived complexity could exacerbate pre-existing low levels of digital literacy and disincentivize adoption. CBDC could stimulate even more segments of the population to opt out of formal financial systems due to a lack of trust in national governments. This in turn could inadvertently increase the costs of payments through predatory pricing by unsupportive payment service providers (PSPs). These risks, as well as those that are more context-specific, are crucial to assess whether CBDC is best suited to address financial inclusion within a given country.
- 5 CBDC may not be an appropriate or relevant financial inclusion tool for every developing country.** The specific financial needs, and barriers impeding those needs being met, will differ from country to country. Therefore, the right tool to address those barriers is likely to be different as

well. CBDC may be a good match to address the concerns of one developing country, such as those with high digital readiness or a heightened need to more rapid climate related disaster recovery assistance, but it may not be for others where existing inclusive instant real-time payment instruments or systems may be better suited. The choice to pursue a CBDC should thus not be seen in a vacuum, but rather as part of a set of interventions considered by central banks.

- 6 Retail CBDC implementation needs to be context-specific and fit-for-purpose.** The decision to pursue a CBDC as a relevant tool to support financial inclusion needs to be accompanied by a careful approach to its design that avoid copy-and-paste designs that may not account for local market context and barriers. To make CBDC work for a country's citizens and businesses, CBDC should therefore be designed from the bottom up, considering the specific context and needs of the market, particularly vulnerable communities as much as possible. This approach will be crucial to avoiding the traps that current DFS channels have experienced to serve customers and ensure financial inclusion policy goals are met.

Findings from this report suggest that CBDC may not always be the right tool for addressing financial inclusion in different developing country contexts relative to other digital payment interventions. The unique feature of CBDC, which makes it distinct from other digital payments instruments, is that is issued by the central bank. But this feature does not necessarily make CBDC a better tool.

For example, interoperability and affordability are key design features for CBDC - but are also key design features for all digital payment instruments. The introduction of CBDC will not in itself solve this. CBDC could also offer another layer of complexity to models that need to be simple and efficient to contribute to financial inclusion, while also further straining institutional capacity. This does not mean that central banks should shy away from it: instead, they need to be clear on the unique value of a CBDC to financial inclusion in the existing digital payments landscape. Central banks can then design a CBDC around that.

¹⁰ The ability of CBDC to support network interoperability, although not a given, has been proven possible by a number of technical providers to date, including Algorand, eCurrency and Stella among others.

THIS REPORT IS STRUCTURED AS FOLLOWS

SECTION 1

Introduces the study and the problem statement.



SECTION 2

Provides an introduction and overview of the digital payment and CBDC landscape across developing and emerging countries and the world, before unpacking why and how central banks have been considering CBDC for their economies to date.



SECTION 3

Digs into the financial inclusion status of developing and AFI member countries to understand where gains have been made, but more importantly, where opportunities exist to catalyze further inclusion.



SECTION 4

Contextualizes prioritized use cases within developing and emerging countries by evaluating the key trends driving DFS adoption within each, before exploring the most pertinent demand and supply barriers that impede greater access and usage.



SECTION 5

Analyzes the potential of retail CBDC to address the supply and demand barriers identified in section 4 across key use cases by assessing which CBDC design features could uniquely alleviate their impact and support enhanced financial access and inclusion for individuals and merchants.



SECTION 6

Highlights the key risks and unintended consequences that could affect consumers, central banks, payment service providers and other actors if CBDC design and implementation are not carefully considered.



SECTION 7

Provides a decision-making roadmap for central banks in developing countries to assess whether CBDC is an appropriate tool to address financial inclusions concerns, and if so, how to tailor both its design and context to ensure it successfully achieves that goal.



SECTION 8

Concludes the report with regional AFI member cheat sheets aimed at evaluating the readiness of key regions for CBDC, and the relevant design features worth considering for given contexts.



1. INTRODUCTION



Digital technology has evolved to become a powerful tool for financial inclusion. Since the late 1980s, technological developments have played a crucial role in enhancing access to, and use of, formal financial services by unserved and underserved populations in developing and emerging economies¹¹.

A case in point is the mobile phone, which has proven instrumental in broadening financial access beyond the reach of formal financial institutions. In the Philippines, for example, approximately 34.7 million people had a mobile money account in 2020, despite being ranked as one of the world's most unbanked countries with only 37 million people owning a bank account.¹² Further DFS innovations have evolved to support inclusion off the back of mobile phone penetration. These innovations have ranged from e-money in Kenya and remote banking via mobile banking applications, to technologies such as Quick Response (QR) codes and near-field communication (NFC) that have eased infrastructural constraints for merchants to accept digital payments. Most recently, innovations such as private digital currencies like cryptocurrency¹³ have further enabled populations in given countries and pilot projects to generate and store wealth in the absence of bank accounts, as well as transfer value across borders faster and more affordably than ever before.¹⁴

Barriers remain to greater DFS and payments adoption. Despite broadening financial access, DFS and digital payment offerings have yet to achieve universal adoption by underserved populations.

37%

For instance, in 2021, only 37 percent of Latin Americans used digital means to make any payment despite 87 percent of the Latin American population living within the range of a 4G signal.¹⁵

This lack of adoption is illustrative of a larger trend in developing and emerging countries - the persistence of access and usage barriers that limit the ability and willingness of individuals and businesses to go cashless and benefit from digital payment services.

According to recent AFI reports, these barriers include consumer demand factors like weak digital connectivity; consumer distrust in electronic-based money and a lack of required identity documentation; supply constraints such as a lack of sex-disaggregated data; service delivery not being adapted to women; high private sector transaction fees and unreliable payment channels, and regulatory hurdles such as KYC requirements^{16,17,18}.

Current DFS also risks amplifying exclusion. DFS innovations are also prone to exacerbating existing drivers of exclusion to financial inclusion. Exclusion could be triggered by through poorly designed products that do not take into account the unique needs of vulnerable populations. Financial exclusion risk could also be further heightened as a result of the digital divide.

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- 11 Andrianaivo, Mihasonirina, and Kangni Kpodar. 2011. ICT, Financial Inclusion, and Growth: Evidence from African countries. IMF Working Papers 2011 (073): 45. <https://www.imf.org/external/pubs/ft/wp/2011/wp1173.pdf>
 - 12 Ventura, Luca. 2021. World's Most Unbanked Countries . Global Finance. 17 February 2021 Accessed March 25, 2022. <https://www.gfmag.com/global-data/economic-data/worlds-most-unbanked-countries>
 - 13 Cryptocurrencies are "digital assets that are designed to be used as forms of exchange somewhat like traditional money. As the name implies, they exploit strong cryptography to secure exchange" (Tredinnick, Luke. 2019. Cryptocurrencies and the blockchain. Sage Journals 36 (1): 39-44.).
 - 14 Mejia-Ricart, Rodrigo, Camilo Tellez, and Marco Nicoli. 2019. Paying across borders - Can distributed ledgers bring us closer together? World Bank Blogs. Accessed March 23, 2022. <https://blogs.worldbank.org/psd/paying-across-borders-can-distributed-ledgers-bring-us-closer-together>
 - 15 Drees-Gross, Franz, and Pepe Zhang. 2021. Less than 50% of Latin America has fixed broadband. Here are 3 ways to boost the region's digital access. Geneva: World Economic Forum. Accessed March 25, 2022. <https://www.weforum.org/agenda/2021/07/latin-america-caribbean-digital-access/>
 - 16 The AFI study that is cited consists of several barriers, including information asymmetries, low-value and low-margin products, limited knowledge, and capacity to serve youth, low levels of internet penetration, limited financial infrastructure on the supply-side whilst on the demand-side it suggests the lack of experience and knowledge of the formal financial system, low levels of financial literacy, lack of proof of ID/ documentation for KYC, biases against financial institutions, lack of traditional collateral or guarantees, and social cultural norms as key barriers. The study also lists regulatory barriers such as, minimum age, KYC requirements, credit reporting, limited proportionate financial regulation.
 - 17 Our study focused on demand-side (Connectivity, fees, merchant acceptance, digital literacy, trust, identity, instant payments) and supply-side barriers (Provider interoperability, cash management and instant payments).
 - 18 Alliance for Financial Inclusion (AFI). 2021. Youth Financial Inclusion Policy Framework. Kuala Lumpur: Alliance for Financial Inclusion (AFI). Accessed March 25 2022. Available at: https://www.afi-global.org/wp-content/uploads/2021/03/AFI_YFI_PM_AW_digital.pdf, Digital Financial Services Working Group (DFSWG) and the Consumer Empowerment and Market Conduct Working Group (CEMCWG). 2019. Consumer protection for digital financial services: A survey of the policy landscape. Kuala Lumpur: Alliance for Financial Inclusion (AFI). Accessed 6 June 2022. https://www.afi-global.org/wp-content/uploads/2021/01/AFI_CEMCDFS_survey-report_AW2_digital.pdf and Alliance for Financial Inclusion. (AFI) 2017. Bridging the Gender Gap : Promoting Women's Financial Inclusion: Tools & Guidance from the AFI Network. Kuala Lumpur: Alliance for Financial Inclusion (AFI). Accessed 6 June 2022. https://www.afi-global.org/wp-content/uploads/publications/2017-11/AFI2017_Gender_full_AW_ISBN_digital.pdf

For example, vulnerable populations that currently struggle to access and participate in the digital economy due to connectivity and literacy constraints remain at threat of being excluded or underserved by DFS. These segments include, among others, women, the elderly, the displaced, and rural households.

Furthermore, while recent innovations have aimed to reduce identity documentation requirements for account onboarding, the inability to offer a valid identity remains a challenge for the most remote, rural and island populations. FinTechs, banks and e-money providers have sought to alleviate these hurdles, but many of these payment channels still suffer limitations to adequately account for these drivers of exclusion.¹⁹ This suggests that greater innovation is still needed to close exclusion gaps despite the onset of new systems, technology, and schemes.

Growing interest by central banks in CBDC as a frontier tool to overcome DFS and digital payment adoption hurdles. Central banks in developing and emerging economies are increasingly looking at CBDC as a key tool for advancing financial inclusion and overcoming hurdles posed to promoting a more digitalized economy. Indeed, according to a recent Bank of International Settlements (BIS) report, a survey carried out among more than 60 central banks found financial inclusion as a top motivation for developing and emerging economies pursuing a CBDC within their jurisdictions.²⁰

100%

This finding was further reinforced by a poll taken among AFI country members at a 2021 DFS working group in which 100 percent of participants identified financial inclusion as the leading motivation for pursuing CBDC.

While expectations are high, the suitability of CBDC for all developing and emerging countries isn't obvious. The financial inclusion aspirations of central banks for CBDCs among developing and emerging economies have been fueled in part by studies based on developed country drivers, as well as the global hype of CBDCs as viable alternatives to private sector-led currencies, such as Diem²¹, and stablecoins. As a result, less attention has been paid to investigating whether CBDCs are the best, or most fit-for-purpose, instrument to overcome context-specific financial access and usage challenges. Important questions, therefore, exist on the exact value of CBDCs' unique position to unlock entrenched market constraints; how CBDC can

be tailored to achieve inclusion goals given contextual challenges and risks, and whether developing markets and their environments can meet the preconditions that need to be met for CBDC to achieve financial inclusion goals.

This AFI special report aims to clarify the feasible financial inclusion potential of CBDC for developing and emerging economies. To address outstanding questions by central banks on the "why" and "how" of CBDC, the AFI DFS working group has commissioned the Center for Financial Regulation and Inclusion (Cenfri) to produce a special report on the practical feasibility of CBDC to advance financial inclusion using a developing country lens. This report aims to critically evaluate the role of CBDC for financial inclusion within the financial and payment ecosystem across developing and emerging countries, to understand the specific value that CBDC can add to unlocking frictions within key financial inclusion use cases for individuals and businesses, and to outline the preconditions that central banks in developing and emerging economies need to consider before pursuing CBDC as a solution to financial exclusion. This study has been informed by a combination of desktop research as well as extensive key informant interviews with central banks, payment thought leaders, industry providers, international organizations and research institutions²².

19 According to a recent study conducted by MicroSave in Uganda, non-users of mobile money cited unstable network, high tariff charges, unreliable customer care, and lack of documents to fulfil KYC requirements as their top barriers to begin using mobile money. This indicates that a significant portion of customers, and potential customers, do not trust the mobile money system, and perceive it to be expensive, inefficient, and ultimately infeasible for usage (Wright, Graham. 2015. In our digital financial services we trust? MicroSave Consulting. 24 June. Accessed 25 March, 2022. <http://blog.microsave.net/2015/06/24/in-our-digital-financial-service-we-trust/>).

20 Boar, Codruta and Wehrli, Andreas. 2021. Ready, steady, go? - Results of the third BID survey on central bank digital currency. BIS Papers 114. Basel. Bank of International Settlements. Accessed 14 March, 2022. <https://www.bis.org/publ/bppdf/bispap114.pdf>

21 Project Diem (formerly known as project Libra) a permissioned blockchain-based stablecoin payment system proposed by the American social media company Meta Platforms. It was abandoned in January 2022 (Dwoskin, E, and G De Vynck. 2022. Facebook's cryptocurrency failure came after internal conflict and regulatory pushback. 28 January. Accessed 13 April, 2022. <https://www.washingtonpost.com/technology/2022/01/28/facebook-cryptocurrency-diem/>)

22 See full list of stakeholders interviewed in Appendix Table 6

2. OVERVIEW OF CBDC IN DEVELOPING AND EMERGING COUNTRIES AND GLOBAL TRENDS



The purpose of this section is to provide a high-level overview of current CBDC and digital currency trends globally, particularly among developing and emerging countries. This section includes a brief description of CBDC and how it relates to private sector virtual assets currently deployed as digital currencies, key trends on the uptake and supply of these instruments, and an overview of the current state of CBDC exploration by central banks across the world. It concludes with a deeper dive into the predominant form of CBDC prioritized by developing country central banks.

2.1. NATURE AND CHARACTERISTICS OF CBDC

Central Bank Digital Currency (CBDC) is a digital representation of cash. A CBDC is a digital payment instrument, denominated in the jurisdiction's unit of account, that is a direct liability of the jurisdiction's monetary authority (i.e., the central bank in most cases).²³ CBDC can be a balance in a central bank account or a digital version of the physical notes and coins (henceforth "cash") that sits in a retailer's cash register or the wallet of an average citizen. CBDC therefore shares six key characteristics with a national currency.

1. **It is issued by a central bank.** CBDC is a currency that is created and backed, or explicitly regulated, by a national monetary authority.
2. **It is a store of value.** CBDC can act as a store of value with which to transfer purchasing power from the present day into the future.²⁴
3. **It is a unit of account.** CBDC can be used to value goods and facilitate price comparisons between items.²⁵
4. **It is fungible.** CBDC can be readily exchanged as a payment instrument which enables the facilitation

of the interoperability of instruments e.g. enabling mobile money providers to send and receive CBDC from any PSP^{26,27}

5. **It enables instant 24/7 settlement.** Once a payment message is completed over CBDC, value is instantaneously and directly transferred.
6. **It enables peer-to-peer transactions.** Transactions can be conducted directly between individuals.

The digital nature of CBDC adds additional characteristics beyond physical cash. CBDC, in its retail form, aims to mimic physical cash as much as possible. However, there are two additional characteristics that CBDC possess beyond physical cash:

- > **It is programmable.** CBDC enables the programmability of money, it is therefore geared to unlock automation.^{28,29}
- > **It is electronic.** CBDC enables transparency because it is electronic and therefore traceable.³⁰

23 Bank of International Settlements. 2020. Central bank digital currencies: foundational principles and core features. Basel. Bank of International Settlements. <https://www.bis.org/publ/othp33.pdf>

24 Cooper, Barry, Antonia Esser, and Michaela Allen. 2019. The use cases of central bank digital currency for financial inclusion: A case for mobile money. Cape Town. Centre for Financial Regulation and Inclusion (Cenfri). https://cenfri.org/wp-content/uploads/2019/06/CBDC-and-financial-inclusion_A-case-for-mobile-money.pdf

25 Cooper, Barry, Antonia Esser, and Michaela Allen. 2019. The use cases of central bank digital currency for financial inclusion: A case for mobile money. Cape Town. Centre for Financial Regulation and Inclusion (Cenfri). https://cenfri.org/wp-content/uploads/2019/06/CBDC-and-financial-inclusion_A-case-for-mobile-money.pdf

26 An entity that provides services enabling funds to be deposited and withdrawn from an account; payment transactions involving transfers of funds; the issuance and/or acquisition of payment instruments such as checks, E-Money, credit cards and debit cards; and remittances and other services central to the transfer of funds (Alliance for Financial Inclusion (AFI). 2016. Digital financial services: Basic terminology. August. Accessed 14 April, 2022. Kuala Lumpur. Alliance for Financial Inclusion (AFI). <https://www.afi-global.org/wp-content/uploads/publications/2016-08/Guideline%20Note-19%20DFS-Terminology.pdf>).

27 Cooper, Barry, Antonia Esser, and Michaela Allen. 2019. The use cases of central bank digital currency for financial inclusion: A case for mobile money. Cape Town. Centre for Financial Regulation and Inclusion (Cenfri). https://cenfri.org/wp-content/uploads/2019/06/CBDC-and-financial-inclusion_A-case-for-mobile-money.pdf

28 e.g. it can be used to automate payments such as tax payments etc.

29 Kiff, John, Jihad Alwazir, Sonja Davidovic, Aquiles Farias, Ashraf Khan, Tanai Khiaonarong, Majid Malaika, Hunter Monroe, Nobu Sugimoto, and Peter Zhou Hervé Tourpe. 2020. IMF Working paper: A Survey of Research on Retail Central Bank Digital Currency. Washington DC. IMF. Accessed 11 March 2022. <https://www.imf.org/-/media/Files/Publications/WP/2020/English/wpia2020104-print-pdf.ashx> and Cooper, Barry, Antonia Esser, and Michaela Allen. 2019. The use cases of central bank digital currency for financial inclusion: A case for mobile money. Cape Town. Centre for Financial Regulation and Inclusion (Cenfri). https://cenfri.org/wp-content/uploads/2019/06/CBDC-and-financial-inclusion_A-case-for-mobile-money.pdf

30 Kiff, John, Jihad Alwazir, Sonja Davidovic, Aquiles Farias, Ashraf Khan, Tanai Khiaonarong, Majid Malaika, Hunter Monroe, Nobu Sugimoto, and Peter Zhou Hervé Tourpe. 2020. IMF Working paper: A Survey of Research on Retail Central Bank Digital Currency. Washington DC. IMF. Accessed 11 March 2022. <https://www.imf.org/-/media/Files/Publications/WP/2020/English/wpia2020104-print-pdf.ashx> and Cooper, Barry, Antonia Esser, and Michaela Allen. 2019. The use cases of central bank digital currency for financial inclusion: A case for mobile money. Cape Town. Centre for Financial Regulation and Inclusion (Cenfri). https://cenfri.org/wp-content/uploads/2019/06/CBDC-and-financial-inclusion_A-case-for-mobile-money.pdf

Two distinct types of CBDC exist. CBDC can take on either a wholesale or retail format. A wholesale CBDC represents central bank money that is used to facilitate wholesale payments on national payment and settlement systems such as real-time gross settlement systems (RTGS) and post-trade securities settlement systems.³¹ Similar to cash, a retail CBDC is a retail payment instrument, issued and backed by the central bank.³² Unlike wholesale CBDC, retail CBDC can be used directly by consumers to store value or to transact either through a token or account³³, thus making it more relevant for end-users (e.g. merchants or consumers).

Role of underlying technology. CBDC is technology agnostic. It can be run on either a centralized or distributed ledger technology (DLT) platform, or no ledger at all. However, when wholesale CBDC is discussed nowadays, discussions revolve around those that run on DLT-based platforms³⁴. This is because wholesale CBDC is not a very recent innovation. For example, a 2018 IMF staff discussion note characterized central bank reserves as a “wholesale form of CBDC used exclusively for interbank payments” which has been around for a long time.³⁵

Retail CBDC different from other retail digital payment instruments. Digital retail payment instruments are not new to developing and emerging countries. They can range from commercial retail instruments, such as EFTs and (e)-money, to private cryptocurrencies and stablecoins (see below). Retail CBDC is, however, unlike the other digital retail payment instruments in that it is guaranteed by the central bank and not a commercial enterprise. Table 1 further unpacks how CBDC is uniquely distinct from retail payment instruments currently available and used across the world, including developing and emerging economies. Below we discuss these differences in more detail:

> **Commercial retail instruments** such as EFT³⁶ and e-money³⁷ possess several similarities to CBDC in that they are electronic, fungible, and regulated.³⁸ CBDC however has a unique advantage over these instruments in that it can act as a universally accepted legal tender³⁹, that is capable of storing value and being used as a unit of account.⁴⁰ In the case of e-money and EFT transfers for bank deposits, these are claims on central bank money, which suggests that they are not central bank money in and of itself, thus affecting their acceptability and trust.⁴¹ Finally, while commercial digital retail instruments clear instantly, they are not necessarily

- 31 Bech, Morten L., and Rodney Garratt. 2017. Central Bank Cryptocurrencies. 26 September. Accessed 29 March 2022. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3041906
- 32 Kiff, John, Jihad Alwazir, Sonja Davidovic, Aquiles Farias, Ashraf Khan, Tanai Khiaonarong, Majid Malaika, Hunter Monroe, Nobu Sugimoto, and Peter Zhou Hervé Tourpe. 2020. IMF Working paper: A Survey of Research on Retail Central Bank Digital Currency. Washington DC. IMF. Accessed 11 March 2022. <https://www.imf.org/-/media/Files/Publications/WP/2020/English/wpiea2020104-print-pdf.ashx>
- 33 An account based CBDC depends on identity of person. Identity is verified at point of sale. (It is the user who is verified). The identity of the account holder allows the holder to access the funds: “I am therefore I own”. A token based CBDC verifies the veracity of the token rather than the user. The physical possession of the banknotes and coins allows the holder to dispose of the funds “I possess therefore I own” (Bossu, Wouter, Masaru Itatani, Catalina Margulis, Arthur Rossi, and Hans Weenink and Akihiro Yoshinaga. 2020. IMF Working Paper: Legal Aspects of Central Bank Digital Currency: Central Bank and Monetary Law Considerations. November. Washington D.C.. International Monetary Fund (IMF). Accessed 18 March 2022. <https://www.imf.org/-/media/Files/Publications/WP/2020/English/wpiea2020254-print-pdf.ashx>). Box 4 in the appendix adds further clarity on this point.
- 34 Distributed ledger technology (DLT) is a consensus of replicated, shared, and synchronized digital data geographically spread across multiple entities, sites, countries, or institutions (Auer, Raphael, Cyril Monnet, and Hyun Song Shin. 2021. Distributed ledgers and the governance of money. November. Accessed 29 March 2022. <https://www.bis.org/publ/work924.pdf>). The updating mechanism for the ledger that rests on a set of rules for network members that elicits the decentralized consensus on the unique, true history, without appeal to a trusted authority. Once consensus is reached, all network members then coordinate on using the unique, agreed version of the ledger. In this respect, decentralization evens up the playing field and equalizes the distribution of power. This differs from a centralised CBDC where there is a centrally controlled database (see Auer, Raphael, Cyril Monnet, and Hyun Song Shin. 2021. Distributed ledgers and the governance of money. November. Accessed 29 March 2022. <https://www.bis.org/publ/work924.pdf>)
- 35 Griffoli, Tommaso Mancini, Maria Soledad Martinez, Peria, Itai Agur, Anil Ari, John Kiff, Adina Popescu, and Celine Rochon. 2018. Casting Light on Central Bank Digital Currencies. Washington DC. International Monetary Fund (IMF). Accessed 24 March 2022. <https://www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2018/11/13/Casting-Light-on-Central-Bank-Digital-Currencies-46233>
- 36 An electronic funds transfer (EFT) is a standard mechanism for electronically transmitting funds between two parties (Bank of International Settlements. 2001. Glossary: BIS Papers No 7 (part 12) Nov 2001. November. Basel. Bank of International Settlements. Accessed 31 March 2022. <https://www.bis.org/publ/bppdf/bispap07l.pdf>).
- 37 Electronic money (e-money) is considered as stored value held in the accounts of users, agents, and the provider of the e-money service. Typically, the total value of e-money is mirrored in bank accounts, such that even if the provider of the e-money service were to fail, users could recover 100 percent of the value stored in their accounts, depending on the degree of protection afforded to e-money commercial deposit accounts against the creditors of the e-money service, or that of the bank which holds the liability for the deposit. However, bank deposits can earn interest while e-money in most instances cannot. (See 114. Global System for Mobile Communications (GSMA). 2010. Mobile money definitions. London. GSMA. July. Accessed 31 March 2022. <https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2012/06/mobilemoneydefinitionsnomarks56.pdf>)
- 38 Conventus Law. 2021. Fintech: Non-Fungible Tokens: What's All The Fuss? Conventus Law . Accessed 24 March, 2022. <https://conventuslaw.com/report/fintech-non-fungible-tokens-whats-all-the-fuss/> and Scott, Hal S. 2015. The Importance of the Retail Payment System. Harvard Library. Accessed 24 March 2022. <https://dash.harvard.edu/bitstream/handle/1/16883011/hal-scott---mastercard-retail-payment-systems.pdf;jsessionid=62856B085B8505F7D8F65BC95D777E2B?sequence=1>
- 39 In practice, this is likely to be considered a limited legal tender instrument as forcing universal acceptability as legal tender may promote more financial exclusion, particularly for vulnerable groups.
- 40 Dorman, Peter. 2014. “Macroeconomics; A Fresh Start”. <https://books.google.co.za/books?id=j30qBAAAQBAJ&pg=PA141&lp-g=PA141&dq=eft+%27not+legal+tender%27&source=bl&ots=OCFKZ-bO9T8&sig=ACfU3U2JX8kLx7HtQVMgG8bESvIfl5EQrw&hl=en&sa=X&ved=2a-hUKEwivye3e7d72AhWkQkEAHSlgDKU4ChDoAXoECB0QAww> and Kasinyato, Safari. 2014. E-Money as Legal Tender: Does the status really matter? Madrid. Research Gate. Accessed 24 March 2022. https://www.researchgate.net/publication/260906539_E-MONEY_AS_LEGAL_TENDER_DOES_THE_STATUS_REALLY_MATTER
- 41 Kalogirou, Xenia. 2022. Authorities explore how to design central bank digital currencies . International Financial Law Review (IFLR). 21 January. Accessed 24 March, 2022. <https://www.iflr.com/article/b1wf5kshjg9wph/authorities-explore-how-to-design-central-bank-digital-currencies>

settled instantaneously⁴². By contrast, retail CBDC does.⁴³

- > **Private cryptocurrencies** can be described as virtual assets.⁴⁴ Virtual assets are a digital representation of value that can be traded or transferred digitally and can be used for payments or investments.⁴⁵ They are similar to CBDC in that they are fungible, electronic, and can be programmed and settled instantaneously.⁴⁶ In addition, in most jurisdictions, cryptocurrency is not universally accepted as a medium of exchange or unit of account, making it less useful to transact with.⁴⁷ However, while these aspects are some of the key advantages of CBDC over private cryptocurrency, its main advantage relates to trust and security of funds as private cryptocurrencies are often not covered within consumer protection frameworks.⁴⁸ This increases the risk for consumers of private cryptocurrencies as they are not protected by central banks.
- > **Stablecoins** are a class of cryptocurrencies but can also be described as virtual assets. They are pegged to a unit of an underlying asset and may be partially or fully backed by assets denominated in state currency.⁴⁹ Most stablecoins are issued by private sector players and operate on a public, permissionless blockchain ledger.^{50,51} The stability of stablecoins relies on the effectiveness of their stabilization mechanism⁵², as well as their ability to maintain pegging to their underlying reference asset.⁵³ Since the guarantee is not with the central bank, there is a risk of the stablecoin issuer becoming insolvent and unable to meet their liabilities, thereby affecting end-users' trust in stablecoins.⁵⁴ Moreover, the fact that a stablecoin's blockchain may be held in different jurisdictions suggests that there may be some regulatory gaps in terms of full oversight.⁵⁵

In summary: A retail CBDC, whether account or token-based and irrespective of underlying technology, is most likely to directly contribute to financial inclusion rather than its wholesale counterpart. Unlike a wholesale CBDC, a retail CBDC can be accessed and used by individuals and merchants as an alternative to existing banking and financial services. It can be used to store and transact value, as well as value and price goods. It is distinguishable from other digital payment instruments in that it is sovereign legal tender, guaranteed and overseen by the central banks, that is, universally accepted,⁵⁶ and can be exchanged without payment instruments (e.g. e-money). It offers instant

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- 42 EFT's can clear instantly if an instant EFT settlement system is in place. Otherwise, they are processed in batches or cleared in batches within clearing windows, including most instant EFTs.
- 43 Central Bank of the Bahamas. 2020. Driving Financial Inclusion and FinTech Innovation In the Midst of COVID-19. CEMLA. Accessed 21 March, 2022. <https://www.cemla.org/actividades/2020-final/2020-09-i-meeting-market-infrastructures/2020-09-i-meeting-market-infrastructures-2.pdf>
- 44 Described by FATF in this manner (Financial Action Task Force. 2021. Updated Guidance for a Risk-Based Approach for Virtual Assets and Virtual Asset Service Providers. 28 October. Accessed 31 March 2022. <https://www.fatf-gafi.org/publications/fatfrecommendations/documents/guidance-rba-virtual-assets-2021.html>)
- 45 Financial Action Task Force. 2019. Guidance for a risk-based approach : Virtual assets and virtual asset service providers . Accessed 24 March 2022. <http://www.fatf-gafi.org/media/fatf/documents/recommendations/RBA-VA-VASPs.pdf> and Intergovernmental Fintech Working Group (IFWG). 2021. Crypto Assets Regulatory Working group position paper on Crypto Assets. Treasury. Accessed 24 March 2022. http://www.treasury.gov.za/comm_media/press/2021/IFWG_CAR%20WG_Position%20paper%20on%20crypto%20assets_Final.pdf
- 46 KPMG. 2021. Non-Fungible Tokens (NFT): An innovation that presents an opportunity for everyone seeking to tap digital assets? KPMG Nigeria. Accessed 24 March 2022. <https://assets.kpmg/content/dam/kpmg/ng/pdf/non-fungible-tokens.pdf> and Campbell-Verduyn, Malcolm. 2018. Bitcoin and beyond : Cryptocurrencies, Blockchains, and Global Governance. London. Taylor and Francis Group. Accessed 24 March 2022. <https://library.oapen.org/bitstream/id/c8a35b6e-03a3-4116-97b9-af50ce7534b6/1000376.pdf>
- 47 Office of the Director of National Intelligence. 2017. Risks and Vulnerabilities of Virtual Currency Cryptocurrency as a Payment Method. Accessed 24 March 2022. https://www.dni.gov/files/PE/Documents/9---2017-AEP_Risks-and-Vulnerabilities-of-Virtual-Currency.pdf
- 48 World Economic Forum (WEF). 2021. Digital Currency Consumer Protection Risk Mapping. Cologne. WEF. November. Accessed 22 April 2022. https://www3.weforum.org/docs/WEF_Digital_Currency_Consumer_Protection_2021.pdf
- 49 Bode, Ian de, Matt Higginson, and Marc Nidekorn. 2021. CBDC and stablecoins: Early coexistence on an uncertain road. McKinsey & Company. Accessed 11 March, 2022. <https://www.mckinsey.com/industries/financial-services/our-insights/cbdc-and-stablecoins-early-coexistence-on-an-uncertain-road>
- 50 The development and implementation of stablecoins is nascent to date, with very few developing and emerging countries such as Thailand and Singapore having begun looking into its feasibility (Ho, Hang Min, and Josephine Law. 2021. The Virtual Currency Regulation Review: Singapore. 02 September. Accessed 26 April 2022. <https://thelawreviews.co.uk/title/the-virtual-currency-regulation-review/singapore> , Freeman Law. 2021. Thailand and Cryptocurrencies. 21 June. Accessed 26 April 2022. <https://freemanlaw.com/cryptocurrency/thailand/>).
- 51 Bode, Ian de, Matt Higginson, and Marc Nidekorn. 2021. CBDC and stablecoins: Early coexistence on an uncertain road. McKinsey & Company. Accessed 11 March, 2022. <https://www.mckinsey.com/industries/financial-services/our-insights/cbdc-and-stablecoins-early-coexistence-on-an-uncertain-road> and World Economic Forum (WEF). 2021. Digital Currency Consumer Protection Risk Mapping. Cologne. WEF. November. Accessed 22 April 2022. https://www3.weforum.org/docs/WEF_Digital_Currency_Consumer_Protection_2021.pdf
- 52 Most stablecoins rely on the backing collateral to maintain the peg, but there are also stablecoins that rely on algorithmic stabilization mechanisms to offload the stablecoin's price volatility to investment token holders (Catalini, Christian, and Alonso de Gortari. 2021. On the Economic Design of Stablecoins. 06 August. Accessed 24 March, 2022. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3899499)
- 53 World Economic Forum (WEF). 2022. How to close Southeast Asia's financial inclusion gap. Cologne. World Economic Forum. Accessed 14 March, 2022. <https://www.weforum.org/agenda/2022/02/closing-southeast-asia-s-financial-inclusion-gap/>
- 54 World Economic Forum (WEF). 2022. How to close Southeast Asia's financial inclusion gap. Cologne. World Economic Forum. Accessed 14 March, 2022. <https://www.weforum.org/agenda/2022/02/closing-southeast-asia-s-financial-inclusion-gap/>
- 55 Smialek, Jeanna. 2021. Why Washington Worries About Stablecoins? The New York Times. 17 September. Accessed 11 March 2022. <https://www.nytimes.com/2021/09/17/business/economy/federal-reserve-virtual-currency-stablecoin.html#:~:text=The%20trouble%20with%20stablecoins%20is,limited%20to%20oversee%20them>
- 56 Subject to electronic devices and systems being available to both the payer and payee.

TABLE 1: KEY CHARACTERISTICS OF CBDC IN RELATION TO EXISTING PAYMENT INSTRUMENTS

● YES ● No

KEY CHARACTERISTICS	CBDC	EFT (NON-RTGS)	PRIVATE CRYPTOCURRENCY	E-MONEY	STABLECOINS
ELECTRONIC	●	●	●	●	●
SOVEREIGN LEGAL TENDER ⁵⁷	●	●	●	●	●
FUNGIBLE	●	●	●	●	●
CENTRAL-BANK REGULATED	●	●	●	●	● ⁵⁸
STORE OF VALUE	●	●	●	●	●
UNIT OF ACCOUNT	●	●	●	●	●
INSTANTANEOUS SETTLEMENT	●	●	●	● ⁵⁹	●
PROGRAMMABILITY	●	●	● ⁶⁰	●	●

Source: Authors' own, informed by (World Economic Forum 2022)

settlement and the potential for programmability. The rest of the special report will therefore focus on a retail CBDC, the motivations for pursuing such a tool, and if and how its unique characteristics can support these motivations.

2.2. EMERGENCE OF CBDC GLOBALLY

CBDC research and experimentation growing globally in response to the evolution of money. In response to recent trends towards private cryptocurrency exchanges, CBDC is emerging as a regulated alternative by central banks to private cryptocurrencies and stablecoins, as well as a useful tool to signal national digitalizing efforts in line with peers. Once the domain of developed countries, developing and emerging economies are swiftly materializing as CBDC thought leaders and experimenters. Figure 1 shows the growth in CBDC in developed, and developing and emerging economies. Whilst a higher proportion of developed countries (53 percent) are exploring CBDC relative to developing and emerging countries (42 percent), interest from developing and emerging countries is growing at a faster rate relative to developed countries. In just the last five years, CBDC exploration in developing and emerging countries has more than tripled, while it has just more than doubled in developed economies.⁶¹

57 In practice, this is likely to be considered a limited legal tender instrument as forcing universal acceptance as legal tender may promote more financial exclusion, particularly for vulnerable groups. There needs to be specific exemptions from a general legal tender rule to maintain near universal utility but preventing unintended hardship.

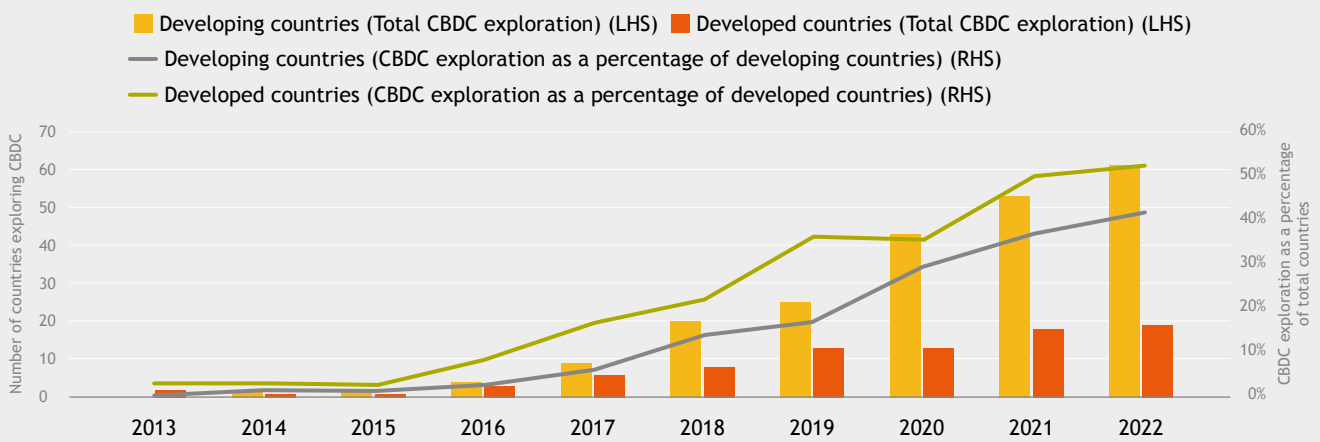
58 Whilst stablecoins can be overseen by Central banks, its inclusion into the regulatory purview of regulators has yet to be formally adopted across both the developed and developing world. For instance, the UK, the Treasury has only recently announced that stablecoins will come into the oversight of the Financial Conduct Authority (McLellan, Lewis. 2022. UK reveals hand with stablecoin announcement. 07 April. Accessed 26 April 2022. <https://www.omff.org/2022/04/uk-reveals-hand-with-stablecoin-announcement/>). Among developing and emerging countries, limited examples of its formal acknowledgment, including Thailand and Singapore, both of whom have begun looking into its feasibility (Ho, Hang Min, and Josephine Law. 2021. The Virtual Currency Regulation Review: Singapore. 02 September. Accessed 26 April 2022. <https://thelawreviews.co.uk/title/the-virtual-currency-regulation-review/singapore>, Freeman Law. 2021. Thailand and Cryptocurrencies. 21 June. Accessed 26 April 2022. <https://freemanlaw.com/cryptocurrency/thailand/>).

59 E-money schemes clear instantly but do not settle instantly. Most regulators require e-money schemes to hold funds equal to 100 percent of the electronic money float in safe, liquid investments at banks.

60 Programmability a key feature only in private digital currencies with smart contract functionality. For instance, smart contracts are being used in increasing trust in retailer-supplier relationships and making international trade faster and more efficient (IBM. n.d. What are smart contracts on blockchain? New York. IBM. Accessed 26 April 2022. <https://www.ibm.com/za-en/topics/smart-contracts#:~:text=They%20typically%20are%20used%20to,action%20when%20conditions%20are%20>

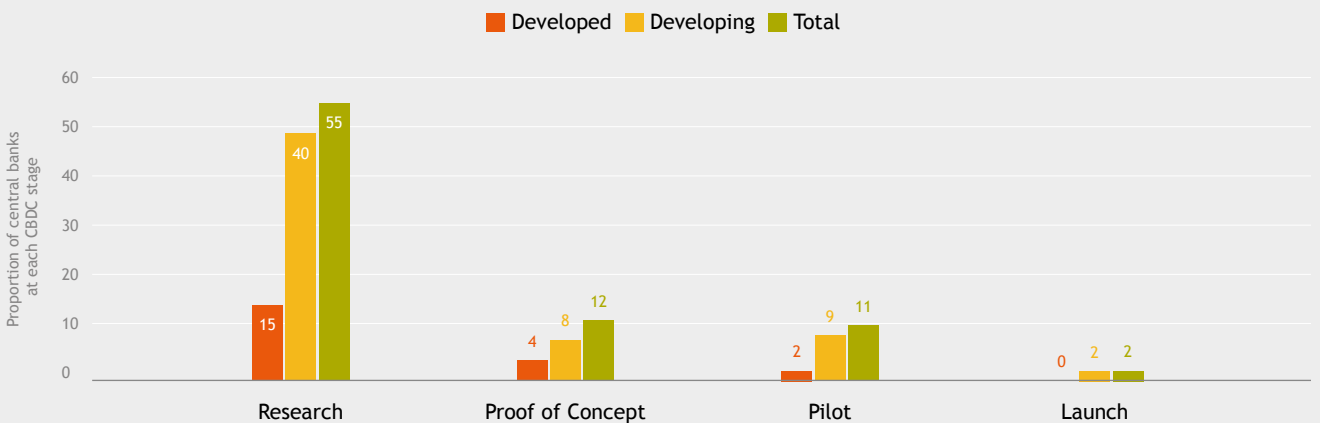
61 CBDC tracker. 2022. Central Bank Digital Currencies tracker. Accessed 14 March, 2022. <https://cbdctracker.org/>

FIGURE 1: CBDC EXPLORATION AMONG DEVELOPED AND DEVELOPING MARKETS



Source: (CBDC tracker 2022)

FIGURE 2: STAGES OF CBDC EXPLORATION⁶²



Source: (CBDC tracker 2022)

Developing and emerging countries in CBDC experimentation and pilots. While developed countries have focused on research, developing and emerging economies have gradually become key leaders in CBDC experimentation and implementation. Figure 2 below indicates that developing and emerging economies are more advanced in their CBDC journey relative to developed countries. To date, there are only two developing and emerging economies that have announced a CBDC launch: Nigeria and the Bahamas. In addition, 81 percent of central banks that have announced a CBDC pilot are from developing and emerging economies.⁶³ This suggests that many of the initial learnings for CBDC will come from developing and emerging economies and therefore be grounded in a developing country context.

Financial inclusion is driving CBDC exploration among developing and emerging economies. Research conducted by the BIS highlights that developing and emerging economies have several reasons for pursuing a retail CBDC. Figure 3 highlights that although there are some overlaps between the motivations for developed countries, and developing and emerging economies⁶⁴, for the latter two, financial inclusion ranks as the highest priority and motivation for CBDC.

62 The ECCB IS currently running pilots on CBDC. This implies that although all eight countries (Anguilla, Antigua and Barbuda, Commonwealth of Dominica, Grenada, Montserrat, Saint Lucia, Saint Vincent and the Grenadines, Saint Christopher (St Kitts) and Nevis) represented by the ECCB may be driving the pilot, it remains only one pilot and is counted as such in Figure 2.

63 CBDC tracker. 2022. Central Bank Digital Currencies tracker. Accessed 14 March, 2022. <https://cbdctracker.org/>

64 Note that in Figure 3 AEs are developed countries and EMDEs are developing and emerging economies.

This can be seen through the significant gap in scores for financial inclusion and payment efficiency between developing and developed economies in Figure 3. Further, these top all priorities for both developed, and developing and emerging economies. In contrast to developing markets, the net motivation to adopt a CBDC in developed countries could be impacted by more complex risks. CBDC could potentially disrupt the established payment systems or accelerate the redundancy of relatively stable developed country market systems. Therefore, developed markets with higher rates of financial inclusion and payment systems at high levels of scale and efficiency would not necessarily benefit to the same extent as developing and emerging economies from introducing a CBDC. Their motivations would thus differ.

Developing and emerging countries are prioritizing key use cases for financial inclusion. According to central bank CBDC design and strategy papers, developing and emerging countries, all of which are AFI members, are increasingly targeting key use cases for the potential for retail CBDC when it comes to financial inclusion. These use cases include domestic and cross-border person to person (P2P) payments, merchant payments (P2B) and government to person (G2P) payments. These use cases are particularly important for vulnerable groups, many of which rely on social payments and remittances from extended family members, and SME businesses which can be reluctant about digital payment use due to costs. Figure 4 shows that the Central Bank of Nigeria and the Bank of Bahamas plan to leverage retail CBDC for low-cost cross-border payments. Further, Nigeria plans to facilitate more direct implementation of G2P payment programs through leveraging CBDC. Central Bank of the Bahamas and Bank of Ghana have explicitly noted their desire for CBDC to support P2P and P2B payments by introducing “an additional instrument for retail payments to bring competition to the Ghanaian payment ecosystem thus leading to lower merchant fees” and to ensure a “zero cost carve out for the P2P payments”.⁶⁵

2.3. CBDC AND AFI MEMBERS

Most members are exploring retail, multi-tiered CBDC. More than two-thirds of AFI members exploring CBDC in developing and emerging economies are considering retail CBDC.⁶⁶ Among those AFI members considering a retail CBDC, all are exploring a hybrid, multi-tiered⁶⁷ distribution model that leverages the existing banking system for distribution.⁶⁸ AFI members are split on the format for CBDC. Of those pursuing a retail CBDC, four have suggested using an account-

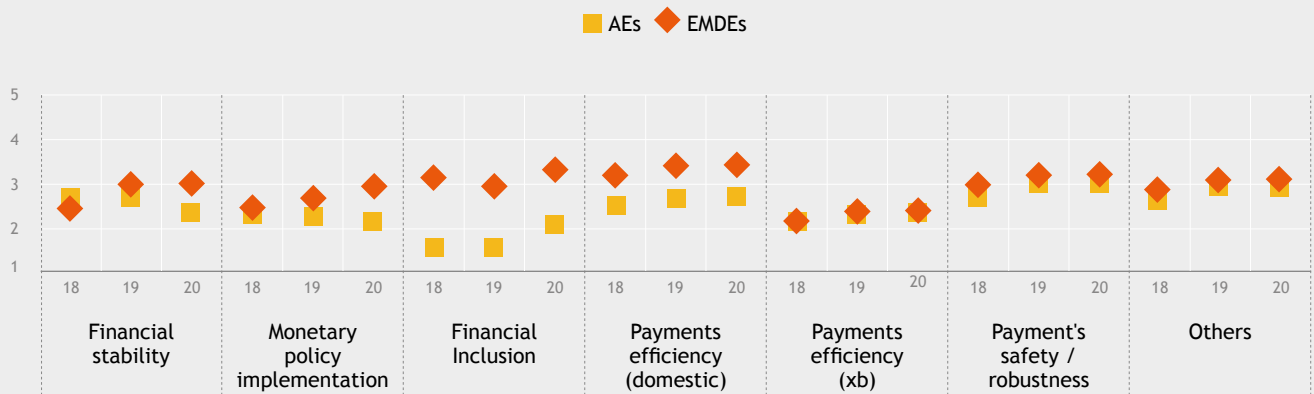
based CBDC while another four have indicated that they are pursuing a token-based CBDC.^{69,70} In terms of the technology architecture, whilst there are slightly more members exploring a DLT-based CBDC, the preference for either a centralized or decentralized DLT, or non-DLT based CBDC, is not yet clear.⁷¹

Various technical providers have emerged to support central bank CBDC initiatives. Since 2013, a range of CBDC technical providers have emerged on the global scene to support developed and developing and emerging economy retail CBDC initiatives.⁷² For example, Bitt Inc is behind the eastern Caribbean Central Bank DCash pilot, and it is currently working with the Central Bank of Nigeria’s e-Naira pilot. Both run on the Hyperledger Fabric DLT-based platform. NZIA Limited supplies the technical platform for the Central Bank of the Bahamas’s Sand Dollar - a proprietary DLT platform (Central Bank of the Bahamas 2019, Central Bank of Nigeria 2021, CBDC tracker 2022).⁷³

Table 2 above provides a brief, non-exhaustive overview of the technology providers working with AFI members in developing and emerging economies to develop context-specific CBDCs.⁷⁴

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- 65 Central Bank of the Bahamas. 2019. Project Sand Dollar: A Bahamas Payments System Modernisation Initiative. <https://www.centralbankbahamas.com/viewPDF/documents/2019-12-25-02-18-11-Project-Sanddollar.pdf> and Bank of Ghana. 2022. Design Paper of the digital Cedi (eCedi). Accra. Bank of Ghana. Accessed 25 March 2022. <https://www.bog.gov.gh/wp-content/uploads/2022/03/eCedi-Design-Paper.pdf>
- 66 CBDC tracker. 2022. Central Bank Digital Currencies tracker. Accessed 14 March 2022. <https://cbdctracker.org/>
- 67 CBDC could take on either a single model or a multi-tiered model. In a direct CBDC model, the Central bank issues money and performs all functions, including direct interaction with end users. In the multi-tiered model to CBDC, Central bank issues money, but delegates functions to non-central bank intermediaries (financial service providers) who interact with end user (Kiff, John, Jihad Alwazir, Sonja Davidovic, Aquiles Farias, Ashraf Khan, Tanai Khiaonarong, Majid Malaika, Hunter Monroe, Nobu Sugimoto, and Peter Zhou Hervé Tourpe. 2020. IMF Working paper: A Survey of Research on Retail Central Bank Digital Currency. Washington DC. IMF. Accessed 11 March 2022. <https://www.imf.org/-/media/Files/Publications/WP/2020/English/wpiea2020104-print-pdf.ashx>).
- 68 At the time of publication (April 2022), no AFI members are exploring a single-tier distribution model.
- 69 See Box 4 in the appendix for a more detail discussion on the value of the token/account-based taxonomy
- 70 CBDC tracker. 2022. Central Bank Digital Currencies tracker. Accessed 14 March 2022. <https://cbdctracker.org/> and based on stakeholder consultations, details refer to Appendix A: Stakeholder Interviews, Table 6.
- 71 Only five AFI members exploring a retail CBDC have indicated their technology choice. Of these three have opted for a non-DLT CBDC, while two have opted for a DLT-based solution.
- 72 CBDC tracker. 2022. Central Bank Digital Currencies tracker. Accessed 14 March 2022. <https://cbdctracker.org/>
- 73 Central Bank of the Bahamas. 2019. Project Sand Dollar: A Bahamas Payments System Modernisation Initiative. <https://www.centralbankbahamas.com/viewPDF/documents/2019-12-25-02-18-11-Project-Sanddollar.pdf>, Central Bank of Nigeria. 2021. Design paper for the eNaira. eNaira. https://www.enaira.gov.ng/download/eNaira_Design_Paper.pdf and CBDC tracker. 2022. Central Bank Digital Currencies tracker. Accessed 14 March 2022. <https://cbdctracker.org/>
- 74 Table 2 only includes developing and emerging economies that have indicated their technology partner as of March 2022.

FIGURE 3: MOTIVATIONS FOR EXPLORING A RETAIL CBDC



Source: (Wehrli and Boar 2021)

FIGURE 4: CURRENT USE CASES FOR CBDC AMONG AFI MEMBERS



Source: (Central Bank of Nigeria 2021) (Central Bank of the Bahamas n.d.) (Central Bank of the Bahamas 2020) (Dong, et al. 2021) (Bank of Thailand 2021)

TABLE 2: MAJOR TECHNOLOGY PROVIDERS ACROSS DEVELOPING COUNTRY CBDC PROJECTS

TECHNOLOGY PROVIDER	TYPE OF CBDC	COUNTRY	USE CASES SUPPORTED	TECHNOLOGY PLATFORM TYPE
BITT INC	Retail	Nigeria, ECCB	G2P, P2P, merchant payments	DLT
FEITIAN TECHNOLOGIES	Retail	China	Merchant payments, P2P	Hybrid of centralized and DLT, plus stored-value devices
NZIA LIMITED	Retail	Bahamas	Merchant payments, G2P, P2G, P2P	DLT
ECURRENCY MINT	Retail	Jamaica		Digital bearer instrument on centralized ledger
QUORUM	Wholesale	South Africa	Wholesale	DLT
G+D	Retail	Ghana, Thailand	Merchant payments, P2P	Centralized ledger
R3 CORDA	Wholesale	Thailand	Wholesale	DLT

Source: CBDC tracker 2022)

3. CBDC AND FINANCIAL INCLUSION IN DEVELOPING AND EMERGING ECONOMIES



This section provides an overview of financial inclusion in developing and emerging economies, and introduces the key financial inclusion use cases for which CBDC has the potential to support.

Financial inclusion remains a challenge for developing and emerging countries. Figure 5 provides an overview of the percentage of adults without an account at a financial institution by developing country region and also highlights key differences in formal financial inclusion. In East Asia and Pacific (EAP), and Europe and Central Asia (ECA), the lack of access to financial accounts is confined to a minority of population groups, at 30 percent and 35 percent respectively. In Latin America and the Caribbean (LAC), however, nearly half of all adults - 47 percent - do not have access. Furthermore, in the Middle East and North Africa (MENA), and Sub-Saharan Africa (SSA), the majority of adults are without access to formal financial accounts, at 57 percent and 67 percent respectively. Notably, there is also a global 9 percent gender gap in access to formal financial services despite the best efforts of financial regulators and policymakers to address this since 2011.⁷⁵

The lack of access to formal financial accounts across all regions, in particular MENA and SSA, suggests that financial exclusion is still rife in developing and emerging economies and highlights the need for innovative solutions.

Digital payments a key driver of financial inclusion across regions but gaps remain. While digital payments usage has grown across regions, not all payment use cases have equally succeeded in including all populations (Findex 2017).⁷⁶ The most prominent use case, which has been instrumental in enhancing financial inclusion and usage of digital payments is P2P. This is most evident in SSA. Figure 6 shows a quarter of adults have received or sent remittances using an account, largely through e-money. G2P and P2B use

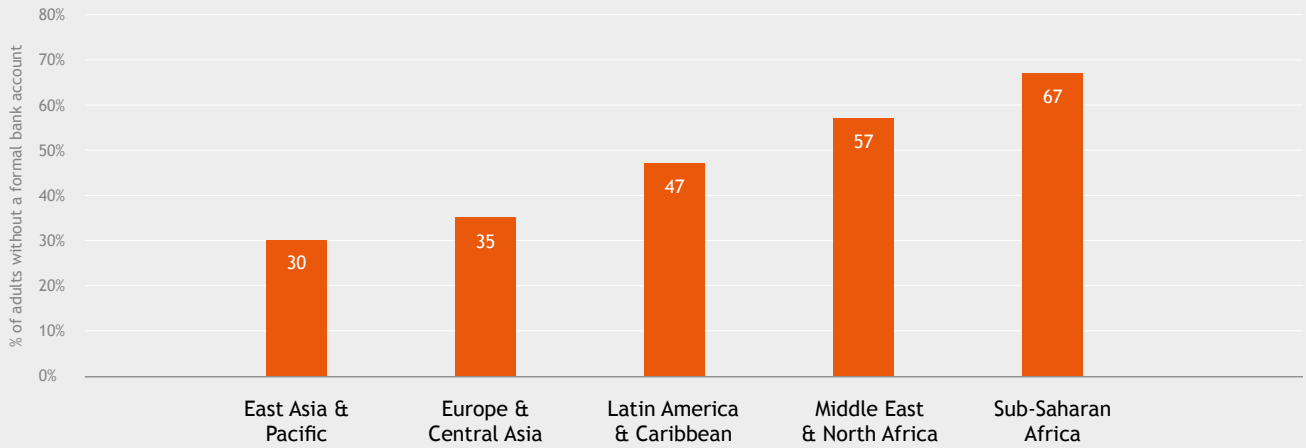
cases, however, lag. Less than 10 percent of adults in SSA receive a G2P payment into a financial account. Other regions have slightly higher uptake. Digital G2P has also been a significant driver for women's financial inclusion, especially in relation to the Covid-19 pandemic, with approximately 80 million women opening their first account to receive G2P payments during the pandemic.⁷⁷ For example, in the ECA region, 29 percent of adults receive government payments into a financial institution account and in EAP, LAC and MENA, G2P payments ranges between 12 percent and 19 percent. In terms of P2B, in EAP and ECA, the percentage of adults that paid for utilities by way of a financial institution account was 31 percent and 33 percent respectively, in comparison to 17 percent and 16 percent in MENA and SSA. A lot has been achieved by AFI members to advance financial inclusion over the past decade, with digital payments emerging as a key driver of usage of financial services. However, while P2P appears to be successfully catalyzing inclusion, key opportunities still exist to better serve businesses and consumers through formal and digital G2P and P2B channels, and highlights the need for innovative solutions to help extend this growth.

⁷⁵ Global System for Mobile Communications (GSMA). 2021. The Mobile Gender Gap Report 2021. London. GSMA. Available at: <https://www.gsma.com/r/wp-content/uploads/2021/06/The-Mobile-Gender-Gap-Report-2021.pdf>

⁷⁶ Findex. 2017. Global Financial Inclusion (Global Findex) Database 2017

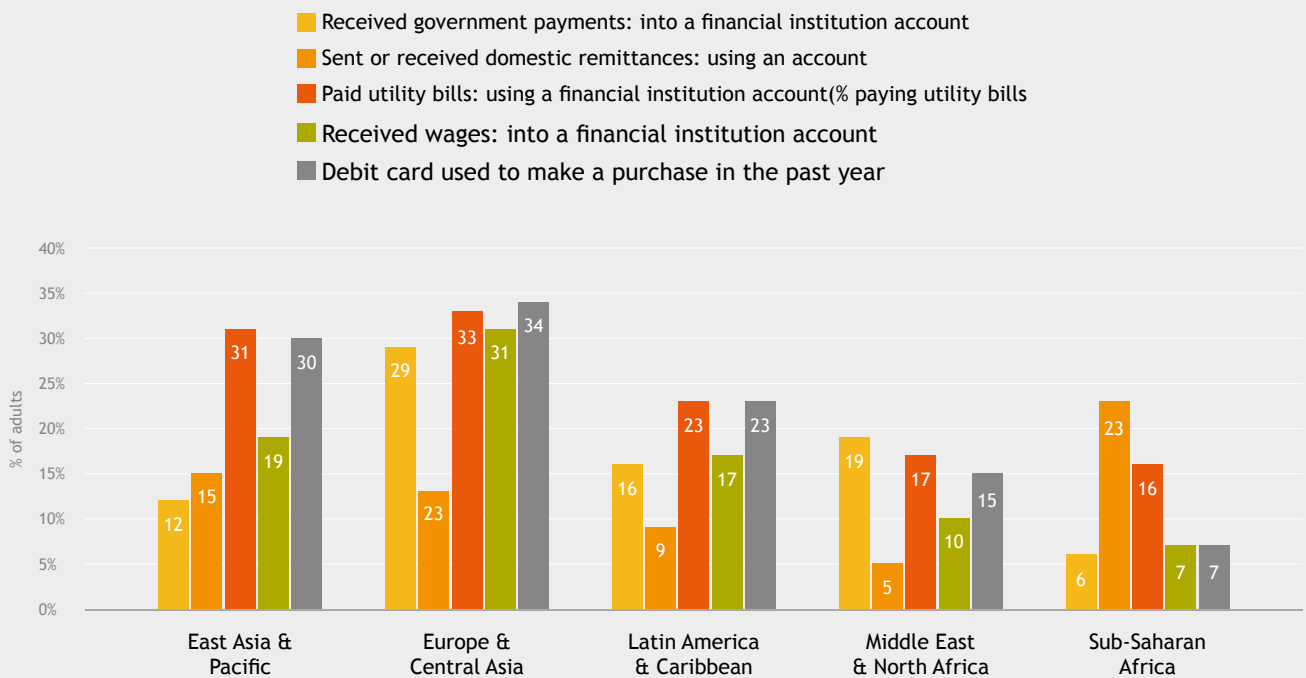
⁷⁷ Consultative Group to Assist the Poor (CGAP). 2022. How Can We Build on COVID-19 Progress in Women's Financial Inclusion. Washington DC. CGAP. Available at: <https://www.cgap.org/blog/how-can-we-build-covid-19-progress-womens-financial-inclusion>

FIGURE 5: PERCENTAGE OF ADULTS WITHOUT AN ACCOUNT AT A FINANCIAL INSTITUTION BY REGION (EXCLUDING DEVELOPED COUNTRIES)



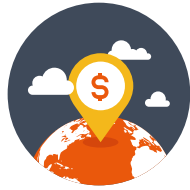
Source: (Findex 2017)

FIGURE 6: SELECTED INDICATORS OF DIGITAL PAYMENT USE CASES BY REGION



Source: (Findex 2017)

4. KEY FINANCIAL INCLUSION USE CASES FOR DEVELOPING AND EMERGING COUNTRIES



Following the analysis in Section 3 to uncover the key drivers and gaps for financial inclusion among developing and emerging economies and AFI members, the purpose of this section is to dig deeper into the three core use cases that are emerging as not only untapped opportunities to deepen financial inclusion but also as financial inclusion goals prioritized by central banks exploring CBDC. This analysis will therefore clarify the definition or scope of use cases considered, explore their current adoption drivers to date, and unpack the barriers that impede greater access and usage by businesses and users in developing and emerging economies.

It must be noted that while only three use cases are considered for this report, they should not be interpreted as being the most important use cases for CBDC from an implementation perspective. For CBDC to achieve scale and broader economic impact, it would need to be implemented throughout an entire ecosystem and support a host of use cases capable of enabling the successful supply, distribution, and circulation of value throughout an economy. While the selected use cases do not represent essential use cases for implementation, they do provide clear illustrations of payment channels that would need to be unlocked for an efficient monetary system. More specifically, G2P payments illustrate one example of how money or income can be received in a system. P2B or merchant payments outline how money moves and circulates throughout an economy when transacting, and P2P describes the management of liquidity between users. Therefore, while the aforementioned use cases are primarily evaluated based on their focus by AFI members from a CBDC perspective, and their lack of inclusiveness as shown by Section 3, they can also serve as useful illustrations of how CBDC could catalyze wider macroeconomic and payment efficiency. This line of analysis, however, is not within the scope of this report.

4.1. DRIVERS AND MOTIVATIONS FOR KEY FI PAYMENT USE CASES

4.1.1. P2P AS A CATALYST TO DIGITALIZE ADDITIONAL PAYMENT USE CASES

P2P definition. Defined as peer-to-peer payments, P2P payments include remittances (transfers of money to family members or friends) which can be conducted both domestically and cross-border. The focus of this report is on domestic P2P (which excludes international remittances).

Importance of use case: Formal P2P uptake a key financial inclusion use case. As alluded to in Section 3, more than a quarter of adults in developing and emerging economies reported sending money to or receiving it from a relative or friend living in another area of their country.⁷⁸ These domestic remittances are particularly important in SSA, where nearly half of all adults reported having sent or received such payments. This is particularly important for rural women, where a significant proportion of disposable income comes from remittances received from family members employed in urban areas. P2P transfers have been the single biggest use case driving e-money use in SSA and provide a gateway for further innovation. It is not only in African economies where the importance of P2P as a key financial inclusion use case is evident - nearly half of all adults in Thailand, Philippines and Mongolia use domestic remittances.⁷⁹ P2P is also a key use case for women, as they tend to send a higher proportion of their income, while on average earning less than men. They also usually send money more regularly and for longer periods of time.⁸⁰ While digital P2P still falls short of trends observed in advanced economies, demand for P2P is likely to continue growing.

Current drivers for inclusive digitalization: Low (perceived) fees and the availability of mobile telephonic services are driving P2P digital transformation. The costs associated with using a payment instrument is often a key deciding factor driving behavior. Qualitative work undertaken in Rwanda highlights that in many circumstances, the biggest barrier lies in the perceptions of fees associated with digital payments, often driven by a lack of awareness and skills. How fees are presented, rather than the fee itself, is a key lever in driving payment

⁷⁸ In terms of the gender split of this figure, across the regions 31 percent of males have reported sending or receiving domestic remittances in the past year, compared to 27 percent for females (Findex. 2017. Global Financial Inclusion (Global Findex) Database 2017)

⁷⁹ Findex. 2017. Global Financial Inclusion (Global Findex) Database 2017

⁸⁰ International Organization for Migration. 2008. Survey on Remittances 2007: Gender Perspectives. Geneva. Available at: <http://www.oim.org.gt/documents/>

digitalization. This is often a significant advantage for cash over digital payment instruments. Cash transactions carry no tangible fees and workers are not charged when receiving their wages. Hence, consumers often view cash as the most affordable payment option.⁸¹ Furthermore, Basic mobile telephony services - voice, SMS text and USSD - have been essential in the proliferation of P2P payments (e.g. M-Pesa in Kenya and bKash in Bangladesh). From a gender perspective, usage of USSD is also more inclusionary, as there is a 15 percent gender gap in smartphone ownership in lower- and middle-income countries.⁸² At the same time, access to data services, at a basic level, starting with 3G, has enhanced the user experience through app-based delivery of DFS services (e.g. Alipay in China and Paytm in India).⁸³

Motivation for prioritization: By further lowering fees, adopting more risk appropriate customer due diligence (CDD) measures, reducing connectivity barriers, as well as leveraging the existing popularity of mobile rails, CBDC could further support the expansion of formal P2P in developing and emerging countries through network effects.

4.1.2. P2B AS AN UNTAPPED USE CASE TO EASE DAY-TO-DAY TRANSACTIONS

P2B definition. P2B is a payment made from a customer to a merchant in exchange for goods and/or services, including the payments of utilities.⁸⁴ This is a P2B transaction and does not include business-to-business (B2B) transactions. As such, the P2B use case requires adoption by both a consumer and the merchant (including utility providers).

Importance of use case: untapped opportunity to digitalize daily payments. Cash is the most common method of transacting with retailers. A study conducted by the World Bank Group and World Economic Forum estimates that micro, small, and medium enterprise (MSME) retailers make and accept payments of about USD34 trillion annually in the form of supplier payments, wages and salaries, and receipts from consumers. Of this, 44 percent of payments are estimated to be done electronically and the rest through cash or checks.⁸⁵

Current drivers for inclusive digitalization: Infrastructure, regulatory reform and market innovations have catalyzed mobile phone-based P2B. Mobile phone-based DFS has underpinned significant improvements in digital P2B adoption, especially in relation to e-money. Mobile phone penetration has been a notable driver of this trend, in particular for

women, with the gender gap in ownership at seven percent.⁸⁶ In 2020, merchant payments accounted for 10 percent of e-money payments in SSA.⁸⁷ This is further supported by mobile internet connectivity and electricity coverage.⁸⁸ Regulatory interventions include ensuring merchant payments acceptance systems are sustainable and accumulate enough reserves to cover operational expenses. This has been achieved by subsidizing a portion of the fees charged to merchants to keep transaction costs low. This was an approach taken by the Indian government, where digital merchant payments received a subsidy of 0.5 percent per transaction for small-value payments, capped at USD0.50 per transaction and USD35 a month.⁸⁹ Market innovations over the past decade have also been key driver of mobile phone based P2B - including digital-first merchant onboarding, which has streamlined application processes and reduced the burden on manual reviews.⁹⁰ Moreover, innovations, such as open APIs have allowed banks to become an open platform

81 Bester, Hennie, Christine Hougaard Iske van den Berg, Georgina Borros, Pieter Janse van Vuuren, and Kinyanjui Mungai. n.d. Drivers of digital payments behaviour in Rwanda: Farmer, merchant and customer perspectives. Cape Town. Centre for Financial Regulation and Inclusion (Cenfri).

82 Global System for Mobile Communications (GSMA). 2021. The Mobile Gender Gap Report 2021. London. GSMA. Available at: <https://www.gsma.com/r/wp-content/uploads/2021/06/The-Mobile-Gender-Gap-Report-2021.pdf>

83 Pazarbasioglu, Ceyla, Alfonso Garcia Mora, Mahesh Uttamchandani, Harish Natarajan, Erik Feyen, and Mathew Saal. 2020. Digital Financial Services. Washington D.C.. World Bank. Available at: <https://pubdocs.worldbank.org/en/230281588169110691/Digital-Financial-Services.pdf>

84 Utilities are included here, as it is an extremely popular on-demand payment via a mobile phone. According to a biannual e-government survey of both developed and emerging economies, digital utility payments have been adopted by 140 countries (United Nations (UN). 2018. United Nations E-Government Survey 2018. New York. UN. Available at: <https://publicadministration.un.org/egovkb/en-us/Reports/UN-E-Government-Survey-2018>).

85 World Economic Forum. 2016. Innovation in Electronic Payment Adoption: The case of small retailers. Cologny. WEF. Available at: https://www3.weforum.org/docs/Innovative_Solutions_Accelerate_Adoption_Electronic_Payments_Merchants_report_2016.pdf

86 Ahmad, Ahmad Hassan. Green, Christopher and Jiang, Fei. 2020. Mobile money, Financial Inclusion and Development: A Review with Reference to African Experience. Journal of Economic Surveys 34 (4): 735-792. Accessed March 22, 2022. Available at: <https://onlinelibrary.wiley.com/doi/full/10.1111/joes.12372> and Global System for Mobile Communications (GSMA). 2021. The Mobile Gender Gap Report 2021. London. GSMA. Available at: <https://www.gsma.com/r/wp-content/uploads/2021/06/The-Mobile-Gender-Gap-Report-2021.pdf>

87 Global System for Mobile Communications (GSMA). 2021. The Mobile Gender Gap Report 2021. London. GSMA. Available at: <https://www.gsma.com/r/wp-content/uploads/2021/06/The-Mobile-Gender-Gap-Report-2021.pdf>

88 G20. 2021. The impact of COVID-19 on digital financial inclusion. Washington DC. World Bank Group. Accessed 22 March, 2022. Available at: https://www.gpfi.org/sites/gpfi/files/sites/default/files/5_WB%20Report_The%20Impact%20of%20COVID-19%20on%20digital%20financial%20inclusion.pdf

89 CGAP. 2019. India: A Testing Ground for Digital Merchant Payments. Available at: <https://www.cgap.org/research/publication/india-testing-ground-digital-merchant-payments>

90 OPUS. 2021. Why Digital-First Merchant Onboarding is Key to Portfolio Growth. Available at: <https://www.opusconsulting.com/why-digital-first-merchant-onboarding-is-key-to-portfolio-growth/>

that fosters a wider ecosystem of third parties, like FinTech and retail partners, to process payments - further increasing digital payments acceptance.⁹¹

Motivation for prioritization. The cash dominance of merchant payments thus suggests an untapped opportunity to better digitalize this use case for a more inclusive payment ecosystem as an onramp for the development of more sophisticated products and services that benefit the poor. Digitalization of P2B can also allow for data trails of transactions to be generated as collateral for SME credit and will impact the processes through which financial institutions evaluate credit-worthiness. Innovation, such as CBDC, could therefore add substantial value to not simply digitalizing merchant payments, but unlocking greater SME access to credit, suppliers and enhanced consumer incentives to engage with the digital economy.

4.1.3. G2P AS AN URGENT USE CASE TO BETTER REACH CITIZENS MORE EFFICIENTLY AND EFFECTIVELY

G2P definition. G2P is defined as payments from government to people. This use case includes social transfers, emergency assistance and relief, tax refunds, government employee salaries, pensions and procurement. The G2P use case is especially relevant for the base of the pyramid population segments, as social transfers may be the only financial service activity experienced by this group.

Importance of use case: formal G2P transfers broadly undigitized and fail to reach masses. G2P payments are typically paid out to two types of beneficiaries: social transfers and payments to current and retired workers. The mode of electronic delivery varies and can include direct deposit into a bank account (e.g. USA, Peru, Colombia), e-money account (e.g. Kenya, Uganda), money order (e.g. Tunisia) or via a cash card (e.g. Brazil, the Philippines). The last two delivery methods are only available upon cashing out of the transferred value.⁹² In many parts of the developing world, however, governments have started to push the digitalization of their payments by making electronic transfers directly into the accounts of individual customers.⁹³ While there has been progress from a low base, most government transfers remain undigitized - as of 2017, only 16 percent of individuals in developing and emerging economies received government payments or transfers digitally.⁹⁴

Current drivers of inclusive digitalization: Social protection innovation, digital identity and connectivity. G2P payments have never been more important as governments worldwide have depended on

technology-enabled social transfers to rapidly respond to the economic and social consequences of public health emergencies, such as the ongoing COVID-19 pandemic, and climate change related disasters.⁹⁵ For example, in the face of frequent tropical cyclones, the Fijian Department of Social Welfare's Help for Homes - a mobile-enabled, G2P social payments initiative - is helping the government expedite the distribution of social aid to affected populations to rebuild their homes. The ability to reach population groups in remote areas has also required a high level of connectivity.⁹⁶ By leveraging growing mobile phone penetration, the Grameen Foundation, together with cLabs, a private cryptocurrency provider, has also delivered financial relief to 3,500 female entrepreneurs and their families in the Philippines by distributing Celo Dollars through the mobile app Valora.⁹⁷ Improved access to digital identities therefore has been key to enhanced penetration of formal G2P channels.

For example, in India, the Aadhaar ID system allows the identity of bank account holders used for government payments to be verified remotely with biometrics, which has made G2P payments considerably more efficient.⁹⁸

91 Accenture. 2018. Open APIs are driving uberization of payment services in Europe. Available at: <https://www.accenture.com/nl-en/blogs/insights/open-apis-are-driving-uberization-of-payment-services-in-europe>

92 Davidovic, Sonja, Soheib Nunhuck, Delphine Prady, Harve Tourpe, and Ed Anderson. 2020. Beyond the COVID-19 Crisis: A Framework for Sustainable Government-To-Person Mobile Money Transfers. IMF eLIBRARY. Washington D.C.. International Monetary Fund (IMF). Available at: <https://www.elibrary.imf.org/view/journals/001/2020/198/article-A001-en.xml>

93 Davidovic, Sonja, Soheib Nunhuck, Delphine Prady, Harve Tourpe, and Ed Anderson. 2020. Beyond the COVID-19 Crisis: A Framework for Sustainable Government-To-Person Mobile Money Transfers. IMF eLIBRARY. Washington D.C.. International Monetary Fund (IMF). Available at: <https://www.elibrary.imf.org/view/journals/001/2020/198/article-A001-en.xml>

94 Findex. 2017. Global Financial Inclusion (Global Findex) Database 2017.

95 Inclusive Green Finance (IGF). 2021. Disaster Resilience Through Financial Inclusion. Kuala Lumpur. Alliance for Financial Inclusion (AFI). Available at: https://www.afi-global.org/wp-content/uploads/2021/02/AFI_IGF_disaster-resilience_AW_1304.21_digital.pdf

96 International Monetary Fund (IMF). 2020. Digital Financial Services and the Pandemic: Opportunities and Risks for Emerging and Developing Economies. Washington DC. IMF.

97 The Celo Foundation. 2021. Delivering Humanitarian Covid Aid using the Celo Platform. Available at: <https://celo.org/papers/covid-aid>

98 Baur Yazbeck, Silvia , Gregory Chen, and Joep Roest. 2019. The Future of G2P Payments: Expanding Customer Choice. Consultative Group to Assist the Poor (CGAP). Available at: https://www.cgap.org/sites/default/files/publications/2019_09_FocusNote_Future_G2P_Payments_0.pdf

Motivation for prioritization: Digitized G2P can do more than administer payments more efficiently. Though functionality differs, accounts delivering G2P payments can also be used to facilitate formal savings, P2P transfers, and payments offering beneficiaries enhanced safety, security, and efficiency compared to informal transactions. G2P accounts can also be an onramp to new financial services, especially for women and other vulnerable groups. As beneficiaries become more active account users, FSPs deepen their understanding of customers' behavior, design new offerings tailored to their needs, and use transaction history to unlock beneficiaries' access to credit, insurance, and other products.⁹⁹ Digitized G2P can support women and other vulnerable groups via payments directed into their accounts, which can provide a private, independent, and consistent income as well as a secure place to store value. However, this potential has not yet translated into practice, providing an ideal opportunity for further innovation, such as CBDC, to advance the digitalization and reach of formal G2P channels in developing and emerging economies.

4.2. BARRIERS TO ACCESS AND EFFECTIVE USAGE OF PRIORITY FINANCIAL INCLUSION USE CASES

By meeting these financial needs, digital payments are playing a critical role in driving financial inclusion in developing and emerging countries. However, not all individuals and merchants in developing and emerging countries are benefiting from the advancing digital payment ecosystem. Demand-side and supply-side barriers to digital payments persist, particularly for underserved and excluded adults. Given that these use cases fall into broader categories of transacting and managing value, many of the barriers are common across them and deal with the flow of digital payments across various economic actors, particularly for underserved and excluded populations. Understanding these barriers is therefore a useful starting point to assessing whether CBDC could potentially alleviate them, and advance financial inclusion.

4.2.1. DEMAND BARRIERS

GENDER

Gender remains an overarching challenge across the demand-side barriers. Many of the demand side barriers identified below are often exacerbated by a number of additional contextual factors that tend to be felt more severely by women across developing and emerging countries. A recent AFI report on multisectoral approaches to integrating digital financial services for women's financial inclusion identified the following constraints for financial inclusion:¹⁰⁰

- > **Limited financial capability and literacy.** Women often report lower levels of financial literacy than men in nationally representative and household surveys.¹⁰¹ The gap in financial literacy also impacts digital financial literacy, a multi-dimensional concept which integrates financial literacy, financial capability and digital literacy.
- > **Lack of formal identification.** The 2017 Global Findex found that in low-income countries a considerably larger number of women (44 percent) compared to men (28 percent) report lacking a national ID or similar documents.¹⁰²
- > **Difficulty of mobile phone ownership and control of connectivity.** The latest research from GSMA finds that 393 million adult women in developing and emerging countries do not own mobile phones. There are also stark regional differences - the gender gap in mobile ownership is much larger in South Asia (23 percent) and sub-Saharan Africa (13 percent).¹⁰³
- > **Discriminatory laws.** In some countries, laws favoring men, such as inheritance law and family law, prevent women from accessing financial services.¹⁰⁴

Below we provide examples of how these constraints uniquely manifest for women in the demand-side barriers for the financial inclusion use cases discussed in this report.

99 It should, however, be noted that unless FSPs collect group and sex-disaggregated data, it is unlikely that new offerings will be tailored to meet the needs of various groups, especially women. Responsible Finance Forum. 2020. Delivering on the Potential of Digitized G2P: Driving Women's Financial Inclusion and Empowerment through Indonesia's Program Keluarga Harapan. Available at: https://www.womensworldbanking.org/wp-content/uploads/2020/08/August2020_G2P_Report.pdf

100 Digital Financial Services Working Group (DFSWG) and the Gender Inclusive Finance workstream. 2021. Case Studies of Multisectoral Approaches to Integrating Digital Financial Services for Women's Financial Inclusion. Kuala Lumpur: Alliance for Financial Inclusion (AFI) Available at: https://www.afi-global.org/wp-content/uploads/2021/10/DWFS_Gender_CS_FINAL.pdf

101 Digital Financial Services Working Group (DFSWG) and the Gender Inclusive Finance workstream. 2021. Case Studies of Multisectoral Approaches to Integrating Digital Financial Services for Women's Financial Inclusion. Kuala Lumpur: Alliance for Financial Inclusion (AFI) Available at: https://www.afi-global.org/wp-content/uploads/2021/10/DWFS_Gender_CS_FINAL.pdf

102 World Bank. 2020. The Global Identification Challenge: ID4D - Findex Survey. Washington DC. World Bank. Available at: https://www.id4africa.com/2020/almanac/ID4D-FindexSurvey_EN.pdf

103 Global System for Mobile Communications (GSMA). 2020. The Mobile Gender Gap Report 2020. London. GSMA. Available at: <https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2020/05/GSMA-The-Mobile-Gender-Gap-Report-2020.pdf>

104 Digital Financial Services Working Group (DFSWG) and the Gender Inclusive Finance workstream. 2021. Case Studies of Multisectoral Approaches to Integrating Digital Financial Services for Women's Financial Inclusion. Kuala Lumpur: Alliance for Financial Inclusion (AFI) Available at: https://www.afi-global.org/wp-content/uploads/2021/10/DWFS_Gender_CS_FINAL.pdf

TRUST

Low trust in DFS and the formal financial sector undermines usage. Trust is a core cross-cutting theme determining individuals' engagement with DFS. It is a composite of several experiences including perceptions of functional efficiency, appropriateness of the service and provider to the user's needs, and satisfaction with the service offering as well as external environment drivers.¹⁰⁵ Barriers such as high perceived fees, lack of interoperability and complexity of financial services all serve to further undermine trust. Beyond cross-cutting barriers that foster distrust, the P2B use case faces a unique trust barrier to DFS: that of visibility. Merchants are deterred by the perception that DFS leads to less privacy and, potentially, greater tax liability. Cash is a common instrument for tax evasion and illicit financial flows. It makes it easier for under-reporting and fraud to take place, as an audit trail does not always exist as it does with card transactions and electronic funds transfers.¹⁰⁶ Women also face specific trust related challenges - as noted in the previous section, women tend to have less opportunities to develop financial capability and literacy, which often manifests in a lack of understanding and usage of DFS, which ultimately undermines trust.

Moreover, in many developing countries, women still face discriminatory social hierarchies. This can result in women being less likely to make a complaint if issues arise and also less likely to get balance redress when they do complain, further eroding trust in DFS.

Costs and complexities present in non-interoperable payment systems limit convenience for consumers.

The high costs of facilitating interoperable payments deter smaller players from interoperating with larger players as the costs per transaction are too high for their low volumes.¹⁰⁷ In this case, smaller providers are hindered from gaining a footing in the payments space and competing with larger providers based on products rather than infrastructure. For customers, this limits their ability to move funds between providers. This can particularly affect G2P recipients who receive payments in one account but may not be able to move funds to a smaller, more competitive provider as their system may be a closed loop. Ultimately, customer and merchant needs remain unmet, and thus, certain segments remain unreached.

FEES

Perceived lack of DFS affordability reinforces cash dominance. A cross-cutting demand-side barrier is the perception of high fees associated with DFS.¹⁰⁸ In addition to this, consumers tend to feel that they do not earn sufficient income to justify opening a financial account in general.¹⁰⁹ This leads low-income users, those most vulnerable, to prefer the status quo: cash. It is therefore difficult to incentivize a shift away from cash towards DFS without a significant and well-understood value-add proposition, particularly for those at the base of the pyramid. The perceived lack of DFS affordability also disproportionately impacts women, who, on average, have lower levels of income and are thus more sensitive to the relative pricing of perceived fees. Women's lower income levels also mean that they often do not have sufficient liquidity needed to be able to qualify for or maintain a DFS account.¹¹⁰

MERCHANT ACCEPTANCE

A lack of standardized payment instruments hinders a pain point for merchant acceptance.

Merchants consequently default to requesting cash as it is a universally accepted, standardized payment instrument. In terms of digital payments, the need for merchants to hold multiple POS terminals and e-money merchant accounts, in order to meet the demand among customers, is a key challenge.¹¹¹ Merchants are therefore disincentivized from offering digital payments solutions in the first place. In turn, customers are also not willing to pay digitally if not all merchants accept their payment instrument. This creates a vicious cycle.

105 insight2impact (i2i). 2017. i2i framework note 3. FinMark Trust and Cenfri. Available at: https://issuu.com/i2i-insight2impact/docs/i2i_mfw_note_3_-_financial_services

106 Bank of International Settlements. 2018. Payments are a-changin' but cash still rules. Basel. Bank of International Settlements. Available at: https://www.bis.org/publ/qtrpdf/r_qt1803g.htm

107 Consultative Group to Assist the Poor (CGAP). 2018. Balancing the Economics of Interoperability in Digital Finance. Washington DC. CGAP. Available at: <https://www.cgap.org/blog/balancing-economics-interoperability-digital-finance>

108 World Economic Forum (WEF). 2017. 6 challenges to financial inclusion in South Africa. Cologne. WEF. Available at: <https://www.weforum.org/agenda/2017/04/financial-inclusion-south-africa/>

109 Allen, Franklin, Demirguc-Kunt, Asli, Klapper, Leora, Peria, Martinez-Soledad, Maria. 2016. The foundations of financial inclusion: Understanding ownership and use of formal accounts. Journal of Financial Intermediation 27: 1-30. Available at: <https://www.sciencedirect.com/science/article/pii/S1042957315000534>

110 Digital Financial Services Working Group (DFSWG) and the Gender Inclusive Finance workstream. 2021. Case Studies of Multisectoral Approaches to Integrating Digital Financial Services for Women's Financial Inclusion. Kuala Lumpur. Alliance for Financial Inclusion (AFI) Available at: https://www.afi-global.org/wp-content/uploads/2021/10/DWFS_Gender_CS_FINAL.pdf

111 McKinsey. 2021. The future of payments in Asia. Accessed 20 March 2022. Available at: <https://www.mckinsey.com/-/media/mckinsey/industries/financial%20services/ouralgora%20insights/the%20next%20frontier%20in%20asia%20payments/the-future-of-payments-in-asia-vf.pdf>

DIGITAL LITERACY

Households lack adequate digital literacy and capability to engage with evolving DFS landscape.

Low-income, potential first-time users of formal financial services often lack awareness of financial services, including having the skills required to understand and responsibly use them. A lack of information or knowledge about a financial service or product can have an adverse impact on a potential customer's adoption or use of that service. For P2P and P2B, factors such as the lack of financial numeracy skills, for example, the inability to navigate a e-money menu or to read financial text messages (including e-money confirmation or promotional messages and bank balances), make it difficult for a consumer to make use of these channels. It also exposes them to fraud risks, for example when they cannot read the balance in their mobile wallet.¹¹² Digital illiteracy is a function of a number of factors including education, employment status and income level.

36%

Many of these factors are more pronounced amongst women, for example, according to the 2020 Mobile Gender Gap Report, 36 percent of women sampled in Senegal specified reading and writing as a key barrier to mobile internet access, compared to only 12 percent of men.¹¹³

Therefore, innovations to advance financial inclusion among underserved groups and women in particular, need to take financial consumer protection frameworks and financial literacy into account to ensure the universality of their use.

IDENTITY

The identification gap hinders DFS uptake in G2P and P2B use cases.

G2P relies on accurate, basic identification of the recipient. Where there is insufficient identification, vulnerable recipients tend to be invisible to the system. This means that targeted social relief will not reach those who need it most. The identification gap relating to the P2B use case tends to fall on the side of the business or merchant. Merchants without KYC documentation specific to their business - such as formal business registration or a trading license - are unable to access DFS designed for the respective segment. Intersecting with matters of trust, merchants choose for their operations to remain invisible to the system due to privacy and compliance concerns. The value add from DFS needs to outweigh the perceived costs experienced by merchants, in order

for them to formalize and engage with digital financial products. This barrier is likely to be exacerbated for certain population segments like women, migrants and rural residents where the identification gap is likely to be more pronounced.¹¹⁴ The disproportionate lack of identity among women and girls can often be traced to the relevant culture and context of certain countries, where there are legal and regulatory barriers for women when obtaining national identification. While there has been considerable progress in removing a number of these barriers, women still faced legal obstacles when applying for a national ID card in eleven economies¹¹⁵ around the world at the time of the study.¹¹⁶

INSTANT PAYMENTS

Real time instant payments not yet available for all:

Although e-money and some banking systems are in existence, these systems are not inclusive of all providers. Many existing payments mechanisms that are reliant on non-instant payments will not meet the growing demand for instant payments. The inability of payments service providers to meet customer needs for instant clearing limits the attractiveness of digital payments in relation to cash. This is because the latter can be trusted to transfer value instantly in face-to-face settings. This is a barrier across use cases (P2P, G2P and merchant payments) e.g. merchants require proof that funds were transferred to conclude the transaction, and transfer goods and services.

112 Lusardi, Annamaria. 2012. Numeracy, Financial Literacy, and Financial Decision-Making. NBER Working Paper. Available at: <https://www.nber.org/papers/w17821>

113 Global System for Mobile Communications (GSMA). 2020. The Mobile Gender Gap Report 2020. London. GSMA. Available at: <https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2020/05/GSMA-The-Mobile-Gender-Gap-Report-2020.pdf>

114 Bill and Melinda Gates Foundation. 2019. Women's Digital Financial Inclusion in Africa. Available at: https://docs.gatesfoundation.org/Documents/WomensDigitalFinancialInclusioninAfrica_English.pdf

115 Afghanistan; Algeria; Benin; Cameroon; Congo, Rep.; Egypt, Arab Rep.; Mauritius; Namibia; Oman; Pakistan; Saudi Arabia

116 World Bank Group. 2018. Women, Business and the Law 2018. Washington DC. World Bank. Available at <https://openknowledge.worldbank.org/handle/10986/29498>

CONNECTIVITY

Infrastructural barriers inhibit financial inclusion across developing and emerging countries. In SSA only 46 percent of the region's population are subscribed to a mobile service according to GSMA.¹¹⁷ In Latin America and the Asia Pacific region it is 69 percent and 58 percent respectively. Even in the case where some populations have access to devices, electricity connectivity is not reliable in some instances to support the digital payments ecosystem.

46.75% For instance, in SSA access is still an issue (46.75 percent).¹¹⁸

This acts as a significant barrier to making mobile P2P payments as digital devices need a reliable source of electricity to charge. Without reliable connectivity, merchants are not only less likely to invest in payments infrastructure to support digital payments, but customers are also less likely to be prepared to pay in this way.

A significant proportion of the population in developing and emerging countries cannot interact with internet intensive DFS. Access to the internet across the developing world is still quite limited. In SSA (29 percent), South Asia (35 percent), Latin America (69 percent), East Asia and Pacific (70 percent) only a limited proportion of the population interact with the internet. The reliability and quality of internet access is another important factor in ensuring secure connectivity to DFS. A significant proportion of the population in developing and emerging countries do not have smartphones and still rely on 2G connectivity. In this case, USSD transmission methods are essential for the accessibility of financial services. This has been seen in SSA with the majority of e-money transactions running through USSD.¹¹⁹ These differences are also more pronounced for women, vulnerable groups and rural population groups. In developing and emerging countries especially, girls and women struggle to afford technology and internet access.

50% The gender digital divide in access to the internet remains largest in the world's least developed countries - where 50 percent of women are using the internet compared with 57 percent of men.¹²⁰

4.2.2. SUPPLY-SIDE BARRIERS

PROVIDER INTEROPERABILITY

Bilateral agreements add costs and complexity in facilitating non-interoperable payments: A 20-country scan by CGAP across developing and emerging economies found that while some form of interoperability was present in each market, the most common type of arrangement was bilateral, or through a third-party or aggregator.¹²¹ Even in the case where a multi-lateral agreement was in place, some providers still made use of bilateral agreements.¹²² This is inefficient and costly for providers as bilateral agreements which determine rules on pricing and other terms for interoperability are unique to every bilateral agreement requiring immense effort and costs to maintain. In the case of aggregators and third-party providers, there could be multiple aggregation points. So, the provider may have one aggregator for bill payments and another for merchant payments etc. This is a barrier to multiple use cases such as merchant payments and bill payments.

The lack of willingness to interoperate by larger providers impedes innovation and competition through encouraging monopolies to thrive on network effects acquired through building closed loop systems.¹²³

117 Global System for Mobile Communications (GSMA). 2021. The mobile economy Sub-Saharan Africa . London. GSMA. Accessed 14 March 2022. Available at: <https://www.gsma.com/mobileeconomy/sub-saharan-africa/>

118 World Bank Open Data. 2019. Access to electricity (% of population) - Sub-Saharan Africa. Washington DC. World Bank. Accessed 14 March, 2022. Available at: <https://data.worldbank.org/indicator/EG.ELC.ACCTS.ZS?locations=ZG>

119 Available at: <https://www.sofrecom.com/en/news-insights/traditional-mobile-money-assets-weakened-by-new-models.html>

120 International Telecommunication Union. 2021. The gender digital divide. Geneva. ITU. Available at: <https://www.itu.int/itu-d/reports/statistics/2021/11/15/the-gender-digital-divide/>

121 Arabehty, Pablo Garcia, Gregory Chen, William Cook, and Claudia McKay. 2016. Digital Finance Interoperability & Financial Inclusion: A 20-century scan. CGAP. Available at: <https://www.cgap.org/sites/default/files/researches/documents/interoperability.pdf>

122 Arabehty, Pablo Garcia, Gregory Chen, William Cook, and Claudia McKay. 2016. Digital Finance Interoperability & Financial Inclusion: A 20-century scan. CGAP. Available at: <https://www.cgap.org/sites/default/files/researches/documents/interoperability.pdf>

123 Gray, J. 2021. Interoperability of data. 15 June. Accessed 22 April, 2022. Available at: <https://cenfri.org/articles/interoperability-of-data-the-next-paradigm-shift-for-financial-markets-in-the-development-world/>

CASH MANAGEMENT

High liquidity costs inhibit the ability of providers to reach vulnerable groups. PSPs that rely on brick-and-mortar operations are constrained to extend physical cash-in, cash-out (CICO) points to more remote and rural populations because of the weak business angle to do so.¹²⁴ A significant challenge faced in this is related to liquidity costs. Agents who do not have their bank account linked to their mobile wallet have to walk to the nearest bank to rebalance their float. These frictions discourage the deployment of agents in remote areas where bank branches are not within a walking distance.¹²⁵ For e-money operators, the costs of providing agent services in terms of recruitment and training of agents, implementing security measures, and dealing with liquidity management challenges are very costly.¹²⁶ These costs have made the recovery of costs on low-value transactions and maintaining low-account balances significantly unprofitable activities, particularly where investment is still needed in physical branches e.g. rural and remote areas. As a result, individuals residing in remote or rural areas have been too costly to serve based on these liquidity costs.¹²⁷

Without access to cash-in, cash-out points, customers and merchants are unable to engage with the digital payments ecosystem which leads to exclusion. This phenomenon acts as a cross-cutting barrier across payment use cases.

PREVALENCE OF THIRD-PARTY INTERMEDIARIES

E-money instant clearing remains hampered by back-end inefficiencies. E-money instant clearing remains hampered by back-end inefficiencies such as the need to have a 1-to-1 matching value between the trust account and settlement account in order to mitigate credit and settlement risk. In fact, this ends up tying up funds that could be used for investment purposes.¹²⁸ This occurs because transactions need to be processed between two payment providers, which require settlement. As in the current case, an interoperable e-money switch as well as the inclusion of third-party intermediaries end up significantly raising the level of clearing and settlement complexity between multiple payment systems and multiple commercial instruments which ultimately slow down the settlement speed and add reconciliation costs. This ultimately hampers the efficiency of digital payments.

CONNECTIVITY

Traditional payments providers struggle to meet the payment needs of customers and merchants in areas with low connectivity. Reliable electricity access and basic mobile telephony infrastructure appears to be a basic prerequisite to providers being interested in launching basic DFS in a particular area.¹²⁹ However as digital infrastructure is a challenge in some developing and emerging economies, it acts as a supply-side barrier. Supporting environments that have poor connectivity is significantly challenging for traditional providers as the business case is not compelling for rolling out POS terminals, setting up e-money agents or physical branches, or automated teller machines (ATMs).¹³⁰

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- 124 Klapper, Leora, and Singer Dorothe. 2017. The World Bank Research Observer. Accessed 14 March, 2022. Available at: <https://academic.oup.com/wbro/article/32/2/211/4064178>
- 125 Perez, Laura Munoz, Michaela Allen, Christine Hougaard, and Barry Cooper. 2019. The evolution of agent networks in Africa: Case study: Kenya. March. Accessed 29 March, 2022. Available at: <https://cenfri.org/wp-content/uploads/2019/04/The-evolution-of-agent-networks-in-Africa-3.pdf>
- 126 Pazarbasioglu, Ceyla, Alfonso Garcia Mora, Mahesh Uttamchandani, Harish Natarajan, Erik Feyen, and Mathew Saal. 2020. Digital Financial Services. Washington DC. World Bank. Available at: <https://pubdocs.worldbank.org/en/230281588169110691/Digital-Financial-Services.pdf>
- 127 Klapper, Leora, and Singer Dorothe. 2017. The World Bank Research Observer. Accessed 14 March, 2022. Available at: <https://academic.oup.com/wbro/article/32/2/211/4064178>
- 128 Dobler, Marc C, José Garrido, Dirk Jan Grolleman, Tanai Khiaonaron, and Jan Nolte. 2021. E-Money: Prudential Supervision, Oversight, and User Protection. Washington DC. International Monetary Fund (IMF). 14 December. Accessed 25 March 2022. Available at: <https://www.imf.org/en/Publications/Departmental-Papers-Policy-Papers/Issues/2021/12/13/E-Money-Prudential-Supervision-Oversight-and-User-Protection-464868>
- 129 Pazarbasioglu, Ceyla, Alfonso Garcia Mora, Mahesh Uttamchandani, Harish Natarajan, Erik Feyen, and Mathew Saal. 2020. Digital Financial Services. Washington DC. World Bank. Available at: <https://pubdocs.worldbank.org/en/230281588169110691/Digital-Financial-Services.pdf>
- 130 Pazarbasioglu, Ceyla, Alfonso Garcia Mora, Mahesh Uttamchandani, Harish Natarajan, Erik Feyen, and Mathew Saal. 2020. Digital Financial Services. Washington DC. World Bank. Available at: <https://pubdocs.worldbank.org/en/230281588169110691/Digital-Financial-Services.pdf>

5. THE ROLE OF CBDC FOR FINANCIAL INCLUSION



This section scrutinizes how specific CBDC features can be used to lessen the barriers identified in Section 4 and thereby enable broader financial inclusion. It concludes with a discussion on the design choices around these features and how they relate to the current design choices being made by AFI members.

5.1. HOW CBDC CAN ADDRESS BARRIERS TO FINANCIAL INCLUSION USE CASES

Regulatory barriers are pre-conditions for CBDC rather than an outcome of CBDC. Before the key barriers can be unpacked, for CBDC to be successfully implemented, key regulations need to be in place to create an enabling environment for CBDC rollout. A baseline regulatory and policy landscape needs to exist for the digital ecosystem to thrive. Lack of a shared vision and strategy, insufficient competitive environment and a lack of cooperation between regulators are key cross-cutting regulatory barriers that need to be addressed before the implementation of a CBDC. As such, regulations are seen to form the foundation of the payment system and its innovation and need to be well established to support new technology.

5.1.1. ADDRESSING DEMAND-SIDE BARRIERS TRUST

CBDC features can foster trust by enabling faster and more accessible payment. CBDC can deepen consumer trust in digital payments by affecting the various composite factors that inform consumer trust. To address the consumer need for reliable and instantaneous payment, CBDC can ensure a high level of finality and irrevocability. In addition, to support reliability, CBDC can be designed to eliminate service downtime by leveraging a decentralized system that relies on multiple servers to reduce the risk of total system failure. While in the case of centralized data architectures, technologies can be utilized to ensure that there are many nodes or processors that coordinate online and offline capabilities. This will help to adjust the processing load among the nodes, even on an offline

device. Additional key features of CBDC that can enable higher levels of functional efficiency for unserved and underserved populations include:

- > **Offline and online capabilities:** CBDC can be designed to work both online and offline. This can happen through NFC and Bluetooth technology, which can facilitate offline payments between two mobile or payment devices.¹³¹
- > **24/7/365 availability:** a key design feature of decentralized CBDC is that of continuous availability. Multiple servers allow for CBDC to continue operating if one server goes down. The recent outage experienced by the Eastern Caribbean Central Bank's (ECCB)¹³² DCash, underlined the importance of putting in place mechanisms to mitigate against the potential of downtime.^{133,134} Including having robust protocols in place in the case of an outage and ensuring proper and timely renewal of expired certificates and system updates (as was the case with the DCash outage).

¹³¹ The level of offline functionality is dependent on a number of factors including the overall scheme cryptography and design, instrument design and protocols, wallet and wallet class structure specifications and then the specific and proportionate mitigation measures required for the CBDC system as specified, to operate within the national context. It should be noted that offline transactions are not a given, and without finding a secure solution, CBDCs could open themselves up to digital counterfeiting. One proposal to negate this risk includes the creation of a secure payment system protocol that can allow a user to make a digital payment in CBDC while both the sender and receiver are temporarily offline (English, Erin. 2021. Finding a secure solution for offline use of central bank digital currencies. Visa Economic Empowerment Institute. March 2021. Available at: <https://usa.visa.com/dam/VCOM/global/sites/visa-economic-empowerment-institute/documents/veei-secure-offline-cbdc.pdf>). Moreover, “double-spending” attacks, a form of counterfeiting where the CBDC is spent multiple times illegitimately, given undeveloped encryption protocols, can be mitigated by imposing spending limits and transaction frequency when the CBDC user is offline. Further, once a device that is conducting transactions is back “online”, the transaction offline history is uploaded as part of the instrument or wallet sync, in systems designed to operate offline. In other system designs with offline features, compliance software could sync with any transactions that have occurred during the offline period (World Economic Forum. 2021. 4 key cybersecurity threats to new central bank digital currencies. Geneva. The World Economic Forum (WEF). Available at: <https://www.weforum.org/agenda/2021/11/4-key-threats-central-bank-digital-currencies/>).

¹³² Eastern Caribbean Central Bank (ECCB). 2022. Region-Wide Service Interruption of DCash Platform. Eastern Caribbean Central Bank (ECCB). Available at: https://www.eccb-centralbank.org/news/view/region-wide-service-interruption-of-dcash-platform?fbclid=IwAR1DF0gznGfXcyG_r9ocRGJ6rQ0ZknC8S138xxXeQ6hXZy4GAjCjGuW5TA

¹³³ ¹³⁴ The problem was related to an expiring certificate on the version of the Hyperledger Fabric that hosts the DCash ledger, which forced the bank to roll out updates. Not only can expired certificates cause unplanned system or service outages but it can also provide an entrance through which malicious actors can find entry into a CBDC's operating platform. Proper and timely renewal of expired certificates is key to mitigating man-in-the-middle attacks (Security Boulevard. 2022. Digital Currency Hit by Expired Certificate – Root Cause for Prolonged Outage. Available at: <https://securityboulevard.com/2022/03/digital-currency-hit-by-expired-certificate-root-cause-for-prolonged-outage/>

- > **Assured irrevocability:** CBDC can further enable trust in digital payments by promising a high level of finality and irrevocability. This is assured as a result of settlement being guaranteed by the central bank.¹³⁵ Like cash, the transaction between two parties using central bank money ensures immediate settlement, without the counterparty risk that occurs with commercial payment instruments. This means that the risk of failed transactions and fraud is significantly reduced.

CBDC interoperability could unlock convenient payments use cases. One of the key features of retail CBDC is that it can enable full network and channel interoperability. In many developing and developed countries, payments still need to be exchanged in a stepwise process of clearing and settlement between uniquely designed payment schemes, often resulting in cumbersome and fee-intensive payment processes. CBDC has the potential to act as a universal digital instrument with which all licensed providers can integrate through secure open API¹³⁶. This will enable a ubiquitous channel for clearing for all licensed PSPs instead of needing to bilaterally integrate or rely on several external switches. CBDC, due to its sovereign currency and legal tender status, has the ability to integrate and interoperate universally among any scheme denominated in the local digital currency as a universal transaction exchange and settlement mechanism. Full interoperability will remove all payment frictions, providing consumers with the ability to make payments with both ease and convenience through CBDC to meet any of their payment needs. For example, the Bahamas' Sand Dollar allows for interoperability among existing and new channels for the provision of payments services. All payments services firms have access to the digital currency and are able to use the Sand Dollar Network to settle retail Bahamian dollar payments.¹³⁷

REAL AND PERCEIVED UNAFFORDABILITY

CBDC could enable lower DFS costs and increase affordability. DFS fees can be significant deterrents for consumers, reinforcing their preference for cash.¹³⁸ A fully interoperable CBDC will eliminate unnecessary third parties and streamline the settlement process.¹³⁹ CBDC would provide complete and secure transaction records without using a central registry which could enable direct P2P transactions, eliminating the need for traditional players, namely third-party intermediaries like financial institutions or clearing houses, reducing costs for PSPs. If these cost reductions are passed onto consumers, end-users will be able to experience more affordable payment services through CBDC. There are

already a number of real-world applications of this. In Ghana, where it is estimated that 99 percent of all merchant payments are conducted in cash, the Bank of Ghana - through the introduction of the e-Cedi - aims to bring down cost and fee related barriers for merchant payments through the launch of the e-Cedi which will compete with existing offerings.¹⁴⁰ Additionally, CBDC also has the potential to operate on a mobile based USSD¹⁴¹ wallet with SIM encryption or operate through a USSD-CBDC exchange leaving the USSD system largely unchanged. This implies minimal start-up investment requirements for basic or feature phone owners who want to use a CBDC wallet. Moreover, in order to further support P2B use cases, CBDC could also be expanded to include contactless hard wallets and NFC wearables that enable consumers to make in-store and transit fare payments, as has recently been introduced for the digital Yuan^{142,143}.

135 Bank for International Settlement. 2021. III. CBDCs: an opportunity for the monetary system. BIS Annual Economic Report 2021. Basel. Bank of International Settlements. Accessed 14 March, 2022. Available at: <https://www.bis.org/publ/arpdf/ar2021e3.pdf>

136 An API allows one software program to "talk" with another. APIs enable a wide range of innovative products and services that millions of people use every day. For instance, APIs are what make it possible for ride-hailing apps to leverage other companies' mapping and payments systems. Sometimes companies create an API for a single or small number of partners. When a financial services provider "opens" its APIs, it makes them widely available for other companies to consume. For example, a digital payments provider could open APIs to enable a whole range of e-commerce companies to plug seamlessly into its payments system. If done right, open APIs generate revenue for the provider and accelerate innovation in the marketplace (Consultative Group to Assist the Poor (CGAP). 2021. Open APIs for digital finance. Washington DC. CGAP. Available at: <https://www.cgap.org/topics/collections/open-apis>).

137 Central Bank of The Bahamas. 2022. The Sand Dollar Project. <https://www.sanddollar.bs/about>

138 Pazarbasioglu, Ceyla, Alfonso Garcia Mora, Mahesh Uttamchandani, Harish Natarajan, Erik Feyen, and Mathew Saal. 2020. Digital Financial Services. Washington DC. World Bank. Available at: <https://pubdocs.worldbank.org/en/230281588169110691/Digital-Financial-Services.pdf>

139 Cooper, Barry, Antonia Esser, and Michaela Allen. 2019. The use cases of central bank digital currency for financial inclusion: A case for mobile money. Cape Town. Centre for Financial Regulation and Inclusion (Cenfri). Available at: https://cenfri.org/wp-content/uploads/2019/06/CBDC-and-financial-inclusion_A-case-for-mobile-money.pdf

140 Bank of Ghana. 2022. Design Paper of the digital Cedi (eCedi). Accra. Bank of Ghana. Accessed 25 March, 2022. Available at: <https://www.bog.gov.gh/wp-content/uploads/2022/03/eCedi-Design-Paper.pdf>

141 The use of USSD in connection with CBDC would need to be adapted through security and cryptography installations. Generally, there is a reluctance for secure instruments to be exposed on unsecured channels by providers and authorities alike. The same result can be achieved through e-money remaining on USSD and connecting to the CBDC economy by operating through an exchange to purchase or sell CBDC using e-money, into or out of the e-money system.

142 Payments, Cards and Mobile. 2021. PBOC extends CBDC pilot to include contactless and NFC wearables. Available at: <https://www.paymentscardsandmobile.com/pboc-extends-cbdc-pilot-to-include-contactless-and-nfc-wearables/>

143 Equally CBDC instruments that can be accommodated on chip cards would not be dependent on mobile phone ownership which can reduce the wallet roll out cost to the similar cost of a chip and PIN NFC debit card per citizen not using a mobile phone. Tap on phone, PIN on glass NFC technology can convert smart phones into POS devices, with the potential to create near ubiquitous merchant and P2P CBDC acceptance.

MERCHANT ACCEPTANCE

CBDC could create more value for merchants to incentivize digital adoption. The P2B use case faces nuanced trust and identification barriers that are specific or exacerbated for merchants. These barriers include concerns around tax visibility, lack of formal registration, P2B fees imposed by PSPs, and cumbersome KYC requirements to register for accounts or POS devices, among others. While CBDC may not be able to easily alleviate all known barriers, it can be tailored to offer sufficient value to merchants to outweigh any real or perceived costs of adopting digital payments. For instance, CBDC programmability could support greater credit access, as CBDC transactions records could be leveraged to provide a more nuanced and accurate credit score¹⁴⁴. Furthermore, mechanisms inherent in a CBDC make it possible to reconfigure inventory management systems, such that inventory counts are updated on a transaction basis, allowing for real-time stock counts to take place. Moreover, programmability and smart contracts could allow for the automation of Value Added Taxes (VAT) and other tax payments at source, relieving vendors of the tedious task of manually calculating and reconciling their VAT liability along with submission and payment thereof. A fully interoperable CBDC wallet could also facilitate payments to suppliers, payment receipts from customers as well as personal payments - all on the same device.

LITERACY

CBDC can be designed to have built-in features to guide groups with low digital literacy. A simplified wallet design could be configured to ensure ease of use in population segments with low levels of literacy. The key to this is to design easy-to-use mobile wallets with an easy-to-use interface for those with limited financial literacy using an approach that involves heavy user testing, interviews, and feedback from users and partners. Furthermore, different formats of CBDC wallet need to exist - CBDC should be available in a format that can be used on feature phones, as well as one for smartphones. To achieve the former, this would involve leveraging existing rails, including USSD, voice as well online functionality that can all be received in one wallet. Alternative mechanisms to ensure ease of use for groups that lack traditional and digital literacy include building in voice recognition and artificial intelligence power chatbots.

IDENTITY

CBDC can cater for, and ease, the severity of identity gaps. The lack of universal access to identity is a particularly challenging constraint for G2P payments, as governments cannot channel transfers or wages to

citizens they cannot see or find. CBDC could potentially be used as a tool to combat the identity gap through three potential avenues:

- 1) pairing CBDC rollout with a digital identity initiative
- 2) CBDC itself becoming a digital identity proxy
- 3) via the creation of a CBDC enabled digital identity stack:
 - > **Pairing CBDC enrolment with digital identity initiatives:** the first avenue may arguably be the simplest, as pairing a CBDC rollout with a digital identity initiative means that the identification process could run as it normally would. As people sign up for their CBDC wallet, they can concurrently be enrolled with a digital identity.
 - > **CBDC as a digital identity proxy:** usage of CBDC and the build of a transaction history by an individual, could be used as digital identity verification by the user. CBDC could therefore be used to verify a person's identity on an ongoing basis, rather than as a one-off event, to create more robust identity profiles, especially for individuals without identity documents.
 - > **CBDC-enabled digital identity stacks:** CBDC could draw on various types of ID proxies (such as phone numbers, biometrics or email addresses) currently held at government entities.¹⁴⁵ It could achieve this by drawing on each of these unique identifiers to create digital identity proxy "stacks." These stacks could in turn act as a unique identity for individuals without any form of identification, as well as be used to enhance the robustness of identities for those that already have some form of ID. This, therefore, gives individuals a convenient and verifiable form of identification that can be used in the place of paper-based documents to access services digitally.¹⁴⁶

144 The facilitation of digital transaction via CBDC will allow for transaction data to be automatically generated which can be easily collected. Such data trails can also be used provide a reliable basis for credit scoring and by enabling off-the-top repayment that reduces risk for providers while easing the burden on merchants (Consultative Group to Assist the Poor (CGAP). 2019. Digital Credit Models for Small Businesses. Washington DC. CGAP. Available at: <https://www.cgap.org/research/publication/digital-credit-models-small-businesses>).

145 Cooper, Barry, Laura Munoz Perez, Antonia Esser, Michaela Allen, Nolwazi Hlophe, and Matthew Ferreira. 2019. ID proxy initiatives across the globe: An analysis. Cape Town. Centre for Financial Regulation and Inclusion (Cenfri). Available at: <https://cenfri.org/publications/an-analysis-of-id-proxy-initiatives-across-the-globe/>

146 Cooper, Berry, Antonia Esser, Gatwabyege Fabrice, Kinyanjui Mungai, Vera Neugebauer, Laura Munoz Perez, Roland Banya, and Ajay Jaganath. 2021. An inclusive digital identity platform in the Pacific Islands. Cape Town. Centre for Financial Regulation and Inclusion (Cenfri). Available at: <https://cenfri.org/publications/an-inclusive-digital-identity-platform-in-the-pacific-islands-country-level-diagnostics/#:~:text=SHARE-,An%20inclusive%20digital%20identity%20platform%20in%20the%20Pacific%20Islands,-10%20JUNE%2C%202021>

CBDC can be designed to manage identification risk. CBDCs' usage of identification proxies or stacks can be paired with a multiple wallet class design to manage the risk from those with less robust digital identities. Such processes can lower the risk of improper CDD than in-person verification, which often relies on a simple piece of paper or card, which can be forged. In countries that still rely on traditional forms of identification such as physical documents for CDD, digital systems can more robustly check their validity because they employ technology for document verification rather than subjective, in-person assessments. Hence, while CBDC itself cannot solve the identification issue, it can be used as a tool to better facilitate the identification process.¹⁴⁷

CONNECTIVITY

CBDC can leverage existing technology to support offline payments. A CBDC that is designed with offline payment capability will support the need for an accessible payment instrument in an environment with weak or non-existent connectivity. Offline payments can be enabled through NFC¹⁴⁸ technology and Bluetooth technology. The NFC technology would leverage radio frequency identification (RFID)¹⁴⁹ infrastructure to enable interaction between two NFC enabled devices i.e. payments occurring on card readers through contactless Europay, Mastercard and Visa (EMV)¹⁵⁰ smartcards.¹⁵¹ A retail CBDC could leverage this technology in an offline setting to facilitate payments. Issuers could then require users to reconcile the offline transactions with the online ledger through a variety of pre-defined ways.¹⁵² CBDC could also be designed as an always-offline bearer instrument, for example, on a stored-value card, as was the Bank of Finland's Avant CBDC launched in 1993.¹⁵³

The Bank of Ghana's recently launched eCedi aims to be accessible to everyone and in any part of the country, even in the absence of mobile data networks in rural areas. As such, its design aims to leverage and enable the use of offline payment capabilities.¹⁵⁴

CBDC can be designed to support a variety of use cases that would otherwise have remained cash heavy. A CBDC designed to support offline payments can encourage merchant payments, G2P payments, and other use cases. Customers can make consecutive payments at merchant outlets with just their smartcards. In farming communities, farmers can make payments for inputs through smartcards and receive payments as well which enables them to build a digital history that can be utilized for accessing credit once

the data is shared with a payments service provider.¹⁵⁵ For G2P, governments can distribute welfare vouchers through this technology to reach vulnerable groups.¹⁵⁶ This includes farmers affected by climate-change related disasters, who can be reached by CBDC-enabled G2P payments with a high level of finality and irrevocability. Not only is the digital payment beneficial in assuring that the next payment will arrive, but the improved predictability and reliability of payments could allow individuals and households to plan and invest over the long run, ultimately improving resilience.¹⁵⁷

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- 147 Cooper, Barry, Matthew Ferreira, and Lezanne Janse van Vuuren. 2020. Digital identity and financial inclusion. Cape Town. Centre for Financial Regulation and Inclusion (Cenfri) Available at: <https://cenfri.org/articles/digital-identity-and-financial-inclusion/>
- 148 Near-field communication is a set of communication protocols that enables communication between two electronic devices over four centimeters or less.
- 149 RFID refers to a technology whereby digital data encoded in RFID tags or smart labels are captured by a reader via radio waves.
- 150 An EMV card is a credit or debit card with an embedded microchip and associated technology designed to enable secure payment at compatible point of sale (POS) terminals. Compatible terminals enable card dipping for chip and PIN or chip and signature authentication.
- 151 Gauthier, Van Damme, Wouters Karel, Karahan Hakan, and Preneel Bart. 2009. Offline NFC Payments with Electronic Vouchers. Research Gate. Accessed 03 15, 2022. Available at: https://www.researchgate.net/publication/221164372_Offline_NFC_Payments_with_Electronic_Vouchers
- 152 PSPs could go to remote/offline environments and support in intermittently reconciling offline payments onto the online ledger. Based on stakeholder consultations on Bank of Ghana eCedi and the Central Bank of Nigeria eNaira, details refer to Appendix A: Stakeholder Interviews, Table 6.
- 153 Grym, A. 2020. Lessons learned from the world's first CBDC. Accessed 14 April, 2022. Available at: <https://helda.helsinki.fi/handle/123456789/17590>
- 154 Bank of Ghana. 2022. Design Paper of the digital Cedi (eCedi). Accra. Bank of Ghana. Accessed 25 March, 2022. Available at: <https://www.bog.gov.gh/wp-content/uploads/2022/03/eCedi-Design-Paper.pdf>
- 155 Based on stakeholder consultations on Bank of Ghana eCedi and the Central Bank of Nigeria eNaira, details refer to Appendix A: Stakeholder Interviews, Table 6.
- 156 Based on stakeholder consultations on Bank of Ghana eCedi and the Central Bank of Nigeria eNaira, details refer to Appendix A: Stakeholder Interviews, Table 6.
- 157 Abdul Latif Jameel Poverty Action Lab (J-PAL). 2020. Should government payments be digitized? Cambridge, MA. J-PAL. Available at: <https://www.povertyactionlab.org/blog/10-13-20/should-government-payments-be-digitized>

Offline capabilities also provide a solution to undertaking payments during power and network outages - events which farmers and marginalized communities living in remote and isolated areas may be prone to. This can support the effectiveness of targeted G2P welfare systems for vulnerable populations, such as those exposed to natural disasters and marginalized groups. For women in particular, who in many developing and emerging countries face greater social demands and who have less bargaining power within the household, CBDC can be programmed to ensure G2P payments are deposited into their own account ensuring control over their money and the ability to allocate money within households fairly.

In India, the direct deposit of wages earned by women into their own bank accounts, instead of those of their husbands, resulted in a significant increase in the number of women that participated in the labour market as well as total incomes.¹⁵⁸

5.1.2. ADDRESSING SUPPLY-SIDE BARRIERS PROVIDER INTEROPERABILITY

CBDC can lower provider costs and complexity related to interoperability. CBDC providers claim that CBDC can overcome the technical (and potentially costly) challenges of integrating schemes for interoperability. For instance, eCurrency provides a common standards-based API.¹⁵⁹ The common technical standard provided by the API reduces the cost of integration and decreases the technology failure risks for the entire ecosystem (Kudrycki 2017).¹⁶⁰ Providers will only be required to connect to the central banks API in a hub-and-spoke¹⁶¹ manner. This is however not the only approach to realizing interoperability. Algorand¹⁶² eases interoperability issues by presenting an open-source blockchain-based network.¹⁶³ Algorand's CBDC model can be fully integrated with local RTGSs and enables CBDC to be issued on its platform through instructions received from the RTGS.¹⁶⁴ This approach removes layers of complexity and costs.

Overall, the interoperability of payments through CBDC in an open-looped system can unlock new opportunities for innovations in DFS from new services and products, as well as new models for access and distribution.

This will encourage competition in the market. For instance, in China, Alipay and Wechat, the dominant mobile financial services offerings do not interoperate. Their dominance and lack of interoperability are key

concerns for the PBOC.¹⁶⁵ It is expected that through the digital Yuan, the two mobile financial services giants will become interoperable, which will enhance the competitiveness of the payments market in China.^{166,167}

CASH MANAGEMENT

CBDC may reduce liquidity management costs. CBDC can play a role in enabling more direct rebalancing of float for agents.¹⁶⁸ Agents will be able to link to their mobile wallet to the CBDC platform enabling direct rebalancing without having to walk to a bank branch. This can be achieved through its decentralized nature, and will lead to the elimination of float issues and costs associated with managing liquidity risks. This will be possible if MMOs are allowed to access CBDC on-demand as independent holders of funds.¹⁷⁰

- 158 Field, E, R Pande, N Rigol, S Schaner, and C Moore. 2019. On Her Own Account: How Strengthening Women's Financial Control Affects Labor Supply and Gender Norms. Available at: <https://www.nber.org/papers/w26294>
- 159 Based on stakeholder consultations on Bank of Ghana eCedi and the Central Bank of Nigeria eNaira, details refer to Appendix A: Stakeholder Interviews, Table 6.
- 160 Kudrycki, Thomas. 2017. Ubiquitous e-Money interoperability. eCurrency. Accessed 14 March, 2022. <https://www.ecurrency.net/post/ubiquitous-e-money-interoperability>
- 161 Central Bank as the hub, and providers as spokes.
- 162 Algorand is a CBDC technical provider employing secure blockchain infrastructure for DFS.
- 163 Based on stakeholder consultations on Bank of Ghana eCedi and the Central Bank of Nigeria eNaira, details refer to Appendix A: Stakeholder Interviews, Table 6.
- 164 Civelli, Andrea, Co-Pierre Georg, Pietro Grassano, and Naveed Ihsanullah. 2022. Issuing Central Bank Digital Currency Using Algorand. Cognizium. Accessed 25 March, 2022. Available at: <https://theblockchaintest.com/uploads/resources/Andrea%20Civelli-Co%20Pierre%20Georg-Pietro%20Grassano%20-%20Issuing%20Central%20Bank%20Digital%20Currency%20Using%20Algorand.pdf>
- 165 Jones, Mark. 2020. China's PBOC urges digital payments antitrust probe on Alipay, WeChat Pay. 03 August. Tech Wire Asia. Accessed 28 April, 2022. Available at: <https://techwireasia.com/2020/08/chinas-pboc-urges-digital-payments-antitrust-probe-on-alipay-wechat-pay/>
- 166 Alper, Tim. 2020. Digital Yuan 'Highly Likely' to Be Compatible with Alipay, WeChat Pay. 20 May. Accessed 28 April, 2022. Available at: <https://cryptonews.com/news/digital-yuan-highly-likely-to-be-compatible-with-alipay-wech-6598.htm>
- 167 Both Wechat Pay and Alipay have been part of the digital yuan CBDC pilots.
- 168 Cooper, Barry, Antonia Esser, and Michaella Allen. 2019. The use cases of central bank digital currency for financial inclusion: A case for mobile money. Cape Town. Centre for Financial Regulation and Inclusion (Cenfri). Available at: https://cenfri.org/wp-content/uploads/2019/06/CBDC-and-financial-inclusion_A-case-for-mobile-money.pdf
- 169 E-float refers to the balance of e-money, or physical cash, or money in a bank account that an agent can immediately access to meet customer demands to purchase (cash in) or sell (cash out) electronic money (Global System for Mobile Communications (GSMA)). 2010. Mobile money definitions. London. GSMA. July. Accessed 31 March, 2022. Available at: <https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2012/06/mobilemoneydefinitionsnomarks56.pdf>).
- 170 Cooper, Barry, Antonia Esser, and Michaella Allen. 2019. The use cases of central bank digital currency for financial inclusion: A case for mobile money. Cape Town. Centre for Financial Regulation and Inclusion (Cenfri). Available at: https://cenfri.org/wp-content/uploads/2019/06/CBDC-and-financial-inclusion_A-case-for-mobile-money.pdf

The result will be enabling better liquidity management and lowering liquidity risks, and enabling access points to serve more clients. Moreover, PSPs will be able to employ more efficient cash logistics and lower levels of vault cash holding as well as make use of instant wholesale deposits.

INSTANT PAYMENTS

CBDC facilitates instant payments for providers while lowering associated risks. One of the key features that CBDC possesses is the ability to facilitate instant clearing and settlement for providers. With a retail CBDC, a payment will only involve transferring a direct claim on the central bank from one end-user to another. Funds will not pass over the balance sheet of an intermediary, and transactions will be settled directly in central bank money, on the central bank's balance sheet and in real time.¹⁷¹ Back-end challenges, such as the need to mitigate credit and settlement risk because settlement is not instantaneous will be reduced as CBDC is a real-time settlement system rather than a deferred one.

CBDC will enable instant settlement, thus removing settlement risk and credit risk, both of which will support cost savings among providers.

This is because it will free up collateral used to mitigate these risks. In addition, instant settlement will support the effective management of cash flow among merchants as they will be able to access funds sent by customers, in real time. This will encourage merchant digitalization. For instance, in Ghana, while the existing e-money interoperability platform on Ghana Interbank Payment and Settlement Systems Limited (GHiPSS) enables cross-platform fund transfers, the settlement of e-money interoperability transactions is still on a deferred net settlement basis.¹⁷² This proves inefficient as it places additional stress on the liquidity needs for industry. Through the interoperability of the eCedi with the GHiPSS, the Bank of Ghana envisions providers settling instantaneously between each other, which will improve liquidity and reduce settlement frictions.¹⁷³

CONNECTIVITY

The technology required to secure the roll-out of an offline CBDC is already here. A CBDC that is designed with offline payment capability will support the need for an accessible payment instrument in an environment with weak or non-existent connectivity. Offline payments do not necessarily increase Money Laundering (ML)/Terrorist Financing (TF)/Proliferation Financing

(PF) risks over and above online transactions.¹⁷⁴

Vulnerabilities in identification can, however, raise ML/TF/PF risks but these are very different risks compared to decisions relating to implementing offline¹⁷⁵ or online payments.

The adoption and effective implementation of the risk-based approach (RBA) to ML/TF/PF risks - which would include the de-conflation and analysis of all related risks, including consumer identity and verification issues within the national context - is key to laying the groundwork for an offline environment. Understanding the magnitude and vulnerability factors of a varied range of risks and mitigants can be employed to address connectivity, in particular, where and how digital ID can be used to support offline transactions.¹⁷⁶

Customers can be onboarded through digital ID, and their transactions, whether offline or online, will still generate a data footprint that can be used for ongoing CDD. In terms of technology, offline payments can be enabled through NFC technology and Bluetooth technology. The NFC technology would leverage RFID infrastructure to enable interaction between two NFC enabled devices i.e. payments occurring on card readers through contactless EMV smartcards.¹⁷⁷ This technology has existed for several decades and has been in use to support a host of payment use cases e.g. paying for public transport and utilities.¹⁷⁸

171 Bank for International Settlement. 2021. III. CBDCs: an opportunity for the monetary system. BIS Annual Economic Report 2021. Basel. Bank of International Settlements. Accessed 14 March, 2022. Available at: <https://www.bis.org/publ/arpdf/ar2021e3.pdf>

172 Bank of Ghana. 2022. Design Paper of the digital Cedi (eCedi). Accra. Bank of Ghana. Accessed 25 March, 2022. Available at: <https://www.bog.gov.gh/wp-content/uploads/2022/03/eCedi-Design-Paper.pdf>

173 Bank of Ghana. 2022. Design Paper of the digital Cedi (eCedi). Accra. Bank of Ghana. Accessed 25 March, 2022. Available at: <https://www.bog.gov.gh/wp-content/uploads/2022/03/eCedi-Design-Paper.pdf>

174 Any mitigants such as caps of number of offline payment transactions should be kept to a minimum and be well thought out in terms of the actual effect in mitigating risks.

175 Offline payments may face operational risks.

176 Financial Action Task Force. 2020. Digital Identity. March. Accessed 8 March 2022. Available at: <https://www.fatf-gafi.org/media/fatf/documents/recommendations/Guidance-on-Digital-Identity.pdf>

177 Gauthier, Van Damme, Wouters Karel, Karahan Hakan, and Preneel Bart. 2009. Offline NFC Payments with Electronic Vouchers. Research Gate. Accessed 15 March 2022. Available at: https://www.researchgate.net/publication/221164372_Offline_NFC_Payments_with_Electronic_Vouchers

178 Gauthier, Van Damme, Wouters Karel, Karahan Hakan, and Preneel Bart. 2009. Offline NFC Payments with Electronic Vouchers. Research Gate. Accessed 15 March 2022. Available at: https://www.researchgate.net/publication/221164372_Offline_NFC_Payments_with_Electronic_Vouchers



Offline capabilities can greatly expand the CBDC acceptance network through the more recent technology that converts off-the-shelf smartphones into CBDC POS and wallet-acquiring devices through Tap-on-phone-PIN-on-glass technology, most commonly exemplified by touch screens. Stored-value cards can also be used to provide near-permanent continuous offline payment capabilities.¹⁷⁹ An example of this can be seen in the design of the digital yuan through the development of soft and hard wallets. With soft wallets, for example, two smartphone users who are in a low-connectivity environment will benefit from the People's Bank of China (PBOC) as users can utilize dual offline functionality to transact with each other using the digital yuan.¹⁸⁰ The PBOC has also enabled hard wallets to be used for transacting when both users do not have smartphones but can leverage NFC technology, where at least one NFC integrated circuit (IC) card is equipped with sender and receiver properties as well as an embedded micro-display to show the transaction amount and remaining balances.^{181,182} Both approaches can be used for merchant payments as well as P2P payments. Pilot tests in Suzhou city have been conducted and provide evidence that offline functionality can be made operational to support disadvantaged communities and the elderly in engaging with financial services¹⁸³.

5.2. CBDC FEATURES VS FINANCIAL INCLUSION BARRIERS

Sections 5.1.1 and 5.1.2 above provide an overview of how CBDC can address demand- and supply-side barriers for the financial inclusion use cases identified in Section 4. The table below summarizes these barriers and the CBDC features that could address them. This will provide a starting point for design choices by regulators and policymakers.

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- 179 Grym, A. 2020. Lessons learned from the world's first CBDC. Accessed 14 April 2022. Available at: <https://helda.helsinki.fi/bof/handle/123456789/17590>
- 180 The payee can take the app into offline mode and request funds. The payer can confirm the amount and transaction through biometrics after which the recipient can place their phone over the sender and through NFC technology can receive the payment from the sender (Atlantic Council. 2022. Atlantic Council-UC San Diego conference on digital currency in China and the Asia Pacific. 14 February. Accessed 4 May 2022. Available at: <https://www.atlanticcouncil.org/event/conference-on-digital-currency-in-china-and-the-asia-pacific/>).
- 181 The user with the card enabled with sender/receiver properties inputs the amount that they want to request and place their card over the sender card. The microdisplay shows information regarding the transaction amount, and remaining balance (Atlantic Council. 2022. Atlantic Council-UC San Diego conference on digital currency in China and the Asia Pacific. 14 February. Accessed 4 May 2022. Available at: <https://www.atlanticcouncil.org/event/conference-on-digital-currency-in-china-and-the-asia-pacific/>).
- 182 Yang, Jingjing. 2021. China's digital yuan proceeding apace. Lakyara no.334. Nomura Research Institute, Ltd. 17 February. Accessed 3 May 2022. Available at: <https://www.nri.com/-/media/Corporate/en/Files/PDF/knowledge/publication/lakyara/2021/02/lakyaravol334.pdf?la=en&hash=61B2566EBA7BCF31B4C82C924C55BE0FF7AD98A5>
- 183 Digital yuan conducted 8,478,000 online transactions and 10,490,000 offline transactions in the pilot (Yang, Jingjing. 2021. China's digital yuan proceeding apace. Lakyara no.334. Nomura Research Institute, Ltd. 17 February. Accessed 3 May 2022. Available at: <https://www.nri.com/-/media/Corporate/en/Files/PDF/knowledge/publication/lakyara/2021/02/lakyaravol334.pdf?la=en&hash=61B2566EBA7BCF31B4C82C924C55BE0FF7AD98A5>).

TABLE 3: SUMMARY CBDC FEATURES AND FINANCIAL INCLUSION BARRIERS

FI BARRIERS	MARKET CONTEXT	CBDC FEATURES	USE CASES SUPPORTED
DEMAND-SIDE 	1. Trust	<ul style="list-style-type: none"> > Low trust in commercial providers due to bad experiences > Lack of control over transactions (cash can always be accessed and any change in income can be noted immediately) > Lack of recourse if issues arise 	<ul style="list-style-type: none"> > 24/7 availability > Instant clearing and value transfer > Final and irrevocable payments > Wallet audit trail and recourse process to recover locked value > Offline capability in case of network issues, or lack of airtime > Smart card capability CBDC, low cost, no phone or airtime needed, and online and offline capability
	2. Fees	<ul style="list-style-type: none"> > High perceived fees for transactions > Monthly account or wallet fees erode value 	<ul style="list-style-type: none"> > Decentralized distribution capable of reducing risk, lower involvement of intermediaries, the use of a secure instrument reduces channel operational and security processes, translating into overall lower costs > Ubiquity of channels results in aggregation of scale advantages
	3. Merchant acceptance	<ul style="list-style-type: none"> > Tax avoidance and privacy > Lack of merchant-specific KYC documentation > A lack of merchant access to POS terminals 	<ul style="list-style-type: none"> > Automated tax payments > Merchant may not need a POS; can use a mobile phone or NFC reader > Value-added services offered by using CBDC wallet
	4. Literacy	Low levels of financial and digital literacy	Designed for simplicity
	5. Identity	KYC regulation drives exclusion due to lack of identification (physical or digital)	<ul style="list-style-type: none"> > CBDC can become an identifier > It can offer risk-based approach options to CDD > Digital identity proof options in line with FATF guidance > Can be part of a digital ID stack and can be rolled out as part of a national ID
	6. Connectivity	<ul style="list-style-type: none"> > Lack of access to high-speed internet > Lack of access to smartphones 	<ul style="list-style-type: none"> > Offline and online capabilities > Design for low connectivity and feature phones
SUPPLY-SIDE 	1. Interoperability	Costly and complex inter-provider payments due to a lack of interoperability (done bilaterally or through third parties)	CBDC can lower provider costs and ease processes by eliminating the need for complex and new integrations through payment instrument standardization
	2. Cash management	<ul style="list-style-type: none"> > Poor liquidity management > Limited PSP access points > High liquidity costs 	<ul style="list-style-type: none"> > Enable better liquidity management through more direct access to liquidity for rebalancing > Enable each access point to serve more clients as liquidity constraints are removed. > Lower liquidity risks will reduce the costs involved in managing liquidity risks
	3. Instant payments	Legacy systems inhibit inclusive instant payment systems. Current systems tie up PSP funds to manage credit and settlement risks.	CBDC to facilitate instant clearing and settlement, and lower credit and settlement risks.

6. POTENTIAL RISKS AND UNINTENDED CONSEQUENCES



The previous sections highlight the potential of CBDC to contribute to financial inclusion by reducing friction for specific use cases related to the existing digital payments landscape in developing and emerging economies. However, implementing a CBDC also comes with risks and potential unintended consequences for central banks, consumers, and PSPs. The below section outlines these unintended consequences and key potential risks and that may arise if CBDC is not appropriately tailored to the context and needs of a given economy.

6.1. CONSUMERS

CBDC could increase the digital divide for users, particularly for vulnerable groups. As highlighted in Section 4, the majority of adults in developing and emerging economies do not have a smartphone and still rely on 2G connectivity. Further, even for those who can access smartphones, digital and financial literacy remain a challenge. While connectivity has improved over the last few years, the majority of adults still rely on USSD transmissions to communicate and facilitate e-money transactions.¹⁸⁴

However, concerns with the security of USSD have meant that central banks exploring or implementing CBDC need to rethink how to include USSD in their design.¹⁸⁵ If USSD is not considered as part of the design, it runs the risk of excluding large swathes of the population from being able to access and use CBDC effectively. If it is integrated into the design, but in ways that increase the complexity of using USSD to access CBDC, it could alienate populations with low digital literacy. This is a particular challenge for reaching vulnerable groups including rural women and the elderly who often live in remote areas with limited connectivity and have limited experience with smartphones or DFS. Thus, while CBDC may encourage greater digitalization, the benefits of this may only be available to those with the devices, data and skills to access and use it. This risk could reduce over time as smartphones and requisite CBDC infrastructure are made more accessible, but in the short-term, it could

result in a further divide between the population being able to access and benefit from CBDC and the group relying on USSD-based e-money products.

Retail CBDC has the potential to infringe on consumers' data protection and privacy. The technology that underpins CBDC has the potential to identify and monitor consumer behavior. This data could be shared by the central bank with other government agencies without the consent of the consumer. While this data could then be used for legitimate purposes such as to clamp down on tax evasion, corruption or illicit financial flows, it could also be misused by government agencies to target individuals or merchants with services they do not want. Worse, it could be used to discriminate against certain individuals or segments of the population.¹⁸⁶ Central banks thus face trade-offs between satisfying legitimate user preference for privacy and mitigating financial integrity risks. This is not unique to central banks. Many developing country governments have introduced data protection and privacy regulation in the financial sector to ensure personal data is not misused.¹⁸⁷ What is unique to CBDC is that the supervisors of these transactions will also be one of the providers executing them. This will require both strong consideration for how privacy is embedded in the design of CBDC and the governance of CBDC to ensure that existing data protection and privacy laws are not undermined.

Applying a copy and paste approach to CBDC regulations could reinforce existing barriers. Beyond effective data protection and privacy regulation, a precondition for the successful implementation of CBDC is to have in place an enabling regulatory environment for digital payments innovation. However, this does not mean simply applying or continuing existing financial regulation for CBDC. For example, a common barrier to financial inclusion is a lack of identity documents to comply with anti-money laundering, countering the financing of terrorism, and combatting proliferation financing (AML/CFT/CPF) regulations. Most PSPs have

184 Sofrecom. 2019. Traditional mobile assets weakened by new models. 5 June. Accessed 22 March 2022. Available at: <https://www.sofrecom.com/en/news-insights/traditional-mobile-money-assets-weakened-by-new-models.html>

185 Based on stakeholder consultations on Bank of Ghana eCedi and the Central Bank of Nigeria eNaira, details refer to Appendix A: Stakeholder Interviews, Table 6.

186 Disparte, Dante A. 2021. The Risks of Central Bank Digital Currencies. Diplomatic Courier. Available at: <https://www.diplomaticcourier.com/posts/the-risks-of-central-bank-digital-currencies#:~:text=Cyber%20threats%20and%20single%20points,Winds%20and%20the%20Colonial%20gas>

187 United Nations Conference on Trade and Development (UNCTAD). Data protection and privacy legislation worldwide. Geneva. UNCTAD. Accessed March 2022. Available at: <https://unctad.org/page/data-protection-and-privacy-legislation-worldwide>

been able to address this through tiering and identifying different requirements for different products based on their functionality. This often leads to more people being included but underserved with the products and services they can access. Further, while FATF has issued guidance for remote CDD for rural individuals and households, many PSPs have struggled to implement it in developing and emerging economies.¹⁸⁸ This is a large risk for rural populations who often live far away from banking infrastructure, as well as forcibly displaced persons (FDPs) who often lack forms of identification required to access humanitarian cash transfers, or send and receive remittances, let alone fully-fledged financial services.¹⁸⁹ If these regulations are not addressed for CBDC, it has the potential to reinforce existing regulatory barriers to financial inclusion, particularly for underserved or excluded groups.

6.2. CENTRAL BANKS

Central banks will be taking on new reputational risks by introducing CBDCs. CBDC could create significant financial stability risks for central banks such as the potential disintermediation of banks. However, perhaps the largest risk for central banks is from assuming responsibility for introducing a new payment instrument and new technology into the existing digital payments ecosystem.¹⁹⁰ Although central banks will work through existing payment providers, if something goes wrong, such as a failure with the technology underpinning CBDC, and consumers cannot access their income, central banks will likely be to blame. This may damage the reputation of the central banks and the trust that consumers have in them. The recent criticism lodged against the Nigerian eNaira by the IMF regarding its potential to be used for money laundering and terrorist in the absence of more well-defined money laundering/terrorist financing risk assessments is a notable example of such reputational damage. In other cases, the risks may just be that the product is poorly designed, or not simple or intuitive enough for consumers to use. In developing and emerging economies, this will likely be exacerbated given low levels of financial and digital literacy. This could also create reputational risks for the central bank if it results in consumers opting out.¹⁹¹ Should this happen, the central bank will have used taxpayers' money to invest in something they aren't benefitting from. This can further undermine the trust that consumers have in the central bank's capabilities.

6.3. PAYMENT SERVICE PROVIDERS

CBDC could negatively disrupt the traditional banking system. The introduction of a retail CBDC will likely lead to some disintermediation of the banking sector

and existing PSPs.¹⁹² Even with a multi-tiered approach where central banks work with banks and PSPs to roll out and implement a CBDC, individuals and merchants may end up preferring to transact directly using their CBDC wallet. This could be a positive development for the market over the medium and longer term. It could open the sector to more innovation as providers compete on value to the consumers and not on building monopolistic infrastructure.¹⁹³ However, given that the initial users of CBDC will likely be reached through this existing infrastructure, in the short-term, CBDC will likely draw on existing volumes and revenues from banks and PSPs. Furthermore, unlike in developed countries, the fees generated from payment transactions in developing and emerging economies, specifically P2P transactions, are a major driver of banking and PSP revenue. Not only will this risk undermining PSP business models, it may lead to unintended consequences. For example, PSPs and banks may increase the cost of CBDC offerings to deter consumers from using it over their other offerings. Alternatively, it may undermine encashment infrastructure. If PSPs cannot recover this investment through fees, they may be less incentivized to build or maintain it. Central banks need to be clear on where and how CBDCs can contribute to addressing barriers to financial inclusion, without undermining the business model of PSPs and banks for the infrastructure that is required to make CBDCs work. Both the Central Bank of Eswatini and the Bank of England have noted this risk and have de-emphasized a CBDC distribution model that would remove the role of the private sector in banking.¹⁹⁴

188 Cooper, Barry, Masiwa Rusare, Matthew Ferreira, and Lezanne Janse van Vuuren. 2020. Identity proofing for Covid-19 recovery: Guidance for regulators, FSPs and market facilitators. Cape Town. Centre for Financial Regulation and Inclusion (Cenfri)

189 Alliance for Financial Inclusion (AFI). 2021. Integrating Vulnerable Groups in National Financial Education Programs and Strategies. Kuala Lumpur. Alliance for Financial Inclusion (AFI). Available at: <https://www.afi-global.org/publications/integrating-vulnerable-groups-in-national-financial-education-programs-and-strategies/>

190 Disparte, Dante A. 2021. The Risks of Central Bank Digital Currencies. Diplomatic Courier. Available at: <https://www.diplomaticcourier.com/posts/the-risks-of-central-bank-digital-currencies#:~:text=Cyber%20threats%20and%20single%20points,Winds%20and%20the%20Colonial%20gas>

191 Light, Jeremy. 2022. The risks to society of central bank digital currencies. Finextra, 17 January.

192 House of Lords. 2022. Central bank digital currencies: a solution in search of a problem? Authority of the House of Lords.

193 Mookerjee, Ajay S. 2021. What if central banks issued digital currency? Harvard Business Review, 15 October.

194 Bank of England. 2020. Discussion Paper: Central Bank Digital Currency Opportunities, challenges and design. London. Available at: <https://www.bankofengland.co.uk/-/media/boe/files/paper/2020/central-bank-digital-currency-opportunities-challenges-and-design.pdf>, and Central Bank of Eswatini. 2020. Eswatini CBDC Diagnostic Study. February. Accessed 25 April 2022. https://www.centralbank.org.sz/wp-content/uploads/2021/04/CBE-Cenfri-CBDC-Diagnostic_Phase1-.pdf

6.4. CROSS-CUTTING

Cybersecurity related risks likely the biggest risk for everyone involved. There are two main cybersecurity risks to consider in the design and implementation of a retail CBDC. The first is related to end-users whereby a CBDC wallet is compromised because of the system or infrastructure it runs on. This risk would likely be contained and managed by the banks and PSPs. It is not a new risk; rather, it is one that is increased by the introduction of a CBDC.

Banks and PSPs must integrate with CBDC wallets, many of which could be first time users of DFS and e-wallets, creating more vulnerability points for fraud, identify theft and cyber-attacks.¹⁹⁵

This is likely a bigger risk in developing and emerging economies where digital and financial literacy rates are lower and where PSPs and financial institutions have fewer resources to invest in cybersecurity.

The second risk is related to the CBDC system. With the current system, cybersecurity risks are more localized within specific financial institutions. While many CBDCs will use DLT, it will require some level of centralization from central banks. Any attack on this system, even a small outage, could disrupt large numbers of the population. Further, it could make a central bank and its CBDC system an attractive target for more sophisticated attacks as we have seen with other providers of large databases such as Equinix or Solar Winds, among others.¹⁹⁶

Failure to future proof CBDC for additional use cases and global transactions. As a priority, central banks need to ensure that CBDC is designed to cater for domestic, country-specific needs that encourage adoption by businesses and individuals. In achieving this, however, central banks may inadvertently design their CBDCs for the needs and challenges of the present day, rather than considering the evolving trends of the digital and payment landscape. Furthermore, by following a narrow focus on a given country's needs, it may lead to CBDC design protocol not adequately taking into account the need to facilitate cross-border CBDC payments in the future i.e. for the protocols of one country's CBDC to be recognized as valid and acceptable by another country's CBDC. To ensure that CBDC designs do not fall into the traps that existing legacy instruments and systems have succumbed to, central banks must ensure their CBDC design is sufficiently agile and adaptive to cater for new or emerging use cases, and also continuously ensure that

it is fit-for-purpose. In addition to catering for new and emerging use cases, the design of CBDC should, as far as possible, not create adverse environmental impacts. Thus, it must be considered how it can best minimize the use of non-renewable energy sources, such as fossil fuels, in terms of its minting and distribution.

Retail CBDC risks being a hammer in search of nails.

Lastly, and perhaps most importantly, central banks need to ask themselves if a retail CBDC is the best tool to advance financial inclusion relative to other digital payment interventions. As shown in Table 3, CBDC can be used as a tool to lessen many of the barriers associated with financial inclusion. However, it is important to remember that the key feature of CBDC, making it distinct from other digital payment instruments, is that it is issued by the central bank. This feature in and of itself does not necessarily make CBDC a better tool relative to other digital payment interventions for tackling use case barriers. For example, interoperability and affordability are key design features for CBDC but this is also the case for all digital payment instruments. The introduction of CBDC will not in itself solve this. CBDC could offer another layer of complexity to models that need to be simple and efficient to contribute to financial inclusion while also further straining institutional capacity. This does not mean that central banks should shy away from it completely. Instead, they may want to clarify and define the unique value of a CBDC to financial inclusion in the existing digital payments landscape.

¹⁹⁵ Deloitte. 2020. Are Central Bank Digital Currencies (CBDCs) the money of tomorrow?. Luxembourg. MarCom. Available at: <https://www2.deloitte.com/content/dam/Deloitte/lu/Documents/financial-services/Banking/lu-are-central-bank-digital-currencies.pdf>

¹⁹⁶ Disparte, Dante A. 2021. The Risks of Central Bank Digital Currencies. Diplomatic Courier. Available at: <https://www.diplomaticcourier.com/posts/the-risks-of-central-bank-digital-currencies#:~:text=Cyber%20threats%20and%20single%20points,Winds%20and%20the%20Colonial%20gas>

7. KEY IMPERATIVES FOR CBDC AS A FINANCIAL INCLUSION TOOL



Section 5 highlights that retail CBDCs can offer the most value for the financially underserved or excluded populations in developing and emerging economies by improving convenience and affordability, reducing barriers to access, and enhancing existing payment systems.

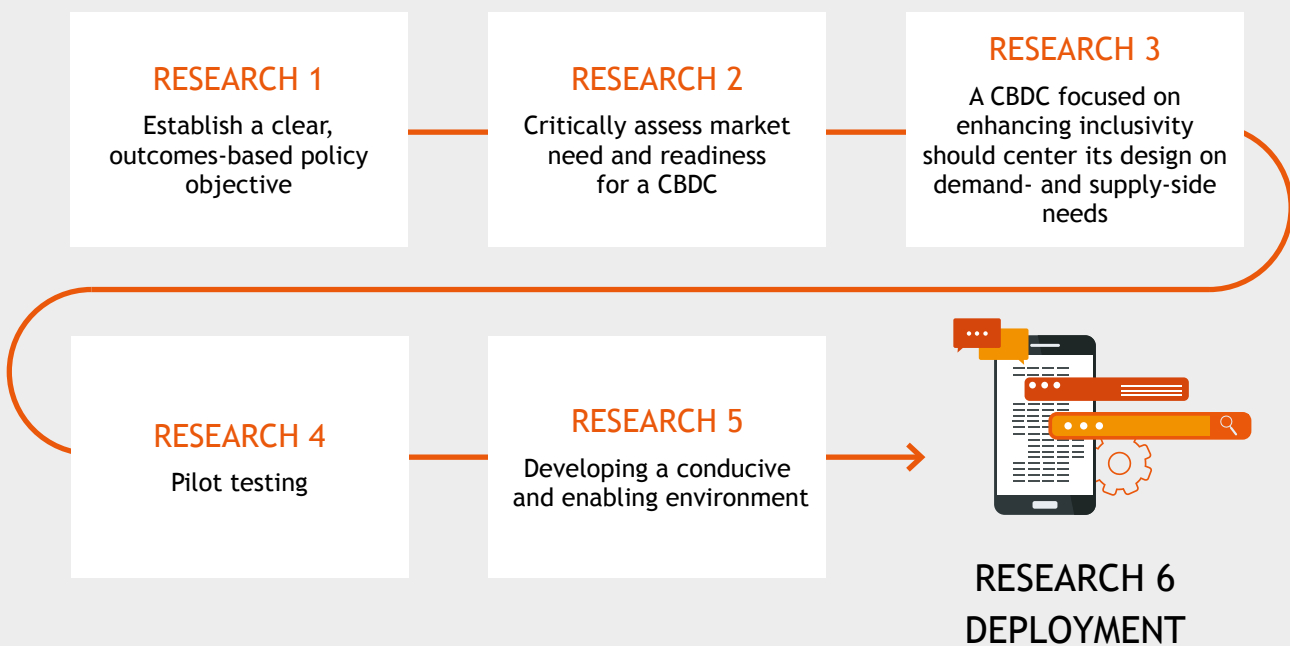
Yet, as shown in Section 6, this potential, does not come without risk or limitation, both of which could unintentionally exacerbate financial exclusion and destabilize economies. It is therefore the task of all central banks to critically assess whether CBDCs are

the most appropriate tool for their context, and, if pursued, to proactively design and tailor both its CBDC and enabling ecosystem to support financial inclusion outcomes.

This section aims to inform central bank decisions to pursue, and potentially deploy, a CBDC by unpacking the preconditions required to assess and ensure the worthiness of a CBDC along three broad stages inspired by the 2020 World Economic Forum CBDC Decision Flow Chart¹⁹⁷. These include:

1. **the Research stage** (initial exploratory analysis to identify motivation, value and contextual feasibility of CBDC including risks);
2. **the Design stage** (technological considerations to match CBDC goals with required design features/ capabilities), and
3. **the Implementation stage** (strategical steps to ensure a country's enabling environment is ready and capable of supporting successful adoption and scale if/when CBDC is deployed).

FIGURE 7: CBDC DECISION FLOW CHART



Source: Authors' own

7.1. PRECONDITIONS AT THE RESEARCH/ EXPLORATORY STAGE

7.1.1. ESTABLISH A CLEAR, OUTCOMES-BASED POLICY OBJECTIVE

The starting point for CBDC exploration is a legitimate motivation. Before embarking on a CBDC journey, a key starting point for all central banks must be the certainty of a clear need or motivation for it as a policy goal. According to the BIS, this motivation should be underpinned by three common foundational principles:

- 1) **do no harm:** assurance that a CBDC will not undermine a central bank's ability to ensure monetary and financial stability;
- 2) **coexistence:** a CBDC must not radically disrupt or displace any private monies or instruments that citizens express a need for, and
- 3) **innovation and efficiency:** the introduction of innovation must be balanced with the need to protect businesses and consumers from associated risks and unintended consequences.¹⁹⁸

In addition, as noted in the G20 principles for innovative financial inclusion, policy tools like a CBDC should expand meaningful access and usage of financial services^{199,200}. These principles imply that the decision to explore CBDC cannot be purely in response to growing competition from private sector innovations or the urge to participate in global hype cycles. Instead, the decision must stem from an observed legitimate need for CBDC within the market that the existing financial landscape cannot address.

Precise pain points and underserved segments must underpin financial inclusion policy objectives. Stakeholder consultations with technology providers and central banks reveal that the key to successful CBDC adoption is having a clear idea of what the problem or need is, and what the ideal outcome ought to look like. For developing and emerging economy central banks considering CBDC, this means that financial inclusion cannot be labelled as an objective *prima facie*, but rather drawn from a clear understanding of what the drivers of financial exclusion are, who the priority segments to target are, and an identification of the change required to overcome said drivers. With the three foundational BIS principles in mind, a crucial starting point and precondition for developing and emerging economies seeking to explore CBDC for financial inclusion is therefore to have a clear understanding of the rationale and goal. Defining this outcomes-based objective for financial inclusion is central to the whole framework for assessing, designing and implementing a CBDC as an appropriate tool, in

addition to monitoring its success, as illustrated in Figure 7.

7.1.2. CRITICALLY ASSESS MARKET NEED AND READINESS FOR A CBDC

Unmet financial needs must drive the value of, and motivation for, CBDC. The research stage is essential to identifying the need and relevance of a CBDC for a country given its financial inclusion status. In other words, determining what gaps the existing payment and financial landscape struggles to overcome to effectively serve the financial needs of people and businesses. As highlighted in Figure 7, this requires central banks to assess and understand the extent to which economic participants are already included in the formal financial sector, have access to and use existing digital payment services to satisfy payment use cases, and whether these services effectively and securely cater for all population segments including women, forcibly displaced persons, and the elderly, among other groups. From this analysis, the motivation to test CBDC must therefore stem from the existence of unmet consumer needs and an understanding of how CBDC would be uniquely positioned to best overcome the drivers of being excluded or underserved.

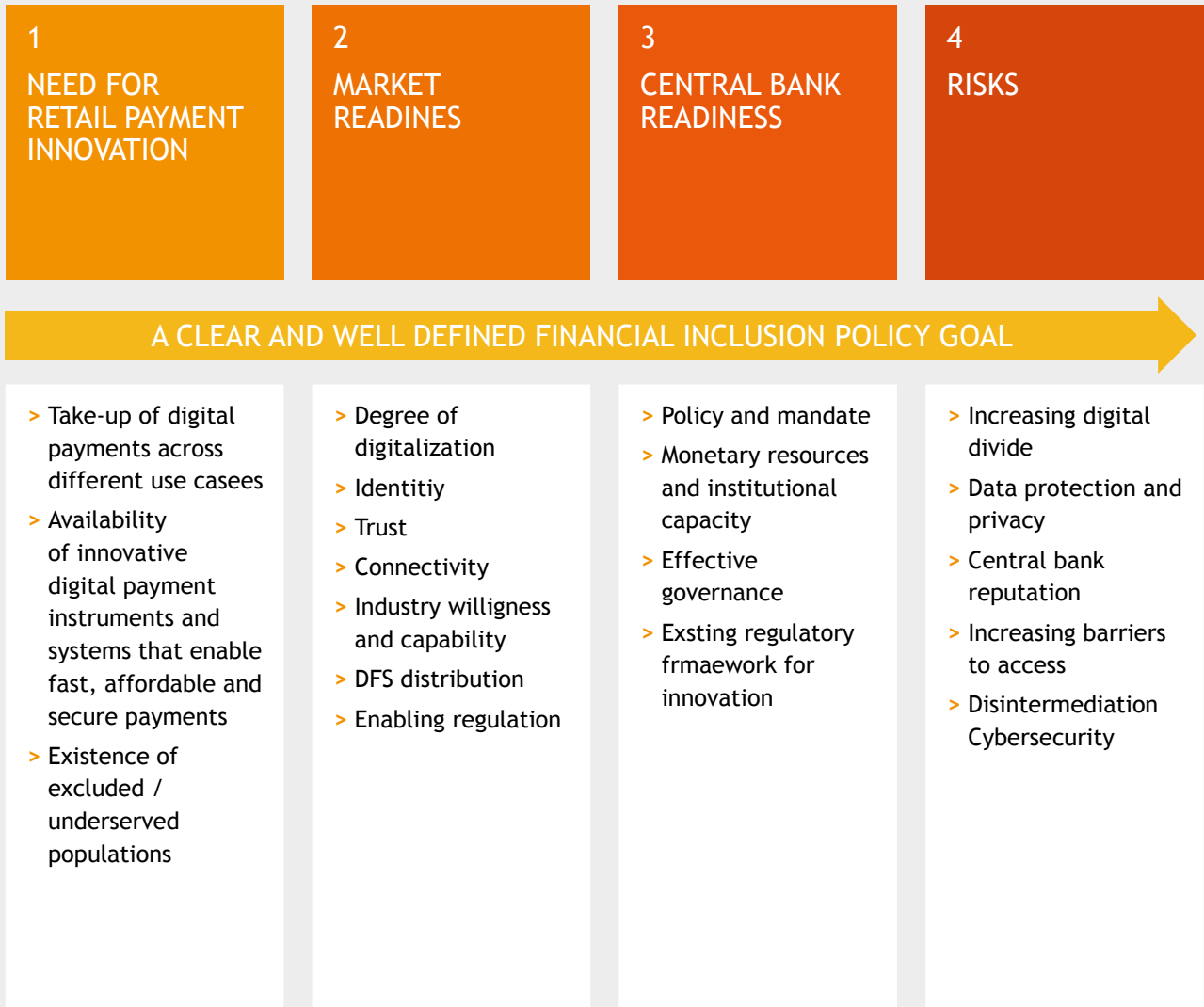
CBDC feasibility must be informed by market readiness and known risks. Beyond the needs assessment, the suitability of a CBDC to meet an economy's financial needs depends on the extent to which consumers - both people and businesses - are able and willing to engage with DFS. It also depends on the extent to which the market can accommodate it without incurring undue risks, as highlighted in Section 6. The upper right-hand quadrant of Figure 7 highlights four categories of considerations to evaluate and determine economic readiness for CBDC. These categories refer to the extent to which target population segments can (and want to) access and use DFS to meet their financial needs; whether existing DFS already meet financial needs; the degree to which structural factors like infrastructure can support the data and technological intensity of a CBDC; how

198 Bank of International Settlements. 2020. Central bank digital currencies: foundational principles and core features. Basel. Bank of International Settlements. Available at: <https://www.bis.org/publ/othp33.pdf>

199 Global Partnership for Financial Inclusion. n.d. G20 Principles for Innovative Financial Inclusion. Accessed 26 April, 2022. Available at: <https://www.gpfi.org/sites/gpfi/files/documents/G20%20Principles%20for%20Innovative%20Financial%20Inclusion%20-%20AFI%20brochure.pdf>

200 Principle 2 on diversity says emphasizes the sustainability of financial inclusion and the need to ensure that customers can access and use a variety of financial services, "Implement policy approaches that promote competition and provide market-based incentives for delivery of sustainable financial access and usage of a broad range of affordable services (savings, credit, payments and transfers, insurance) as well as a diversity of service providers."

FIGURE 8: FRAMEWORK TO ESTABLISH NEED FOR CBDC AS TOOL FOR FINANCIAL INCLUSION



supportive and capable PSPs are to catering for DFS such as CBDC, and whether market development orientated regulation is already in place to support the issuance of CBDC. The feasibility of a CBDC to address existing financial inclusion pain points relies on most, if not all, of these market readiness preconditions being in place before deciding on its suitability for a country, as well as an acknowledgement of the associated risks.

Box 1 illustrates the careful evaluation conducted by the Central Bank of the Bahamas to determine the suitability of CBDC for its particular context and respective financial inclusion goals.

Central bank resources and capacity essential to pursuing CBDC. Once the need and readiness of an economy for a CBDC are established, central banks finally need to critically evaluate whether they are capable and equipped to undertake the product innovation journey of CBDC. Central banks need to determine whether they are willing to allocate human and monetary resources to overseeing the recruitment of required talent, undergo the development and iterative product testing process, evaluate outcomes,

convene market stakeholders, and manage feedback processes with target population markets. These requirements would be over and above the existing responsibilities of central banks to supervise regulated entities on traditional compliance matters.²⁰¹ Central banks also need to ensure that they not only possess the required mandate for market development but also have a regulatory framework in place that is sufficiently enabling to innovation while balancing risk management.

IN SUMMARY

The culmination of considerations at the research stage for a CBDC is the go/no-go decision point for central banks regarding whether to pursue CBDC as a viable, fit-for-purpose tool. Figure 8 outlines the key roles and responsibilities of central banks and partners in informing this decision. Where CBDC does not emerge as a relevant option for a country, due to the nature of financial inclusion needs or the readiness of the ecosystem to support it, moving to the design stage may not be advisable.

BOX 1: CENTRAL BANK OF THE BAHAMAS SAND DOLLAR PROJECT

In August 2018, the Central Bank of the Bahamas (CBOB) launched Project Sand Dollar as part of the Bahamian Payments Modernisation Initiative that has been ongoing since the early 2000s. In March 2019, NZIA Limited was selected by the CBOB as the Sand Dollar technology implementation partner.



The primary objective of Project Sand Dollar has been to enhance access to financial services and facilitate improved outcomes for financial inclusion in the Bahamas. Within this broad policy goal, however, the Central Bank of Bahamas undertook an exercise to pinpoint the exact drivers of exclusion among its citizens and businesses. These drivers included:

- > a highly dispersed population characterized by sparsely populated areas prone to lacking access to physical

financial institutions, as well as reliable internet connectivity

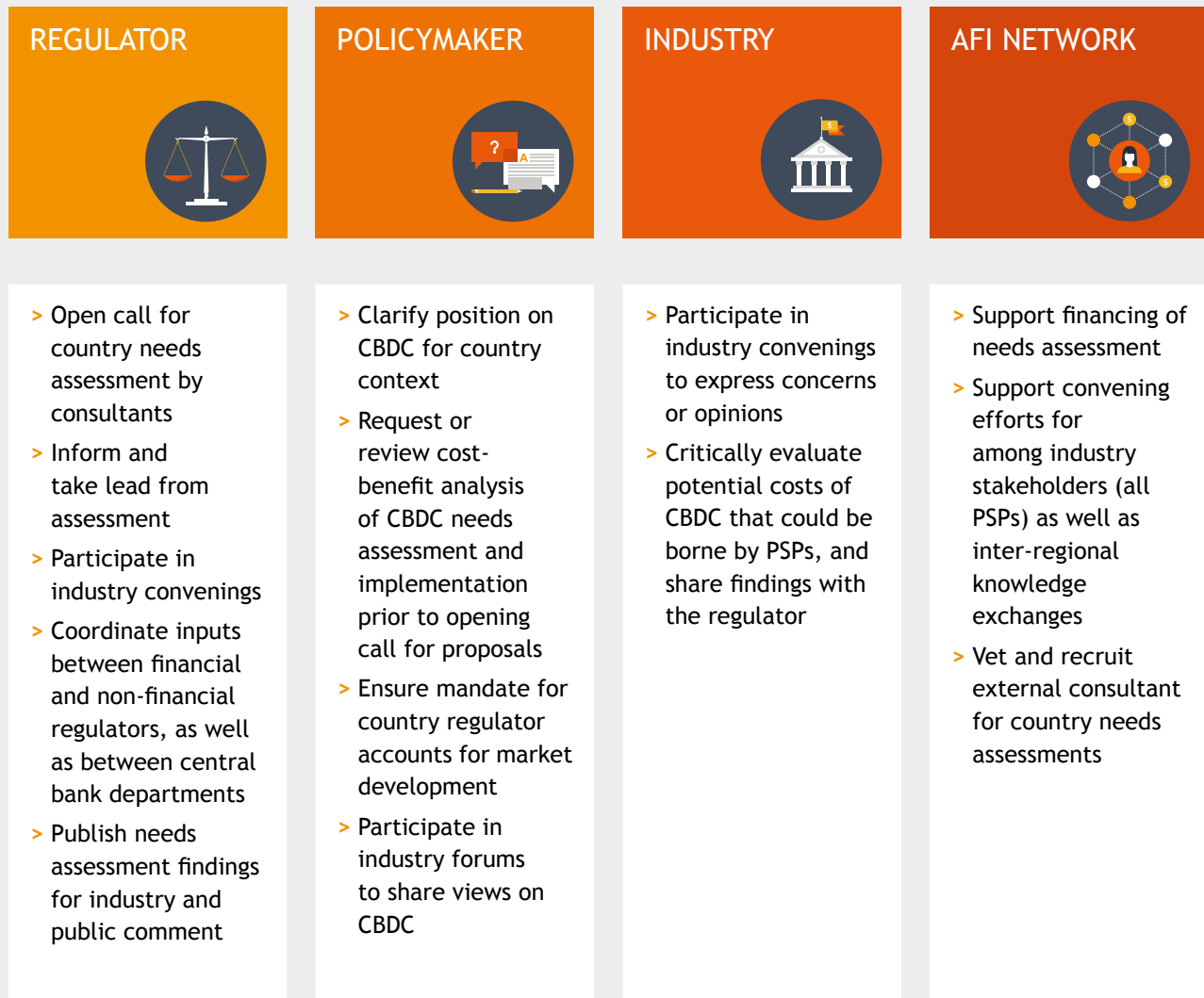
- > stringent CDD and KYC requirements due to strict international regulatory standards translate into:-
 - weak merchant digitalization due to perceived high electronic transactions costs.
 - low awareness and understanding of financial products

Against this backdrop, the CBOB, together with its partners, initiated work to develop a retail CBDC, the Sand Dollar. Unlike the current banking system, the Sand Dollar is proposed as a DLT-based currency that can exist offline. As a currency solely minted and backed by the CBOB, CBDC was also deemed best placed to engender public trust in financial services. As it is digital and programmable by nature, there is also a proposal for the Sand Dollar to be tailored for identity and cost constraints.

Source: Project Sand Dollar: A Bahamas Payments System Modernisation Initiative (2019) Central Bank of Bahamas. 2019. Project Sanddollar: A Bahamian Payments Systems Modernization Initiative. Central Bank of Bahamas. December 24, 2019. Available at: <https://www.centralbankbahamas.com/viewPDF/documents/2019-12-25-02-18-11-Project-Sanddollar.pdf>

201 Sonderberg, Gabriel, Marianne Bechara, Wouter Bossu, Natasha X Che, Sonja Davidovic, John Kiff, Inutu Lukonga, Tommaso Mancini Griffoli, Tao Sun, and Akihiro Yoshinaga. 2022. Behind the Scenes of Central Bank Digital Currency: Emerging Trends, Insights, and Policy Lessons. International Monetary Fund. Washington DC. International Monetary Fund (IMF). Available at: <https://www.imf.org/en/Publications/fintech-notes/Issues/2022/02/07/Behind-the-Scenes-of-Central-Bank-Digital-Currency-512174>

FIGURE 9: ROLES AND RESPONSIBILITIES FOR KEY ACTORS DURING THE CBDC RESEARCH STAGE



7.2. DESIGN STAGE PRECONDITIONS

Ensure a consumer-centric design that adapts to unserved and underserved contexts. The design stage for a CBDC is critical to ensuring that it is tailored to be as context-specific and fit-for-purpose as possible to achieve desired financial inclusion goals. Doing so, through collaboration between the central bank, local industry and the technical provider, will require taking stock of the existing barriers or pain points to given financial inclusion goals, and matching those with appropriate design features that can ameliorate them. In designing a CBDC however, while considering clear use cases may be a key starting point, its design should ultimately work to ensure its effective circulation and distribution throughout the economy. As noted in Section 4, effective circulation and distribution are key to ensuring that CBDC can reach the most excluded and underserved populations, similar to cash.

This for instance includes ensuring that vulnerable groups such as women and women owned MSMEs are sufficiently considered in the interface and design of CBDC e.g. ensuring USSD is able to interface with CBDC.²⁰²

This includes having sufficient consumer research that is gender disaggregated to better understand the unique needs of women.

Key design principles for CBDC. Below are some of the key design principles that can anchor the choices central banks make to align financial inclusion and broader CBDC motivations:

1. **Inclusiveness.** A key defining feature of CBDC is that it is issued and backed by the central bank. Unlike commercial instruments, CBDC's intent, and therefore design and implementation, must be to be accessible and available to all adults, including the most vulnerable. This includes reducing barriers to access and affordability. To achieve this, central banks and their technical partners must ensure that, firstly, a retail CBDC is designed to accommodate those without either a foundational identity (through the creation of digital identity proxies via the CBDC) or higher-order requirements such as proof of identity (through tiered CBDC wallets). Furthermore, CBDC access cannot rely solely on mobile phones but rather on an array of devices such as smart cards or wristbands and should be capable of facilitating offline consecutive payments using Bluetooth or NFC technology. CBDC should also therefore always be available as a means of

payment for end users 24/7/365. These design features should notably be influenced and guided by specific considerations for those potential users with cognitive, motor, or sensory impairments.²⁰³

2. **Interoperability.** A key defining feature of cash is that it is fully accepted anywhere. This convenience should be mimicked by CBDC for it to truly be a digital representation of cash, and contribute to financial inclusion. This includes the ability to leverage CBDC for a broad range of payment use cases, and through any provider, channel or scheme.
3. **Instantaneous 24/7.** CBDC should be designed in a way that reduces friction for users. A key driver of this for individuals and merchants is that their payments are settled instantly so when they make or receive a payment it is instantly reflected in their wallet or account, and they don't have to worry about where their money is.
4. **Scalable.** CBDC needs to be scalable in two ways. Firstly, unless CBDC is designed to accommodate and leverage existing payment ecosystems that consumers and businesses are already familiar with, CBDC will fail to obtain buy-in and sustainable usage. Incentives to adopt CBDC will also be hampered if it cannot accommodate the potential for large transactions volumes across an economy, as well as expand to reach more population segments and facilitate future payment use cases.²⁰⁴ These requirements imply a CBDC design that leverages a highly stable distribution architecture; enables industry PSPs to plug into CBDC platforms or APIs to ensure CBDC runs through existing and familiar payment rails, and accommodates fair participation of all PSPs that can support secure payments to underserved populations. Secondly, CBDC should be designed for agility to future-proof it ahead of new CBDC demands, such as cross-border payments, and to ensure its robustness to potential risk, demands or innovations.

202 Financial Services. 7 April. Accessed 22 April 2022. Available at: <https://nextbillion.net/ussd-smartphones-women-financial-services/>


203 Bank of International Settlements. 2020. Central bank digital currencies: foundational principles and core features. Basel. Bank of International Settlements. Available at: <https://www.bis.org/publ/othp33.pdf>

204 Bank of International Settlements. 2020. Central bank digital currencies: foundational principles and core features. Basel. Bank of International Settlements. Available at: <https://www.bis.org/publ/othp33.pdf>

5. **Secure.** CBC should be designed in a way that increases trust. Users must know that their money is secure and that the data and information associated with that digital money will not be misused or abused. A financial inclusion driven-CBDC, therefore, needs to be extremely resistant to cyber-attacks and other threats such as fraud or counterfeiting; enable a high level of traceability; foster resilience to operational failure and disruptions, such as natural disasters, electrical outages and other issues, and embedded with stringent data privacy protocols to avoid manipulation (and invasions of privacy) by any public or private entity.²⁰⁵
6. **Utility:** CBDC needs to be designed to not only complement cash, but to eventually drive sufficient utility for users to incentivize switching to formal digital channels. This implies designing CBDC with additional value-added functionality for key population segments and use cases. An example is programming CBDC to enable easier tax compliance for SMEs or to enable CBDC transactions to act as collateral for credit.



These design principles can be the basis for CBDC to address financial inclusion pain points across access barriers, effective usage barriers, and scalability.

TABLE 4: KEY CBDC DESIGN ELEMENTS FOR FINANCIAL INCLUSION

MARKET BARRIER	BARRIER SUB-CATEGORY	NEED	REQUIRED DESIGN CONSIDERATIONS
DEMAND 	Access	Identification	<ul style="list-style-type: none"> > In the absence of any formal identity: enable CBDC to create and act as de facto digital proxy identifiers > In the absence of higher-order identity documentation: tiered CBDC wallets with variable KYC requirements, proportional to consumer risks
		Device access	<ul style="list-style-type: none"> > Compatibility with all devices > CBDC for stored value cards and custom devices fitted with near field communications (NFC) such as smartcards or wristbands > Cryptography/thin SIM/STK or CBDC/e-money exchanges to accommodate feature phones on unsecure USSD channels
		Online and offline 24/7/365 availability	<ul style="list-style-type: none"> > Leverage NFC and Bluetooth technology for offline payments (applying predetermined thresholds for risk mitigation) > Offline consecutive payments between wallets i.e. value bearing digital instruments and protocols that guarantee transfer at wallet level avoiding quality of service issues > No dependency on airtime or mobile data
	Effective usage	Interoperability-driven convenience	<ul style="list-style-type: none"> > Accommodate and leverage the common data standards ISO 20022 > Open APIs to platform business models, PSPs and third-party intermediaries for channel ubiquity > Device interoperability across ATMs, POS devices and NFC terminals, irrespective of provider > Embed with standardized mechanisms to make inter-account transactions
		Speed	<ul style="list-style-type: none"> > Utilize architecture capable of high transaction velocity > Hook into existing real-time (RT) capabilities of PSP or e-money schemes
		Affordability	<ul style="list-style-type: none"> > Leverage architecture capable of facilitating volumes that can drive marginal costs to extremely low levels > Limit data intensiveness of CBDC through zero rating data costs for the CBDC mobile application

Source: Authors' own adapted from BIS (2020)

TABLE 4: KEY CBDC DESIGN ELEMENTS FOR FINANCIAL INCLUSION

MARKET BARRIER	BARRIER SUB-CATEGORY	NEED	REQUIRED DESIGN CONSIDERATIONS
DEMAND 	Effective usage	Trust and security	<ul style="list-style-type: none"> > Strong fit-for-purpose controls for RT fraud and theft detection and mitigation > Traceability of transactions e.g. wallet audit trail and recourse process to recover locked value > Fungibility > Strong fit-for-purpose controls for RT fraud and theft detection and mitigation, traceability of transactions, fungibility > Application of mature cryptographic techniques flexible enough to be used across centralized or distributed ledgers > Embed key governance protocols to avoid tampering and uphold data privacy regulations
		Value addition	<ul style="list-style-type: none"> > Program added value (e.g. automated tax management)
SUPPLY 	Scale	Network interoperability	<ul style="list-style-type: none"> > Hook into open APIs for PSP plug-and-play > Single secure legal tender instrument enabling RT payments to secure many-to-many network-routing transactions without traditional exchanges at the provider or financial services intermediary levels > Wallet and instrument protocols to enable some wallets within a wallet risk class structure to operate in legal entity consolidation structures for large merchant and financial institutions
		Fair and equal access	Open API to non-PSPs if capable of reaching scale among hard-to-reach populations e.g. e-money schemes
		Future-proof	Capacity to be iterated on through agile protocol and cryptography

Box 2 highlights the Bank of Ghana as a key case study of a central bank already tailoring its CBDC design through a needs lens.

Acknowledge and manage trade-offs. Pursuing CBDC for financial inclusion or any policy goal unfortunately comes with trade-offs between fundamental considerations and drivers of uptake. These trade-offs can include a desire for consumer privacy but also a high degree of traceability to mitigate fraud, or between unidentifiable populations to have CBDC access but only with limited functionality. Furthermore, putting in additional functionality and value-added services to cater for various use cases might reduce the speed and quality of service, which in turn could undermine trust and uptake.

Enabling offline capabilities through basic systems such as USSD or even wristbands could require additional security safeguards that may reduce their appeal to the underserved or unregistered. Within the context of developing and emerging economies, where risks of financial instability and exclusion may be heightened, central banks and ecosystem partners will need to think critically about how to proactively manage these trade-offs and communicate them without undermining its possibility of adoption and scale. Figure 9 outlines key guidance that central banks and their partners can consider to inform and manage these trade-offs in the CBDC Design stage.

BOX 2: BANK OF GHANA

In 2019, the Bank of Ghana (BOG), as part of the implementation of its Digital Financial Services Policy,²⁰⁶ announced its intention to pilot a Ghanaian CBDC - the eCedi.



In 2021, the BOG began its exploration, design and testing of the eCedi. The core objective of the eCedi is to cultivate an efficient and financially inclusive payment ecosystem in Ghana. According to the eCedi design paper, the key challenges that the eCedi is expected to address are:

- > Weak electricity access (approximately 50 percent of the Ghanaian population) and low internet penetration, particularly among rural communities.
- > Many Ghanaian citizens do not have a smartphone or a bank account.
- > Existing limitations of mobile money infrastructure (MMI) such as high mobile money transaction fees and use of a deferred net settlement system that limits real-time payments.

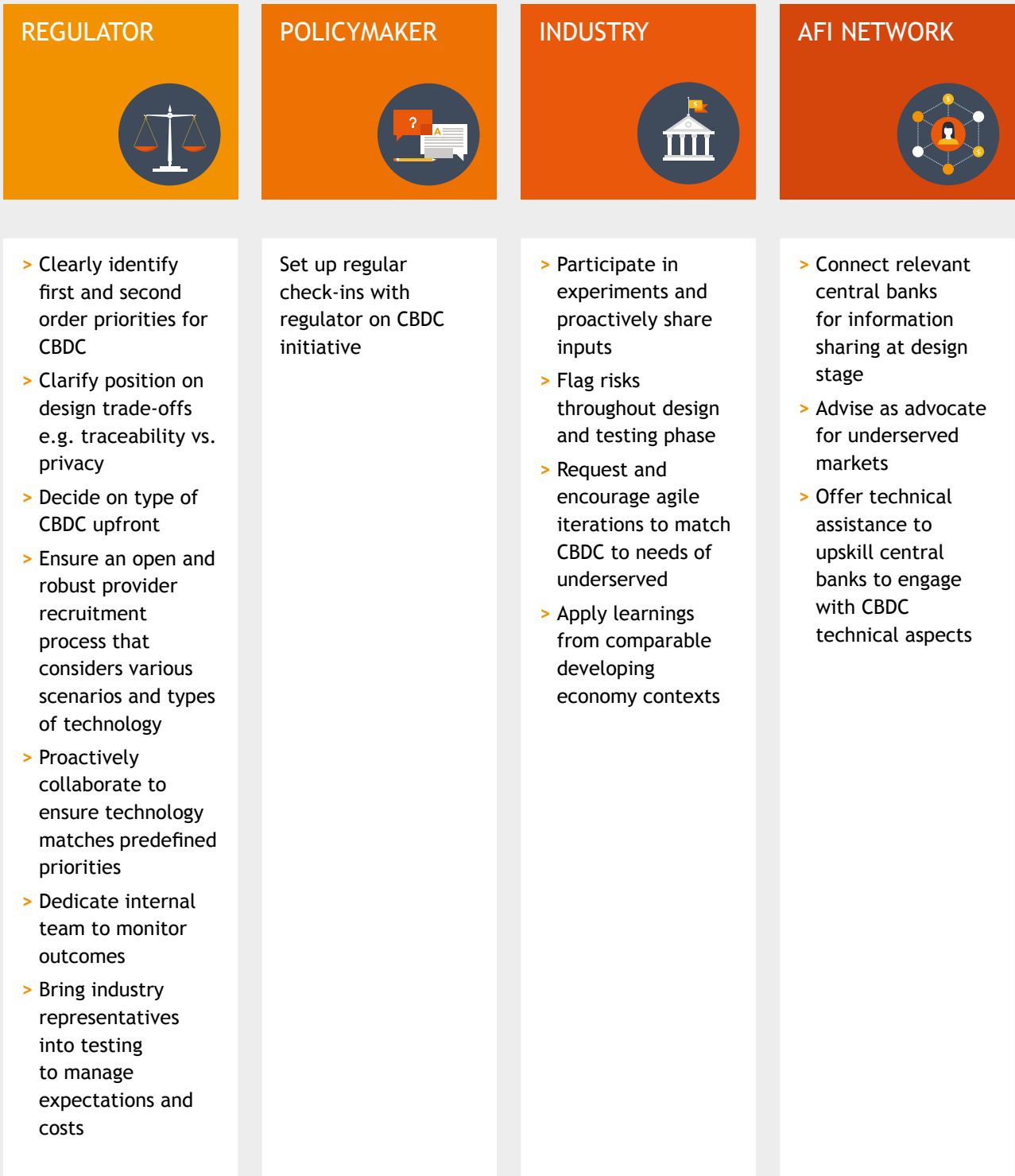
The design of the proposed eCedi is directly informed by these challenges. The proposed design is a retail, token-based CBDC. This implies that an eCedi represents a token or a digital value note, and payment is done by transferring this value note from one person to another. This concept is very similar to cash payment transactions.

The BOG has designed two types of wallets for the eCedi to facilitate both online and offline environments, namely: hosted wallets and hardware wallets. Hosted wallets are server-based storage systems that are managed by financial institutions and require access to the internet, whereas hardware wallets are secure portable storage devices that can work in offline mode. Given that not all Ghanaians own a smartphone, the hardware wallet will be able to be used on a number of other devices, including smart cards and key fobs.

Unlike mobile money transfers, eCedi transactions will be free of any additional costs and have a near-instant transfer of funds. Standard interfaces like NFC or Bluetooth will facilitate offline payments and enable instantaneous settlement without accessing a backend system. By effectively addressing the limitations of the existing mobile money system, the eCedi will be able to broaden access to financial services and boost financial inclusion.

Source: Bank of Ghana. 2022. Design Paper of the digital Cedi (eCedi). Accra. Bank of Ghana. Accessed 25 March, 2022. <https://www.bog.gov.gh/wp-content/uploads/2022/03/eCedi-Design-Paper.pdf>; Sundararajan, Sujha. 2022. Ghana deploys hardware wallets for CBDC - eCedi. FXEMPIRE. <https://www.fxempire.com/news/article/ghana-deploys-hardware-wallets-for-cbdc-ecedi-937961>

FIGURE 10: KEY ROLES AND RESPONSIBILITIES FOR ACTORS IN THE CBDC DESIGN STAGE



7.3. IMPLEMENTATION STAGE

CBDC roll-out that prioritizes the excluded and underserved. Similar to the CBDC decision flow charts created by the IMF²⁰⁷ and WEF²⁰⁸, the next key stage for central banks pursuing a CBDC is piloting and implementation. For the developing and emerging economy context, however, a nuanced approach should be taken to ensure that is CBDC rolled out safely and securely, and also succeeds indirectly in overcoming financial inclusion barriers. This approach can be broken down into three sequential phases:

1. pilot testing
2. ensuring a conducive and enabling environment
3. deployment

7.3.1. PILOT TESTING

Experimentation through iteration and priority segment testing. While advanced or developed markets may be immediately ready for a payment innovation like a CBDC, developing and emerging economies often need to account for more complex ecosystems characterized by various access and usage constraints. Therefore, gradual and staggered testing should be undertaken with the approved CBDC design against predefined financial inclusion outcomes, among others. These tests should take into account the priority underserved populations that CBDC is meant to cater for, and the need to manage risks noted in Section 5.2

Monitor customer journeys of the underserved specifically. While it is important to test the accessibility and useability of CBDC among the general population, developing and emerging economies should aim to test among key priority segments such as women, rural households and SMEs and use the data collected and analysis conducted to inform decisions and iterations. This approach should be agile and flexible, and adjusted based on testing, feedback and new research. For user-facing components, it should involve user input, testing and interviews to inform effective user interface (UI) and user experience (UX), taking a “user-centric” approach where possible.²⁰⁹ Critically, these tests should also be performed using various potential devices, including but not limited to, smartphones, feature phones, NFC cards and wristbands, among distinct population segments.

7.3.2. DEVELOPING A CONDUCTIVE AND ENABLING ENVIRONMENT

Address key ecosystem prerequisites for CBDC success. In many instances, developing and emerging economies will need to introduce or tailor ecosystem drivers to ensure regulatory frameworks, infrastructure,

and industry players work to support rather than impede CBDC penetration. These preconditions for CBDC success include:

- > **Regulatory prerequisites:** Central banks will need to review, and if needed, amend their central banking laws to enable the issuance of CBDCs. In addition, central banks need to lead the development, enforcement, and revision of adequate data; consumer privacy and cybersecurity regulation, and revision of competition regulation to account for fair competition between PSPs using CBDC, ensuring or revising monetary regulation so that CBDC meets legal tender definitions. This includes revising AML-CFT regulations to account for the speed and frequency of CBDC transactions, as well as CBDC wallet design considerations.²¹⁰ Over and above these regulatory considerations, central banks will need to critically evaluate their current approaches to balancing innovation while ensuring the safety of the financial system. This may require the adoption of test-and-learn approaches, or a more principles-based approach.
- > **Infrastructure prerequisites:** Although CBDCs in developing and emerging economy contexts will need to adapt to specific contextual realities, public sector authorities will need to embark on efforts to improve structural infrastructure to ensure their ability cater for the evolving payment and CBDC needs of consumers. This implies efforts to enhance access to reliable electricity, increase the affordability of mobile devices and mobile internet data packages, and ensure that public sector identification databases are not only accessible to CBDCs but are harmonized, and allow for robust digital identity proxy stacks to be created via CBDC.²¹¹

207 International Monetary Fund (IMF). 2020. A Survey of Research on Retail Central Bank Digital Currency. Washington DC. IMF, Available at: <https://www.imf.org/en/Publications/WP/Issues/2020/06/26/A-Survey-of-Research-on-Retail-Central-Bank-Digital-Currency-49517>

208 Centre for the Fourth Industrial Revolution. 2020. Central Bank Digital Currency Policy-maker toolkit. Geneva. The World Economic Forum (WEF) Available at: https://www3.weforum.org/docs/WEF_CBDC_Policymaker_Toolkit.pdf

209 Centre for the Fourth Industrial Revolution. 2020. Central Bank Digital Currency Policy-maker toolkit. Geneva. The World Economic Forum (WEF) Available at: https://www3.weforum.org/docs/WEF_CBDC_Policymaker_Toolkit.pdf

210 Cooper, Barry, Antonia Esser, and Michaela Allen. 2019. The use cases of central bank digital currency for financial inclusion: A case for mobile money. Cape Town. Centre for Financial Regulation and Inclusion (Cenfri). Available at: https://cenfri.org/wp-content/uploads/2019/06/CBDC-and-financial-inclusion_A-case-for-mobile-money.pdf

211 Cooper, Barry, Laura Munoz Perez, Antonia Esser, Michaela Allen, Nolwazi Hlophe, and Matthew Ferreira. 2019. ID proxy initiatives across the globe: An analysis. Cape Town. Centre for Financial Regulation and Inclusion (Cenfri) Available at: <https://cenfri.org/publications/an-analysis-of-id-proxy-initiatives-across-the-globe/>

- > **Policy prerequisites:** the success of a CBDC, in part, needs to be backed and supported by the policymaker in addition to the regulator. This implies the development of DFS policy that accounts for and supports CBDC, as well as emboldens the central bank to undertake CBDC initiatives. It is also essential that the policymaker develops or clarifies laws that balance consumer privacy with AML-CFT concerns, in addition to protecting consumer CBDC funds from misuse by government agencies or members of law enforcement. To bolster faith and trust in the central bank, as the likely issuer of CBDC, policymakers will also have a key role to play in supervising the central bank to ensure it operates in good faith. The policymaker will also need to clarify the approach to CBDC, and if considered a cash-like complement or substitute, adopt an appropriate tax policy towards it.
- > **Industry player prerequisites:** industry buy-in for the value and relevance of CBDC will be crucial to not only obtaining scale but also incentivizing uptake among users already using digital payment systems. This buy-in would need to take place during the research stage initially, but again during the implementation stage to confirm the parameters of CBDC, how channel ubiquity will be fostered and who will pay the costs of distributing devices to users as well as facilitating transactions. The consent of industry players on proposed business models and product pricing agreements that ensure CBDC cost savings are passed to consumers will also be required during the research and implementation stage.
- > **Central bank institutional prerequisites.** the design and implementation of DFS is usually conducted by formal FSPs. In the case of CBDC, the central bank will have to go through a similar procedure as incumbent providers in developing and testing financial service products with consumers. Central banks will have to go through these steps with the support of technology providers and distribute its product through PSPs. This will be a resource-intensive exercise which will require continuous appraisal and review of resources and capabilities to ensure that a well-designed and implemented final product becomes accessible to the masses.

7.3.3. DEPLOYMENT

Launch omni-channel communication campaign with sufficient lead time to support CBDC acceptance.

Broad and detailed public engagement is crucial to the successful adoption of a CBDC among consumers and businesses, particularly among those prone to mistrust of DFS and the formal financial sector.

To target all prioritized underserved segments, central banks and relevant partners must commit to an omni-channel communication campaign aimed at creating positive awareness of CBDC and educating population segments on its value proposition.

This campaign should ideally have at least a six months to a year lead time on the deployment of CBDC such that sufficient trust, knowledge and awareness are fostered to support adoption. During this time, the central bank should work with industry players to release education and informational programmes aimed at communicating the advantages and risks related to the CBDCs, password or key management, and teaching the safe use of passwords and private keys.²¹²

Dedicate central bank resources to oversee implementation. As with any financial system, central banks will need sufficient monetary and human resources to effectively supervise market players in distributing CBDC and ensuring regulatory compliance. This task may require dedicated units or departments to be created, guidelines developed to specify CBDC oversight mandates, as well as new Key Performance Indicators (KPIs) proposed for new compliance teams. This step will be crucial to ensuring that central bank staff are incentivized to rigorously monitor the outcomes of CBDC and to hold distribution partners accountable where financial inclusion goals are not being achieved.

²¹² Centre for the Fourth Industrial Revolution. 2020. Central Bank Digital Currency Policy-maker toolkit. Geneva. The World Economic Forum (WEF) Available at: https://www3.weforum.org/docs/WEF_CBDC_Policymaker_Toolkit.pdf

BOX 3: PEOPLE'S BANK OF CHINA

In 2014, the People's Bank of China (PBOC) set up a task force to investigate the international experience surrounding CBDC and its applicability in China.



Two years later, in 2016, the PBOC set up the Digital Currency Institute of the People's Bank of China (PBCDCI). The PBCDCI developed an initial prototype of the Chinese CBDC, which would be called the e-CNY.

The PBOC began working with commercial institutions to further develop and test the e-CNY in late 2017. Once the top-level design, function development, and systems testing were mostly completed, the PBOC began the pilot phase of the CBDC initiative.

The pilot phase was initiated to test whether the designed e-CNY would effectively address challenges relating to high levels of rural financial exclusion and the prevalence of e-money relative to the yuan. This phase can be split into the following stages:

- > 2019: the PBCDCI, in partnership with technology firms, local authorities, and private agents, launch pilots in a number of cities, starting with Shenzhen, Suzhou, Xiong'an and Chengdu.
- > November 2020: four additional cities were added to assess and verify the application of the digital currency in different regions of China. The trials in each city tested both core technologies and supplementary features, such as identification, offline payments, and programmability.

- > Early 2021: the PBOC expanded the e-CNY operating institutions to include a joint-stock bank - China Merchants Bank, as well two private banks - WeBank and MyBank, in addition to the six state-owned banks of China.
- > End of 2021: over 260 million e-CNY accounts are held across 10 different regions.
- > January 2022: In response to positive trial results, the PBCDCI recruited WeChat and Alipay, as well as the e-commerce giant, JD.com, as pilot-testing partners. By doing so, the PBCDCI aimed to leverage the existing dominance of these platforms to broaden the reach of the e-CNY.
- > February 2022: The e-CNY made its international debut to global users by introducing it at the Winter Olympic Games venues in Beijing and Zhangjiakou.

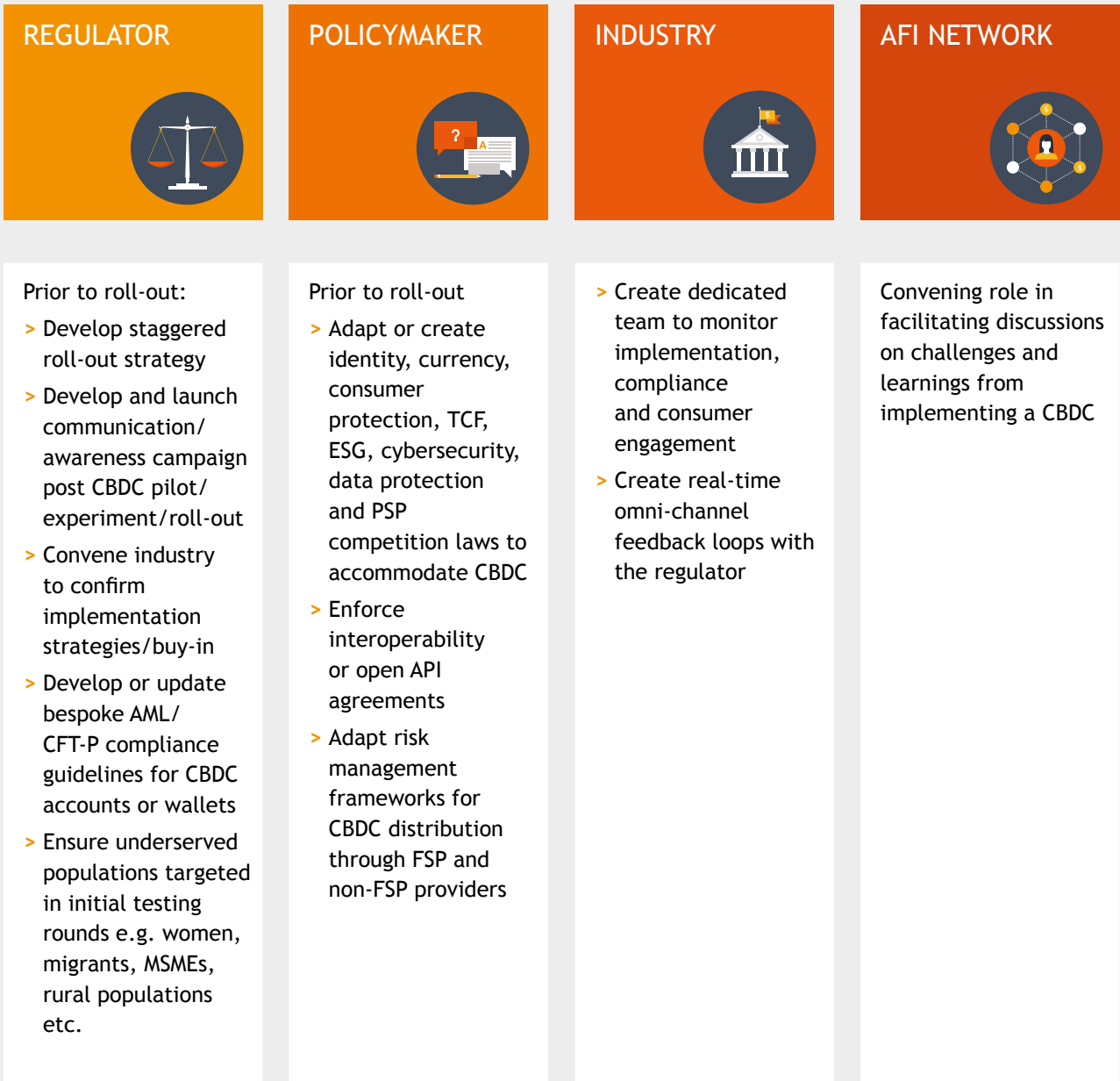
The pilot phase launched by the PBOC and the PBCDCI was strategic and logical. The implementation of trials in a variety of regions, in partnership with local authorities, commercial banks and other service providers, simultaneously tested the applicability and efficiency of the CBDC in different areas and fostered trust amongst a large number of businesses and individuals. Furthermore, partnering with large players in the e-commerce and payments industry allowed the PBCDCI to leverage an existing customer base and promote consumer confidence in the CBDC system. Ultimately, this enabled the PBCDCI to deepen the reach and adoption of the e-CNY.

Source: China is pushing for broader use of its digital currency (2022); China has given away millions in its digital yuan trials. This is how it works (2021), Progress of Research and Development of e-CNY in China (2021); China to Expand Scope of e-CNY Pilot (2022)

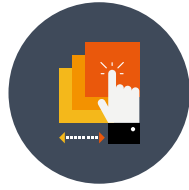
Launch CBDC using familiar and trusted payment rails. With awareness sufficiently raised, and the readiness of the central bank developed, a key next step for CBDC deployment will be to pilot using existing payment rails. This will boost consumer confidence by using trusted platforms and encourage the initial scale desired. Box 3 provides a case study on the implementation strategy leveraged by the People's Bank of China as an example of using well-established digital platforms to deepen CBDC reach and adoption.

Publicize CBDC implementation plan, drivers and desired outcomes. Trust in the intentions of a central bank issuing CBDC can be bolstered by ensuring its design and outcomes-based implementation plan is transparent and open to public opinion. This implies that, before or alongside the launch, central banks should aim to share the details of their CBDC design, the timeline of deployment, the desired objective, and the monitoring strategy with the public. The cooperation of market players such as the policymaker and industry, with the assistance of development partners, can help to ensure the smooth facilitation of this process. Figure 10 highlights these potential roles.

FIGURE 11: ROLES AND RESPONSIBILITIES FOR MARKET PLAYERS IN THE IMPLEMENTATION STAGE



8. CONCLUDING REMARKS



The link between CBDC and financial inclusion is not obvious. For years, central banks across the developing world have widely touted financial inclusion as a primary and dominant policy objective for pursuing a CBDC. This has been evident from its identification as a primary motivation in BIS central bank CBDC surveys to DFS working group discussions within the AFI network.

Yet while this belief appears to have been widely subscribed to, key questions remain, and evidence gaps persist around whether CBDC is the right intervention to overcome barriers to financial inclusion. This evidence gap is particularly relevant in developing and emerging economies where digital poverty is often a critical constraint to engaging in DFS.²¹³ Without this evidence, it is unclear where CBDC could truly meet the financial needs of citizens or simply reinforce existing drivers of exclusion among vulnerable populations such as the elderly, rural households, MSMEs, forcibly displaced persons, and women (among others).

This special report uncovered the true financial inclusion potential of CBDC for AFI members.

Considering the uncertainty around how CBDC could be used as a tool for financial inclusion, the objective of this AFI special report has been to investigate the extent to which retail CBDC can truly accelerate financial inclusion in the developing and emerging economy context and for key vulnerable populations. A use case approach was applied to interrogate this potential by evaluating if and how CBDC could alleviate access and usage barriers within three financial inclusion use cases that have yet to be fully digitalized or made inclusive to all citizens in the developing world. These use cases include P2P, P2B, and G2P.

The study reveals that while CBDC can address some access barriers, it cannot meet all. The greatest contribution of CBDC to financial inclusion in developing and emerging economies is likely to be in its ability to foster consumer demand through enhanced convenience, affordability and security. CBDC is not a silver bullet for financial inclusion, however, as it

potentially threatens to exacerbate existing inequalities through its digital nature. Therefore, while CBDC may not be suitable for all developing and emerging country contexts, if driven by a clear and achievable goal and designed to be fit for purpose, it could have the potential to enhance the financial lives of millions.

Table 5 provides a regional lens as a starting point for AFI members to explore the readiness and appropriateness of a CBDC for their jurisdiction, as well as to evaluate the type of CBDC that could be best suited to match levels of CBDC readiness. It provides a high-level overview of:

1. the DFS landscape of different regions across the developing world,
2. the DFS ecosystem in place to enable innovation, and
3. context-specific priorities for the design of a CBDC for central banks considering it as an instrument to address financial inclusion barriers.

²¹³ United Nations Conference on Trade and Development (UNCTAD). 2019. Digital poverty needs to be a development priority. Geneva. UNCTAD. 3 April 2019. Available at: <https://unctad.org/news/digital-poverty-needs-be-development-priority>

TABLE 5: FEASIBILITY OVERVIEW FOR DEVELOPING AND EMERGING COUNTRIES BY REGION

CRITERIA	ENABLING ENVIRONMENT PRIORITIES		CBDC DESIGN PRIORITIES
CRITERIA	DEMAND	INFRASTRUCTURE	SUPPLY
EAST AND SOUTH EAST ASIA	70 percent penetration 42 percent used digital payments for P2P, 21 percent used digital payments for G2P Literate: 95.9 percent	Electricity: 98.14 percent Mobile phone: 78 percent Smartphone penetration: 67 percent Access to 3G: 97 percent Internet: 60 percent Electricity: 98.14 percent Internet ²¹⁴ : 70 percent	Instant payments available in at least half of region Commercial bank branches (per 100,000 adults): 10.66 ATMs (per 100,000 adults): 56.24
LATIN AMERICA	53 percent penetration, 25 percent used digital payments for P2P, 10 percent used digital payments for G2P Literate: 94.9 percent	Electricity: 98.27 percent Mobile phone: 68 percent Smartphone penetration: 69 percent Access to 3G: 94 percent Internet: 54 percent Mobile phone: 69 percent Internet: 68 percent (rural 37 percent, urban 71 percent)	Instant payments not available in more than of region. Interoperability is a challenge. Commercial bank branches (per 100,000 adults): 13.25 ATMs (per 100,000 adults): 42.24 MM agents (per 100,000 adults): 46
MIDDLE EAST AND NORTH AFRICA	43 percent penetration, 24 percent used digital payments for P2P, 6 percent used digital payments for G2P Literate: 79.9 percent	Electricity: 97.12 percent Mobile phone: 65 percent Smartphone penetration: 62 percent Access to 3G: 91 percent Internet: 43 percent Electricity: 97.12 percent	Instant payments available in at least half of region Commercial bank branches (per 100,000 adults): 12.8 TMs (per 100,000 adults): 39.25
PACIFIC	41 percent penetration Literate: 91.3 percent	Electricity: 86.75 percent Mobile phone: 46 percent Smartphone penetration; 30 percent Internet: 18 percent	Instant payments not available in more than half of region Interoperability is a challenge
SOUTH ASIA	48 percent penetration, 23 percent used digital payments for P2P, 8 percent used digital payments for G2P Literate: 73.6 percent	Electricity: 94.40 percent Mobile phone: 58 percent Smartphone penetration: 67 percent Access to 3G: 91 percent Internet: 33 percent	Instant payments available in at least half of region Interoperability is a challenge Commercial bank branches (per 100,000 adults): 10.41 ATMs (per 100,000 adults): 10.84
SUB-SAHARAN AFRICA	33% penetration, 45% used digital payments for P2P, 7% used digital payments for G2P Literate: 65.9%	Electricity: 46.8% Mobile phone: 45% Smartphone penetration: 48% Access to 3G: 75% Internet: 26% (16% rural, 40% urban) Electricity: 46.75%	Instant payments only available through mobile money. Without interoperability, the instant payments is not inclusive. Commercial bank branches (per 100,000 adults): 4.45 ATMs (per 100,000 adults): 6.09

* Format refers to whether retail or wholesale, token or account and mobile based or other.

** Payment rails refer to what system CBDC should ideally be distributed through for higher adoption. For example, existing e-money rails, banking networks etc.

§ Distribution architecture refers to what kind of technology should ideally underpin the CBDC based on the current state of the financial system e.g. blockchain, decentralised ledgers, centralised ledgers etc

²¹⁴ Internet connectivity refers to mobile internet connections

²¹⁵ Legal certainty for FinTech and other emerging services

REGULATION	VIABLE FORMAT*	PAYMENT RAILS**	DISTRIBUTION ARCHITECTURE [§]	KEY FEATURES
Risk-based CDD is a strength Market entry barriers (non-banks) are minimal Emerging services promoted There are however weaknesses in: data protection, cybersecurity as well as intra-governmental cooperation on financial inclusion strategy implementation	Retail, account-based	Existing e-money rails and banking networks	Multi-tier, Conventional system	Interoperable, Instant payments (24/7) Non-interest bearing Pseudo-anonymous Programmability Smartphone and feature phone compatibility
Inclusive risk-based CDD, Market entry barriers (non-banks) minimal The enforcement of consumer protection and data protection are of concern	Retail, account-based	Banking networks	Multi-tier conventional system	Interoperable, Instant payments (24/7) Non-interest-bearing Pseudo-anonymous Programmability Smartphone and feature phone compatibility
Significant variance in regulatory readiness Risk-based CDD largely in place Some countries are struggling with cybercrime and data protection, whilst others are struggling with emerging services	Retail, account-based	Banking networks	Multi-tier, Conventional system	Interoperable, Instant payments (24/7) Non-interest bearing Pseudo-anonymous Programmability Smartphone and feature phone compatibility
Strengths are in having minimal market entry barriers Areas for improvement: there is a need to move towards a risk based CDD Consumer protection issues in dispute resolution (little regulation)	Retail, token-based	Existing e-money rails and banking networks	Multi-tier, centralized, permissioned DLT	Interoperable, Non-interest bearing, Offline Instant payments (24/7) Pseudo-anonymous Programmability Strong focus on feature phone compatibility, but also ensure smartphone compatibility
Overall good regulatory environment Strengths in having risk-management framework for consumer credit Weaknesses in the area of emerging services.	Retail, token-based / account-based	Existing e-money rails and banking networks	Multi-tier, Conventional system	Interoperable, Instant payments (24/7) Non-interest bearing Pseudo-anonymous Programmability Smartphone and feature phone compatibility
Overall good regulatory environment. Risk-based CDD, Market entry barriers (non-banks) minimal. Areas for improvement related to supervisory capacity and emerging services ²¹⁵ .	Retail, token-based / account-based	Existing mobile money rails and banking networks	Multi-tier, Conventional system	Interoperable, Non-interest bearing Offline Instant payments (24/7) Pseudo-anonymous, Programmability Strong focus on feature phone compatibility, but also ensure smartphone compatibility

Source: (World Bank Open Data, 2019. Individuals using the Internet (% of population) - Latin America & Caribbean, South Asia, East Asia & Pacific, Pacific island small states, Sub-Saharan Africa. Washington DC. World Bank. Accessed 22 March, 2022. Available at: <https://data.worldbank.org/indicator/IT.NET.USER.ZS?locations=ZJ-85-Z4-S2-ZG>); (World Bank Open Data, 2019. Access to electricity (% of population) - Latin America & Caribbean, South Asia, East Asia & Pacific, Pacific island small states, Sub-Saharan Africa. Washington DC. World Bank. Accessed 22 March, 2022. Available at: <https://data.worldbank.org/indicator/EG.ELC.AC.SZ?locations=ZJ-85-Z4-S2-ZG>); (Findex, 2017. Global Financial Inclusion (Global Findex) Database 2017.); (Committee on Payments and Market Infrastructures, 2021. Developments in retail fast payments and implications for RTGS systems. December. Bank of International Settlements. Basel. Bank of International Settlements. Accessed 25 March 2022. Available at: <https://www.bis.org/cpmi/publ/d201.pdf>) (The Economist Intelligence Unit, 2019. Global Microscope 2019: The enabling environment for financial inclusion. Accessed 25 March, 2022. Available at: http://www.eiu.com/Handlers/WhitepaperHandler.ashx?fi=EIU_Global_Microscope_2019.pdf&mode=wp&campaignid=microscope2019) (Seminario, Fabiola, 2022. Digital payments trend 2022: Interoperability, crypto and cash out. IUPANA. Accessed 28 March 2022. <https://iupana.com/2022/01/17/digital-payment-trends-2022/?lang=en>) (Seminario, Fabiola, 2022. Digital Payment Trends: Interoperability, Crypto and Cash-out. Iupana. 17 January. Accessed 28 March 2022. Available at: <https://iupana.com/2022/01/17/digital-payment-trends-2022/?lang=en>), (World Bank, 2020), (GSMA, 2020), (Global System for Mobile Communications (GSMA), 2020. The state of mobile internet connectivity. London. GSMA. Available at: <https://www.gsma.com/r/wp-content/uploads/2020/09/GSMA-State-of-Mobile-Internet-Connectivity-Report-2020.pdf>)

APPENDIX A: STAKEHOLDER INTERVIEWS

Table 6 below outlines the range of key informant interviews that were conducted by the Cenfri team between February and March 2022. All interviews were conducted remotely using either Zoom or MS Teams.

TABLE 6: KEY INFORMANT INTERVIEWEE LIST

STAKEHOLDER TYPE	STAKEHOLDER NAME	DATE OF INTERVIEW
CENTRAL BANKS	1. Bank of Canada	16/02/2022
	2. Central Bank of Nigeria	24/02/2022
	3. Central Bank of Ghana	10/03/2022
	Participants of the AFI event	
	4. Bank Negara Malaysia (BNM)	1-3/03/2022
	5. Bank of Thailand (BOT)	1-3/03/2022
	6. Bangkok Sentral ng Pilipinas (BSP)	1-3/03/2022
	7. Central Bank of Russian Federation (CBR)	1-3/03/2022
INDUSTRY THOUGHT LEADERS	8. Central Bank of the Bahamas (CBB)	1-3/03/2022
	9. Professor Bitange Ndemo (Former MiN ICT Kenya and current professor of entrepreneurship at the University of Nairobi)	02/02/2022
TECHNOLOGY PROVIDERS	10. Klaus Martin Löber (Chair of the CCP Supervisory Committee at the ESMA)	14/02/ 2022
	11. Algorand	07/02/2022
	12. eCurrency	09/02/2022
	13. Mastercard	14/02/2022
	14. Stellar	18/02/ 2022
	15. R3	22/02/2022
	16. Celo	04/03/ 2022
INTERNATIONAL ORGANIZATIONS	17. G+D	10/03/ 2022
	18. World Bank	15/02/2022
	19. GIZ	21/02/ 2022
	20. IMF	22/02/2022
	21. CGAP	04/03/ 2022

BOX 4: ACCOUNT- VERSUS TOKEN-BASED DIGITAL CURRENCY

This special report does not place emphasis on the distinction between “account-” or “token-based” CBDC. The reason for this decision stems from a wide consensus among providers that this classification does not create mutually exclusive categories (there is overlap), and the terms have come to mean different things to different people.

These classifications originally stemmed from seminal academic papers that were focused on physical currency and were written before “token” came to denote cryptocurrency units. Those papers describe account-based systems as requiring the verification of the identity of the payer, and token-based systems requiring verification of the validity of the object used to pay.

To aid its understanding, cryptocurrencies have often described themselves payment tokens, and have subsequently been characterized as token-based by many. However, as the New York Federal Reserve point out, cryptocurrencies can be characterized as both account- and token-based. For example,

- > Bitcoin is account-based, where the account is the Bitcoin address, and the private key is the proof of identity needed to transact from that account, and
- > Bitcoin is token-based, where the “object” is an unspent transaction output (UTXO), which is only valid if it has not already been spent.

The distinctions between tokens and accounts may be helpful in the respective cryptocurrency and central banking communities, but not as standardized terms as can be seen in the example above. This is because it is not a choice between either and or, but there are instances of overlaps in both communities. This means attempting to standardize definitions in CBDC papers may lead to confusion in these communities.

More recent discussions provide further ways of classifying the secure and robust allocation of payment claims to identifiers based on different aspects. However, there is no globally established means to classification which that simplify discussions and create a common high-level language around these aspects of digital currencies.

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GLOSSARY OF TERMS

2G	Second Generation	MMI	Mobile Money Infrastructure
3G	Third Generation	MMO	Mobile Money Operator
4G	Fourth Generation	MENA	The Middle East and North Africa
AE	Advanced Economies	MSME	Micro, Small and Medium Enterprises
AFI	Alliance for Financial Inclusion	ML	Money Laundering
AML-CFT	Anti-Money Laundering and Combatting the Financing of Terrorism	NFC	Near-Field Communication
API	Application Programming Interface	P2P	Peer-to-peer
ATM	Automated Teller Machine	P2G	Person to Government
BIS	Bank for International Settlements	P2B	Person to Business
BOG	Bank of Ghana	PBOC	People's Bank of China
CBOB	Central Bank of Bahamas	PBCDCI	Digital Currency Institute of the People's Bank of China
CBDC	Central Bank Digital Currency	PF	Proliferation Financing
CDD	Customer Due Diligence	PIN	Personal Identification Number
CGAP	Consultative Group to Assist the Poor	POS	Point of Sale
DFS	Digital Financial Services	PSP	Payment Services Provider
DLT	Distributed Ledger Technology	RFID	Radio Frequency Identification
EAP	East Asia and the Pacific	RT	Real Time
ECA	Europe and Central Asia	RTGS	Real-Time Gross Settlement
ECCB	Eastern Caribbean Central Bank	RTL	Real Timeline
EFT	Electronic Funds Transfer	QR	Quick Response
E-money	Electronic Money	SIM	Subscriber Identity Module
EMDE	Emerging Markets and Developing Economies	SME	Small and Medium-Sized Enterprise
EMV	Europay, Mastercard, Visa	SMS	Short Message Service
ESG	Environment, Social and Governance	STK	SIM Toolkit
FATF	Financial Action Task Force	SSA	Sub-Saharan Africa
FDP	Forcibly Displaced Persons	TCF	Treating Customers Fairly
FI	Financial Inclusion	TF	Terrorist Financing
FSP	Financial Service Provider	UI	User Interface
G2P	Government to Person	UNCTAD	United Nations Conference on Trade and Development
G+D	Giesecke+Devrient	USA	United States of America
GSMA	Groupe Speciale Mobile Association	USDC	United States Dollar Coin
i2i	Insight-to-Impact		
IC	Integrated Circuit		
ID	Identity Document		
IFWG	Intergovernmental FinTech Working Group		
ISO	International Organization of Standardization		
KYC	Know Your Customer		
LAC	Latin America and the Caribbean		
IMF	International Monetary Fund		

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