

FINANCE, COMPETITIVENESS & INNOVATION GLOBAL PRACTICE

Payment Systems Development Group

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CENTRAL BANK DIGITAL CURRENCY

A Payments Perspective

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FOREWORD

Several waves of innovations and accompanying reforms have, over time, regularly changed the landscape of national payments system (NPS) in virtually every country in the world. A topic now grabbing widespread attention is crypto-assets, investments in digital currencies, and the related concept of stablecoins, which are digital currencies whose value are pegged to an underlying national currency issued by a central bank. These innovations are forcing us to revisit the very definition of *money* and *currency* as an exchange of value, terms we had for decades taken for granted. A few central banks are considering or beginning the process of issuing a central bank digital currency (CBDC). From design to implementation, researchers are looking at implications for the financial system, including for policy, regulation, and oversight, plus effects on the economy more broadly.

We urge policymakers to be sure in their objectives for adopting CBDC and think carefully about the potential for unintended consequences on the financial system. This Guidance Note is based on the World Bank Group's many years of experience supporting holistic NPS reforms in more than 120 countries and provides an analytical framework for central banks and relevant public authorities to identify and navigate the various issues related to payment systems and CBDCs. The Guidance Note also discusses how the right choices could help amplify the benefits and mitigate the risks of CBDC.

The decision-making process for implementing CBDC is multidimensional, and its success requires diverse stakeholders to collaborate and chart a path forward. Decisions must be guided by the specific country context. Accordingly, this Guidance Note does not advocate for the adoption of CBDC. Rather, it suggests that a well-structured, inclusive decision-making process is essential for evaluating whether it is the best choice for a particular country.

The technology underlying CBDC might be novel and complex, but the basics of what constitutes the successful adoption of money and payment services remains unchanged. Users need guaranteed and convenient access to funds and trusted ways to transact with each other, businesses and Government. I urge all those considering CBDCs to ensure that whatever form money and payments take, they reflect the values and well-being of society, foster economic growth, and leave no one behind.

I want to thank the team of senior specialists involved in the preparation of this Guidance Note and the many internal and external reviewers who significantly improved its quality. The World Bank looks forward to participating in ongoing global discussions and initiatives on CBDC and to continuing to work with clients in emerging markets and developing economies as they factor CBDC and other innovations into their payment system reforms.

Indermit Gill

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ACRONYMS AND ABBREVIATIONS

AML/CTF	anti-money-laundering and countering the financing of terrorism
API	application programming interface
BIS	Bank for International Settlements
CBDC	central bank digital currency
CPMI	Committee on Payments and Market Infrastructures
CPSS	Committee on Payment and Settlement Systems
DLT	distributed ledger technology
FMI	financial market infrastructure
IOSCO	International Organization of Securities Commissions
KYC	know your customer
NPS	national payments system
PAFI	payment aspects of financial inclusion
PFMI	principles for financial market infrastructures
PSP	payment service provider
PSSS	payment and settlement systems and services
RTGS	real-time gross settlement



EXECUTIVE SUMMARY

Payment and settlement systems and services have become vital components of the economic life of contemporary societies. Over the last decades, they have gone through several waves of reforms that have changed the landscape of the national payments system (NPS) in virtually every country in the world. Yet, in the middle of the 20th century, as payment technology settled down, payment and settlement systems and services issues were still appreciated less than other aspects of the financial system. They were seen mostly as technical matters, or “plumbing”, to be dealt with by sub-units of IT departments at both the central banks and commercial banks.

Recently, the issuance of central bank digital currency (CBDC) has become a highly debated financial-sector topic worldwide. Rapidly evolving technology and its application to practically all areas of finance—but especially in the issuance of value in electronic forms—has made it possible for central banks to issue their own digital currency for widescale use. The international financial community is studying aspects of CBDC, from design to implementation, and implications for the financial system, including on policy, regulation, and oversight and the economy more broadly.

This Guidance Note is about CBDC from the perspective of payment systems and services. It does not answer whether countries should issue CBDC, nor does it recommend that they issue any particular type of CBDC. The answer to these questions is country specific and can be decided only by the public authorities concerned, based on their strategic objectives and policy priorities. Rather, Guidance Note to assist central banks and other relevant public authorities by providing a decision-making framework to be used as they investigate the potential use of CBDC as an instrument to strengthen or modernize their NPS.

The innovative potential of CBDC to make digital payment services universal, ubiquitous, and instantaneous in contemporary economies must be weighed against the potential risks. The expected advantages of CBDC should be evaluated against potential disadvantages, such as the disintermediation of commercial banks, distortions to the level playing field vis-à-vis other existing or planned digital payment instruments, and reputational risk for the central bank in case of glitches. Thus, a central bank that intends to exploit the advantages of CBDC must carefully evaluate in co-ordination with relevant public authorities all its implications and adopt a plan that can prevent and mitigate its risks.

Certain conditions must be in place for CBDC to amplify its potential benefits and minimize its risks. All these conditions do not necessarily need to be present at the beginning of the implementation project, but—to the extent possible—they should be achieved as soon as feasible. For example, the presence of relevant foundations, such as a sound legal and regulatory framework, efficient infrastructures (including information and communications technology, identity, and networks of service providers), and the strong commitment of relevant stakeholders, are critical success factors for reforms of the NPS. Moreover, being able to count on adequate human and financial resources is an important requirement for embarking on a major reform program, such as the issuance of CBDC. Several examples exist of countries that were able to leapfrog to more advanced payment arrangements in relatively short periods of time following a strategic approach to NPS development.

In principle, a widely available CBDC for retail use could reinforce the central role of central bank money in today’s digital world. The history of retail payment services, since the origin

of modern banking, has been driven by society's desire to economize on the use of physical cash through instruments that eventually became cash substitutes for the public. Some examples include mobilizing bank deposits through checks and other means and, lately, through electronic-transfer facilities and e-monies. This constant innovation has been motivated by the high cost of handling and storing cash and the impossibility of using it in not-in-person transactions. CBDC could potentially reposition a digital, state-issued form of legal tender at the center of transactions.

Where appropriate, CBDC could be a way to promote competition and innovation in the NPS and enhance efficiency. Issuance of CBDC is not a full replacement of physical cash or private-sector money, including new digital currencies. All these forms of money can well coexist. This coexistence would require a level playing field aimed at ensuring that competition is open and fair, and interoperability would be essential for an environment that needs to be open to innovation.

CBDC is not a panacea for financial-inclusion challenges. The existing guidance from the Committee on Payments and Market Infrastructures and World Bank Group around the Payment Aspects of Financial Inclusion continues to be relevant and has proven to be effective in advancing financial inclusion across a range of countries. Globally, several countries have made rapid progress in financial inclusion by, among other things, a combination of (i) fostering public- and private-sector commitment to financial inclusion; (ii) adopting legal and regulatory reforms to allow the entry of non-bank players into the provision of e-money-based payment services; (iii) introducing agent-based models and simplified customer due-diligence requirements and increasing coverage of digital identities; (iv) improving interoperability of payment services; and (v) shifting large-scale recurrent payment streams such as government-to-person payments and domestic and international remittances from cash to direct credit to accounts. These actions would also help establish the enabling environment for any eventual issuance of CBDC to be successful.

Similarly, CBDC may help, but should not be viewed as a panacea to enhance the efficiency and accessibility of cross-border payments. It does have the potential to streamline cross-border payment arrangements, but several enabling conditions need to be in place, as identified in a recently issued G20 road map.

This Guidance Note articulates the analysis and central bank decision-making process on CBDC through the following five fundamental W questions:

WHY? Refers to the reasons and objectives that motivate CBDC implementation.

WHAT? Refers to the type and model of CBDC to be eventually chosen.

WHEN? Refers to the timing for implementing CBDC.

WHERE? Refers to the system/infrastructure (existing or planned) from which CBDC would be issued and circulate.

WHO? Refers to the stakeholders that should be involved in the process, their roles, and their mutual cooperation and competition in the process to CBDC.

The W questions need to be seen holistically, as each is equally relevant and important. For each, the Guidance Note discusses the main issues that would have to be looked at in the decision-making process on CBDC and advises on the actions that the central bank in consultation with relevant public authorities and other stakeholders should take as it decides to proceed with CBDC implementation in the form of some key words and policy recommendations.

Analysis of the five Ws is instrumental for addressing the one W question that underpins them all: Whether? As mentioned earlier, the Guidance Note does not answer whether central banks should issue CBDC, nor does it recommend that they issue any particular type of CBDC. The answer to these questions is country specific and can be decided by the central banks and relevant public authorities concerned, based on their strategic objectives and policy priorities. Rather, the Guidance Note seeks to assist central banks and public authorities as they investigate the use of CBDC as an instrument to strengthen or modernize their NPS. By addressing the five fundamental Ws in the context of their jurisdiction, central banks and public authorities can draw the elements they need to decide on CBDC issuance and organize their action, should they decide to move forward.

Indeed, the Guidance Note does not conclude that the issuance of CBDC is necessary or even appropriate in all countries and under all types of circumstances; rather, it suggests that a well-structured decision-making process should be organized around this option where appropriate. The Guidance Note does not detail all the technical and operational aspects that should be considered when

implementing CBDC, nor does it present any particular country case, as the level of implementation of CBDC across the world is still at a very early stage. Finally, this Guidance Note is intended to be used primarily by central banks and relevant public authorities considering the issuance of CBDC and by those institutions and individuals supporting them in this process.



SUMMARY OF POLICY RECOMMENDATIONS UNDER EACH W QUESTION

WHY?

In the process of identifying the reasons and objectives that could motivate CBDC implementation, the central bank and public authorities should take into account the following three key policy recommendations:



1. **BE INFORMED!** The decision to launch a new CBDC initiative should be based on a clear vision of its benefits and costs relative to alternatives. This requires an extensive knowledge of the NPS, its current and future needs, and the range of alternative solutions to address them.



2. **BE STRATEGIC!** The decision to launch a CBDC initiative should be articulated in a broad strategic context regarding the reform of the NPS.



3. **INSTILL EFFICIENCY!** CBDC should be adopted only if it improves the efficiency of payments while also facilitating competition and innovation.

WHAT?

In the process of determining the type and model of CBDC to be chosen for implementation and the key elements that CBDC should feature, the central bank and relevant public authorities should take into account the following three key policy recommendations:



4. **BE FAIR!** CBDC, especially retail, should integrate smoothly with other payment instruments or schemes, and its introduction should be consistent with the need to balance competition and cooperation within the NPS.



5. **BE NEUTRAL!** CBDC should at least maintain the same level of market integrity that existed before its introduction.



6. **SUPPORT GLOBAL PAYMENTS!** Where used for cross-border payments such as international remittances, CBDC should enhance the efficiency and safety of the global payments system.

WHEN?

In the process of determining the timing for implementing CBDC, the central bank and relevant public authorities should take into account the following three key policy recommendations:



7. AVOID MISSTEPS! At a minimum, CBDC issuance for NPS purposes should not exceed the existing infrastructure capacity and should not negatively affect the other critical central banking functions: monetary policy and financial stability.



8. FIX THE LAW! Launching CBDC should be preceded by the necessary legal and regulatory changes to ensure that the rights and obligations of its stakeholders are legitimately recognized and enforced.



9. STRENGTHEN OVERSIGHT! The central bank's NPS-oversight policy and activities should be strengthened as needed to ensure that CBDC is fully consistent with public-policy objectives.

WHERE?

As the central bank and relevant public authorities are engaged in the process of determining the infrastructure on which CBDC could be issued and circulated, they should take into account the following three key policy recommendations:



10. DON'T FORGET WHOLESALE! Since launching retail CBDC would absorb considerable resources, the central bank should not lose sight of the wholesale systems and should keep improving them, as needed.



11. BE SAFE! Even if the prime motive for issuing CBDC is achieving greater NPS efficiency, safety must remain an overarching concern, and it should guide the choice of the underlying infrastructure for CBDC, which should adhere to the strictest international standards.



12. BE INCLUSIVE! Issuing CBDC would add to the central bank's and relevant public authorities' responsibility for financial inclusion, and the underlying infrastructure should be able to accommodate widespread access to the service.

WHO?

In the process of defining the different roles for the implementation of CBDC, the central bank and relevant public authorities should take into account the following three key policy recommendations:



13. BE COLLEGIAL! The decision to issue CBDC and its implementation should follow a structured process of policy dialogue with all relevant stakeholders that will also determine how each relevant stakeholder will contribute to the effort.



14. CHECK RESOURCES! The central bank should carefully check on the resources needed for implementing CBDC and vis-à-vis the other NPS projects underway; resource availability will determine how to allocate responsibilities in the design and implementation of CBDC.



15. MIND THE STEPS! CBDC should be subject to rigorous planning, careful definition of the responsibilities of the different stakeholders, and project discipline and management, bearing in mind that delays and failures would harm the reputation of the central bank.



I. THE PURPOSE AND SCOPE OF THIS GUIDANCE NOTE

Against the backdrop of development of new forms of private money—crypto-assets and stablecoins—over the last few years, the issuance of central bank digital currency (CBDC) has become a highly debated financial-sector topic worldwide. With rapidly evolving technology and its application to practically all areas of finance—in particular, the issuance of value in electronic form—the possibility for central banks to issue their own digital currency to the broad public has raised the attention of the international financial community and attracted conspicuous resources to study the various aspects of CBDC, from design to implementation, and implications of CBDC for the financial system, including on its policy, regulation, and oversight and the economy more broadly.

There is, however, a gap in the literature on whether and how CBDC fits into the reforms of national payments system (NPS), particularly in emerging markets and developing economies. This Guidance Note (hereafter referred to as guide) seeks to address that gap. The literature on CBDC is now vast and includes analytical and experimental contributions from several central banks of advanced and emerging market economies, as well as analysis and studies from the Committee on Payments and Market Infrastructures (CPMI) and Bank for International Settlements, international financial organizations, academic scholars, private-sector institutions, policy experts, and market practitioners from all over the world.¹

This guide is aimed at senior policy makers, primarily in central banks but also in ministries of finance, and other relevant public authorities of jurisdictions that are studying the topic of CBDCs and their relevance as part of reforms to the NPS.

The guide does not answer whether central banks should issue CBDC, and even less does it recommend that they issue any particular type of CBDC. The answer to these questions is country specific and can be decided only by the central banks and public authorities concerned, based on their strategic objectives and policy priorities.

This guide is about CBDC providing a framework for analysis of the implications of CBDC primarily from the perspective of payment systems and services, as part of overall NPS reform initiatives. The guide does consider the potential impact of CBDC on other critical central banking functions—notably, monetary policy and financial stability—and the remedies to mitigate the associated risks. However, as these aspects have been dealt with in other contributions and by other institutions, the focus of the guide is on the issues, challenges, and choice options that a central bank and other relevant authorities² would have to confront if they decided to introduce CBDC—in particular, retail CBDC—as a means to strengthen or modernize the NPS, an area of activity in which the World Bank has significant experience. The guide thus seeks to offer guidance to central banks and other relevant authorities on the actions and precautions to be taken when planning to design and implement CBDC for NPS developmental purposes, and it identifies the building blocks that are necessary to launch and manage CBDC effectively. The guide does not provide a comprehensive technical analysis of CBDC design features and technology options, although it discusses these aspects in the context of the central bank's decision-making process.

The guide considers both wholesale and retail CBDC but focuses on the latter in view of its far greater innovative aspects. The guide’s content does not extend to digital currencies that are not issued by the central bank and do not represent a liability of (claim on) the central bank.

The guide articulates the analysis on CBDC through the following five fundamental W questions:

- WHY?** Refers to the reasons and objectives that motivate CBDC implementation and how to evaluate the fit of CBDC into a jurisdiction’s NPS context.
- WHAT?** Refers to the type and model of CBDC to be eventually chosen and what specific considerations the current status of the NPS could pose.
- WHEN?** Refers to the timing for implementing CBDC, particularly whether the conditions are in place to harness the benefits of CBDC and mitigate the potential risks that CBDC issuance could pose.

WHERE? Refers to the system/infrastructure (existing or planned) from which CBDC would be issued and circulate, and reiterates specific aspects of the design covered with respect to aspects of the payment system infrastructure.

WHO? Refers to the stakeholders that should be involved in the process, their roles, and their mutual cooperation and competition in the process to CBDC.

The structure of the guide is as follows: It begins with a short discussion about essential CBDC contexts to set the stage for the detailed analysis. Each of the following sections is devoted to one of the five W questions. For each section, one subsection (“Key Aspects for Consideration”) discusses the issues that would be involved in the central bank’s decision-making process, and a second subsection (“Policy Recommendations”) provides advice on the actions that the central bank should take as it decides to proceed with CBDC implementation. (See figure 1.) It needs to be stressed that the policy recommendations under the five W questions need to be seen holistically and that most of them are interlinked.

FIGURE 1 Overview of Policy Recommendations



Source: Own elaboration

Also, some aspects are treated under a specific *W* question for presentational purposes and could have fitted under other *W* questions as well. Finally, the sequence of the *W*s does not imply any order of priority among them. They are all equally fundamental—although, in a logical sense, it is natural to address the “why,” “what,” and “when” first and then answer the “where.” Obviously, a plan for implementing CBDC would have to set priorities and build a sequence of actions and steps, and the fact that the “who” comes last in the sequence does not mean it should not receive priority consideration at implementation. The guide does not

answer whether central banks should issue CBDC, and even less does it recommend that they issue any particular type of CBDC.

This guide is part of a World Bank package on CBDC and constitutes the flagship guide in the package. The other two notes—*Central Bank Digital Currency Background Technical Note*, and *Central Bank Digital Currencies for Cross-Border Payments*—offer supplementary background and technical information. (See box 1.)

BOX 1 OVERVIEW OF THE OTHER TWO NOTES OF THE WORLD BANK PACKAGE ON CBDC

Overview of the Background Technical Note on Central Bank Digital Currencies

The note discusses the main technical features of domestic retail CBDCs and their potential implications. It provides a general description of CBDCs as they have evolved in the literature and discusses the economics and, in particular, the implications for monetary policy, financial stability, financial intermediation, payments and settlements, financial integrity, and financial inclusion. The note also evaluates the main legal and regulatory aspects of CBDC and concludes by raising issues for further analysis.

CBDC has attracted conspicuous research on the various aspects of CBDC, from design to implementation and implications. The related literature is now vast and includes analytical and experimental contributions from several central banks of advanced and emerging market economies, as well as analysis and studies from the CPMI, the Bank for International Settlements, international financial organizations, academic scholars, private-sector institutions, policy experts, and market practitioners from all over the world.

Overview of the Note on Central Bank Digital Currencies for Cross-Border Payments

The report discusses the use of CBDC for cross-border payments. It reviews the models that have been developed for this purpose to date and discusses critical legal

issues that arise in the context of cross-border use of CBDC. While no CBDC project has an explicit focus on payments beyond the jurisdiction of the issuing central bank, a number of central banks are working on cross-border payment models in parallel with CBDC efforts, and international cooperation among central banks on CBDC, including for cross-border payments, is intensifying. The ongoing cooperative efforts, some of which are reviewed in the report, focus on wholesale types of CBDC.

The report also evaluates how cross-border CBDCs address challenges of the existing correspondent banking arrangement. Moreover, the report discusses the legal issues involved in cross-border use of CBDC and concludes with some general remarks and forward-looking issues for consideration.

The report is intended to shed light on how CBDC-based solutions can facilitate cross-border payments. To this end, the report reviews and evaluates models that are being considered by the international central banking and payments community and discusses some of the advantages they feature and challenges they raise. The report does not assess or rank the models discussed on the observance of given standards or resolution of given challenges, nor does it make recommendations as to which model(s) would or should be preferable.



II. SETTING THE STAGE: CBDC IN THE CONTEXT OF THE NATIONAL PAYMENTS SYSTEM

Payment and settlement systems and services (PSSS) have become vital components of the economic life of contemporary societies. They consist of integrated networks of institutions involved in the execution and delivery of fund-transfer services across the economies. Their smooth functioning is essential to the overall efficiency and stability of the financial sector and market economies. To promote such smooth functioning, national oversight authorities have been strengthened worldwide, and oversight activities have been developed to take account of the growing interconnectedness and mutual interdependence of PSSS, which are the core of what is often referred to as the NPS of each country. (See box 2.) NPSs encompass all payment, settlement, and depository activities, processes, mechanisms, infrastructure, institutions, and users in a country or an integrated region (for example, common economic area). NPSs are also mutually interconnected in what can be referred to as the global payment system.³ Appendix A presents a short overview of the main developments in NPS reforms over the last five decades.

Impressive progress has indeed been achieved to enhance the safety and efficiency of payment services, both enabling financial institutions to exchange large-value (wholesale) payments safely through sophisticated infrastructures and allowing more and more customers to make and receive small-value (retail) payments digitally and on a nearly real-time basis. In the last few years, the emergence of so-called fast (also known as instant, faster, or real-time) payment systems, the spread of additional access channels and enabling environments that accommodate the use of digital payments such as QR codes and application programming interfaces (APIs), and the launch of payment means

based on new technologies such as blockchain (for example, crypto-assets, stablecoins) have all pushed the frontier of payments technology further ahead. Despite all the noted progress, however, evidence suggests that in most countries cash—in the form of physical banknotes and coins issued by the central bank or government—still remains the prevalent retail payment instrument and, in some cases, store of value, indicating that further efforts are needed to understand user preferences and advance the widespread adoption and usage of more efficient digital payment instruments.⁴

Payment services are built on top of the concept of money. Money performs three functions in a market economy: (1) as a medium of exchange, money facilitates exchange between two parties; (2) as a store of value, it stores value from one period to another; and (3) as a unit of account, it acts as numeraire. Different types of money perform these functions—for example, cash in circulation, deposits at commercial banks, commercial bank reserves at a central bank, privately issued assets, and so on. The categories of money that are used widely for payments have largely been either central bank money or commercial bank money.

All forms of money coexist in modern economies and are exchangeable via payment systems that are regulated and overseen by central banks and widely accessible by banks and also by non-banks—in many cases, indirectly through banks. Central bank money is in the form of reserves and settlement accounts held at the central bank by the institutions participating in the payment systems, as well as banknotes in circulation. Commercial bank money is a claim against the relevant commercial banks, rather than legal tender. Electronic monies issued by non-banks are claims on com-

BOX 2 COMPONENTS OF THE NATIONAL PAYMENTS SYSTEM

An NPS consists of a defined group of institutions, instruments, and procedures used to facilitate the circulation of money within the country and internationally. An NPS includes the following main components:

- ➔ Payment instruments used to initiate and direct the transfer of funds between the accounts of payers and payees.
- ➔ Payment infrastructures for transacting and clearing payment instruments, processing and communicating payment information, and transferring the funds between the paying and receiving institutions.
- ➔ Securities-settlement systems to clear and settle securities transactions safely on a delivery-versus-payment mode.
- ➔ Electronic book-entry securities system(s) and trade repositories to register and record changes in ownership of both private and government securities and other capital market instruments.
- ➔ Financial institutions that provide payment accounts, instruments, and services to consumers, and businesses and organizations that operate payment transaction, clearing, and settlement service networks for those financial institutions.
- ➔ Nonfinancial institutions that provide payment and access to payment-related services and offer various products to satisfy market needs.
- ➔ Market arrangements such as conventions, regulations, and contracts for producing, pricing, delivering, and acquiring the various payment instruments and services.
- ➔ Laws, standards, rules, and procedures set by legislators, courts, and regulators that govern the payment-transfer process and the conduct of payment service markets and define the rights and obligations of the transacting parties, in force of which funds are transferred, cleared, and settled.

mercial bank deposits and, indirectly, on cash. Central bank money is often also called “public money,” and the other two types are included in the term “private money,” which now also includes the crypto-assets and stablecoins that seek to be used as a medium of exchange. The unit of account for central bank money, commercial bank money, and e-money remains the same underlying fiat currency, but crypto-assets and stablecoins have their unit of account. Further, the big distinction between central bank money, on the one hand, and commercial bank and non-bank electronic monies, on the other, is that the former does not bear default risk while the latter carry the possibility of their issuers eventually defaulting on their liabilities. In the case of crypto-assets and stablecoins, there may or may not be an issuer, and even if an issuer exists, there is no recourse of the holder to the issuer.

Not all of these types of money are equivalent—some are riskier than others in certain functions—but most are already in digital form. Cash is an obvious exception to this last point. At the same time, it also has other specific properties such as anonymity, universal acceptance, and being non-interest bearing and instantly exchangeable without the need of a third-party intervention.

Money has a crucial role in a market economy, as it facilitates exchanges. Acceptance of any form of money in an exchange process means that the payees are confident that, next time, they can use that same money in exchange for a good or service and there will be someone else accepting it in turn. Money carries value across time and space and, given its acceptance, can be exchanged at no or negligible cost. Paper money and, more recently, electronic monies—none of which has intrinsic value—are accepted in exchange, and trades based on this premise of trust. Hence, the value of money lies in public trust.

In a market economy, in general, the central bank is tasked with preserving the value of money and therefore the trust in it, in the interest of the public. To do so, the central bank issues money (the central bank’s liability—that is, central bank money) and adopts policies to preserve its (internal and external) value. At the same time, commercial banks issue liabilities in the form of commercial bank money (deposits held at commercial banks), convertible on par with central bank money, and lately, in a growing number of countries, non-banks have started issuing electronic forms of money convertible on par with commercial bank deposits.

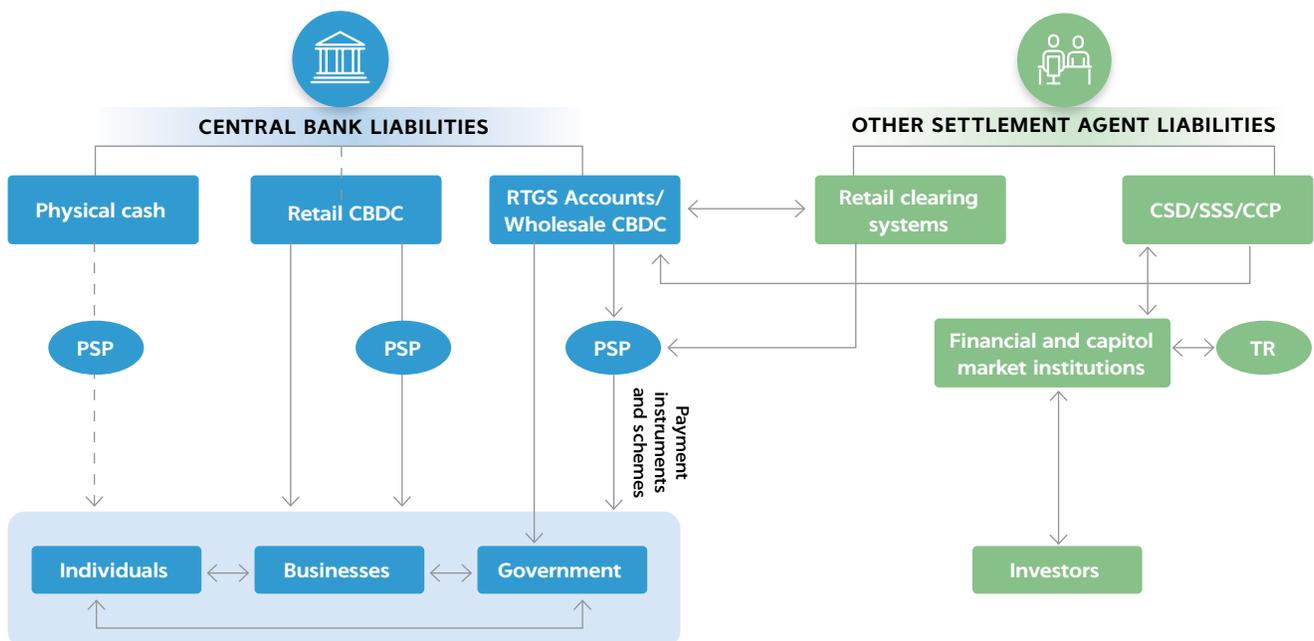
The last decade has seen attempts to break the hold of central bank and commercial money in payments by introducing private forms of money—digital currencies. The concept of digital currency is derived from the desire to replicate the specific properties of cash with an instrument in digital form, since this would allow exchanges that would not be possible otherwise. Digital currencies, therefore, are those that are anonymous, universally accepted, and can be exchanged peer to peer like cash, without the need for a third party facilitating the exchange. The CPMI noted in 2015 that, while digital currencies do have some but not all characteristics of a currency, they may also have some characteristics of commodities or assets.⁵ In earlier reports, the CPMI used the term *virtual currencies* or *virtual commodities* instead of digital currencies. A 2012⁶ report from the Committee on Payment and Settlement Systems (CPSS)⁷ defined virtual currencies as those that have their own denomination system and are mostly used for exchange of goods and services offered within their community. The terminologies have since evolved, and two new terms are now widely used by standard-setting bodies and financial-sector authorities—crypto-assets and stablecoins. The former are essentially defined in the same way as digital currencies, but the use of cryptography is emphasized. Notable examples of crypto-assets include Bitcoin and Ether. Stablecoins as a concept evolved out of a desire to address the inherent volatility of crypto-assets that made them challenging to use for payments. Stablecoins are crypto-assets that seek to stabilize the value by backing up the issued base

against a stable source of value—other assets, commercial bank money, and low-volatility financial securities. The notable examples include Tether, USD Coin, and Diem (which was formerly called Libra and is currently in planning stage).

As mentioned, CBDC is a new form of central bank money. It is a central bank liability, digitally created and recorded on centralized or decentralized ledgers, denominated in an existing unit of account, and, in principle, convertible in physical cash and commercial bank money on demand by the holder with authorized entities. Box 3 clarifies the CBDC-related terms used in the guide.

Figure 2 introduces the CBDC concept in the context of the NPS architecture. Depending on the design, in the context of an NPS, retail CBDC could be distributed directly to end users (individuals, businesses, government agencies) by the central bank, or payment service providers (PSPs) could act as intermediaries between the central bank and end users. Wholesale CBDC, which would be accessible only to a specific class of actors (that is, PSPs and some government agencies), could also serve as a settlement instrument for market infrastructures such as securities settlement systems or central securities depositories with securities settlement functionalities. Physical cash—another form of central bank liability—does not need any associated infrastructure, although it is often distributed through banks and other PSPs. (See figure 2.)

FIGURE 2 CBDC in the Context of the National Payments System



Note: Dashed lines are used to indicate that cash does not need associated system infrastructure.
 Source: Own elaboration

BOX 3 CENTRAL BANK DIGITAL CURRENCY: TAXONOMY

For the purpose of this guide, the following taxonomy is used. The taxonomy does not wish to introduce new definitions of CBDC and related terms and intends only to offer readers clarity and consistency across the guide. Since no single glossary on the topic has yet been agreed upon internationally, the guide has built on and retained explanations as generally accepted in the existing literature, especially including the contributions by international institutions, most notably the Bank for International Settlements, CPMI, International Monetary Fund, and central banks that are most active in this area.

Central bank digital currency (CBDC): Liability of (claim on) the central bank issued in digital form, which can be used as a medium of exchange and means of payment, store of value, settlement asset, and unit of account. CBDC is convertible in physical cash and commercial bank money on demand and is legal tender (as physical cash). It can be wholesale or retail.

Wholesale CBDC: CBDC whose access and circulation are restricted to predefined classes of agents (typically banks and other select financial institutions) under specific regulatory and policy requirements, as is the case today with central bank reserves. In principle, the existing reserve accounts held at the central bank and mobilized electronically are a version of wholesale CBDC. However, in this guide and for simplicity, aspects that could differentiate between wholesale CBDC and existing central bank reserves would be CBDC transfers executed via distributed ledger technology (DLT) solutions.⁸

Retail (or general-purpose) CBDC: CBDC whose access and circulation are open to a wider class of agents—in principle, including all agents in a given jurisdiction and beyond. The latter would be the case where CBDC is made accessible for nonresident individuals and entities.

Account-based CBDC: Centrally held on accounts at the central bank or at an authorized financial institution, which the central bank makes available to users, or held in custody on accounts at other intermediaries authorized by the central bank.

DLT-based CBDC: Held on a ledger that is replicated and shared across several participants. Authority for ver-

ifying and/or committing transactions could be given to a selected group of users (“permissioned”) or by all network participants (“permissionless”). A DLT-based ledger could be accessible by anyone (“public”) or restricted to a group of selected participants (“consortium” or “private”).

Token-based CBDC: Created as a digital token—that is, a representation of value encapsulated in a digital record. The transfer of the token from one user to another does not require reconciliation of two databases but consists of the near-immediate transfer of ownership through a system, very much like handing over cash from one person to another.⁹

CBDC system: System for the execution, clearing, settling, or recording of CBDC payments, including the system platform, operator, participants, and service providers; legal and governance rules; and operations and procedures. The guide will use the word *system* interchangeably with *infrastructure* or *arrangement*.

The following standard definitions will recur through the guide:

Wholesale payments: Typically (but not necessarily) large-value payments made between financial institutions (for example, banks, pension funds, insurance companies) and/or large (often multinational) corporations, although there is no legal distinction between wholesale and retail payments, and financial institutions can make retail as well as wholesale payments. (See below.) Wholesale payments can also be the result of the aggregation of a number of retail transactions. Some jurisdictions use systemically important classifications for systems dealing with large-value payments.

Retail payments: Small-value payments made between households, small or medium-sized businesses, and government agencies.

Domestic payments: Payments made between parties in a given jurisdiction.

Cross-border payments: Payments made across jurisdictions.

It is important to notice that in all models of CBDC issuance discussed in this guide, CBDC is always a liability of (claim on) the central bank. This also includes those cases where CBDC is distributed indirectly to the public through the intermediation of service providers. In all other cases where the service providers issue liabilities that are accepted by the public as digital currency and are fully backed with reserves held by the service providers at the central bank, the following holds: (i) the digital currency accepted by the public is not CBDC; (ii) the central bank has liabilities only to the service providers (not the public); and (iii) the holders of the digital currency have claims on the service providers (not the central bank).^{10,11}

Furthermore, the following important design features should be considered:

- i. Anonymity:* Cash is anonymous, but CBDC could be anonymous when issued as a digital token, or it could be linked to an individual/entity when issued as balances in an account maintained with the central bank or by delegation with PSPs.
- ii. Availability:* Limited to central bank operating hours, versus 24 hours a day, seven days a week (24/7). Compare to the current situation: access to digital central bank money is limited to central bank operating hours—though this is changing as countries move toward 24/7 real-time gross settlement (RTGS) solutions. Cash is available 24/7, and CBDC would be expected to be available 24/7.
- iii. Interest:* Zero versus non-zero. Compare to the current situation: currently zero. With CBDC, non-zero interest rates are possible. Cash does not bear interest.
- iv. Transfer mechanism:* Peer to peer (P2P) versus via an intermediary. Cash is transferred on a peer-to-peer basis. CBDC can be designed to be transferred via an intermediary or to be P2P exchangeable.
- v. Limits or caps:* Can be established to deter undesirable use. There are limits to cash transactions. For example, it is generally not possible to make very large transactions in cash or to carry more than a specified amount in cash across borders, due to financial-integrity considerations. Similar limits may be placed on CBDC. It might be easier to enforce these limits, given that CBDC is digital. However, the limits are often set on a per-account or per-individual/entity basis. The former would be easier to enforce, while the latter would require a way of uniquely identifying each holder and aggregating the holdings of an individual across different providers.

Different combinations of these properties and design features would yield different types of CBDC and have different implications. Each property and design feature fits different use cases and bears different implications for monetary policy, financial intermediation, financial integrity, financial inclusion, and payments and settlement systems.

The following are additional considerations:

- CBDC needs to be one to one convertible to reserves/banknotes to ensure proper functioning of the payment system.¹²
- In the current setup with no CBDC, the general public does not have access to central bank money that is not in physical form (notes and coins). In fact, central bank money has always been considered safer than commercial bank money (bank deposits), and CBDC might enable the general public to have access to the same safety of cash but in digital form (similar to bank deposits) in the form of central bank money. In principle, therefore, there could be a very high demand for CBDC as opposed to commercial bank deposits. Studies have shown equivalence under certain conditions¹³ that may not necessarily apply in practice.

The literature covers a range of potential motivations and advantages of CBDC, but its relative weight and importance depend on specific country contexts and the design features. On the one end of the spectrum, the motivations are largely to preserve the role of public money and safeguard financial stability and monetary sovereignty in the context of a rapid shift to digital payments and the potential of some private forms of money (for example, stablecoins) to rapidly displace digital payments based on public money. On the other end of the spectrum are motivations based on perceived gaps or failures of traditional digital payments to address public-policy objectives such as financial inclusion, competition, and interoperability. The literature also discusses additional motivations and potential benefits with respect to financial stability, improving effectiveness of government payments and collections, and monetary-policy implementation. The motivations and potential advantages are discussed in section III. How the design choices and infrastructure affect them are discussed in section IV and section VI, respectively.

The literature also covers the range of risks that CBDC can introduce and approaches to mitigate those risks. Depending on design and country context, CBDCs can have implications for financial stability, current financial-intermediation structures, financial integrity, and privacy. Fur-

ther, they can have implications for the legal and regulatory framework, increased responsibilities of the central bank, and the separation of the role of the public and private sector in credit provision.

Certain conditions must be in place for CBDC to amplify its potential benefits and minimize its risks. All these conditions do not necessarily need to be present at the beginning of the implementation project, but—to the extent possible—they should be achieved as soon as feasible. For example, the presence of relevant foundations, such as a sound, modern, and open legal and regulatory framework (allowing, for example, open access to the provision of services based on certain functional requirements), efficient infrastructures (including information and communications technology, identity, and networks of service providers), and the strong commitment of relevant stakeholders are critical success fac-

tors for reforms of any NPS reform project, including CBDC. Similarly, being able to count on adequate human and financial resources is an important requirement for embarking on a major reform program, such as the issuance of CBDC. The importance of such foundations has been extensively studied—in particular, in the context of NPS initiatives to facilitate financial inclusion—and lessons could be drawn from the work of the CPMI and World Bank on payment aspects of financial inclusion (PAFI).¹⁴ Building CBDC on such foundations would be consistent with the International Monetary Fund–World Bank Bali Fintech Agenda.¹⁵ On the other hand, several examples exist of countries that were able to leapfrog to more advanced payment arrangements in relatively short periods of time following a strategic approach to NPS development and making sure along the way that sufficient conditions would eventually set the new arrangements on solid foundations.



III. REASONS FOR ISSUING CBDC (WHY?)

A. KEY ASPECTS FOR CONSIDERATION

Improving payment-system performance is cited as the most important motivation for central banks to issue CBDC.¹⁶ The central banks of advanced and emerging market economies, recently surveyed by the Bank for International Settlements, ranked payments safety and domestic payments efficiency as the first motivating factors for potentially issuing a wholesale or retail CBDC.¹⁷ In addition, in the same survey, central banks in emerging markets and developing economies expressed that they consider CBDC as a potential instrument to promote financial inclusion. The survey also seems to indicate that motivations to work on retail CBDC, which can act as a substitute or a complement to cash, are generally stronger in emerging markets and developing economies than in central banks in advanced economies.¹⁸

The potential of CBDC to enable wider and round-the-clock access to real-time transfers could also have a positive effect on the efficiency of cross-border payments, but issues might emerge, such as delays due to compliance checks. While the surveyed central banks generally attributed low importance to the efficiency of cross-border payments, the recent G20 road map for enhancing cross-border payments acknowledges a potential role for CBDC in addressing some of the frictions affecting cross-border payments and calls for additional analysis.¹⁹ As noted before, CBDC, when widely available to individuals and businesses, would enable real-time transfer capabilities in a domestic context. If in a domestic jurisdiction CBDC were made available to a foreign counterpart, then the same real-time and round-the-clock transfer capability would extend to cross-border payments as well. This, however, might encounter a range of legal, regulatory and policy issues, yet there could be design options for integrating the CBDC infrastructure of countries, through the

classic correspondent banking model, interlinking arrangement, or perhaps a new multilateral infrastructure.

The G20 cross-border road map calls for analyzing the various options for leveraging CBDCs for cross-border payments. Central banks have conducted various proofs of concept and pilots on these—which are summarized in the accompanying paper. Clearly, for CBDC to be used for cross-border payments, the existing compliance processes related to anti-money-laundering and countering the financing of terrorism (AML/CFT) and capital-flow management will still need to be observed, and foreign counterparts will need access either directly or indirectly to the CBDC infrastructure. Further, this will require considerable attention to issues of currency conversion and convertibility.

From a payments perspective, the decision to introduce CBDC should start from ascertaining its potential advantages with respect to existing systems and instruments and conducting a holistic analysis of expected costs and benefits and market structures. The potential advantages of wholesale CBDC could include increased operational resilience, the delinking of central bank money from general ledger systems, and, importantly, its peer-to-peer circulation. As regards resilience, wholesale CBDC would be expected to run on a permissioned network relying on several cloud-based nodes, instead of two to three data centers, as is common for RTGS systems, although existing RTGS systems are quite resilient and their extra resilience might not represent a priority at this stage and for the foreseeable future. Wholesale CBDC would provide a valid solution for settling transactions in tokenized digital securities, which are emerging due to innovations in financial and capital-market infrastructures.²⁰ At the retail level, CBDC would foster cost reductions and improve user experiences by putting competitive pres-

sure on the market for payment services. And since similar effects could be achieved through private-sector digital currencies and initiatives such as fast payment systems, deciding whether to proceed with CBDC should rest on a thorough analysis of the business case for it from a holistic perspective, based on the evaluation of the expected costs and benefits of alternative options for different stakeholders and, more importantly, for the society as a whole.

The potential benefits of CBDC could be broadly grouped under efficiency, promoting innovation, and strengthening the role of the central bank. These benefits, however, can be achieved through other means. Their importance and relative weight, and the relative advantages of CBDC versus other options, would all depend on the specific characteristics of each country situation.

Efficiency gains for individuals and businesses:

- **Higher speed:** Given that access to information is instant today, demand has been growing from consumers and businesses for payment mechanisms that allow instant access to funds on the payee’s side on a continuous basis. Retail CBDC, when accompanied with appropriate interoperability arrangements, its potentially country-wide adoption/acceptance, and its inclusiveness capacity, could provide a universal real-time payment service. Fast payment services seek to achieve the same outcomes.
- **Lower cost:** The introduction of CBDC would exert pressure on the efficiency of other payment instruments and support innovation in payments. As retail CBDC might be offered in principle at little or zero cost to the payers and payees—much as for cash today—it could improve the overall efficiency of the retail segment of the NPS by pressing private-sector providers to attain higher levels of efficiency on the instruments they issue and to supply customers with higher-quality and an expanded range of services. Public authorities could use other policy levers to achieve similar outcomes (for example, using moral suasion and interventions on governance of retail payment systems).
- **Efficient cross-border transactions:** If used for cross-border transfers and payments, CBDC can greatly contribute to increased transparency, speed, and cost efficiency but would need implementation of various other reforms (see earlier discussion). CBDC could serve as a cost-effective and faster means for executing international remittances.

Competition and innovation:

- **Enable broader shifts toward digital assets and the digital economy:** There is an increasing interest in converting traditional financial securities and other physical assets into digital assets that can be bought, sold, and exchanged using new-generation trading and financial-market infrastructures developed using blockchain and distributed ledger technology (DLT) more broadly. CBDC would provide a digital variant of central money for use as a settlement asset and mitigate principal risk by allowing delivery-versus-payment and payment-versus-payment functionality for digitalized financial assets. Further, as the internet of things becomes an integral part of everyday reality (in households, work environments, different industries) and users become payers and payees, CBDC would provide a universal means of payment. APIs and tokenization could be potential alternative approaches.
- **Increased competition:** As noted in the discussion on cost, universal availability of CBDC would establish a floor in terms of the service quality for payment services and put pressure on other PSPs to enhance their value proposition. Additionally, CBDC could simplify market entry for new PSPs by freeing them from negotiating access to specific payment infrastructures and banking services. Policy reforms to allow non-bank access to accounts at central banks and risk-based fair and transparent access to critical payment infrastructures could have a similar impact.

Strengthening role of the central bank:

- **Reduced production and distribution costs:** The “production” of CBDC would not incur the costs associated with the printing, handling, storage, and transportation of physical cash. Thus, in principle, the cost of CBDC issuance would be lower than the cost of cash, and this would increase seigniorage (all else being equal). However, it needs to be noted that depending on the design of CBDC, the central bank might need to operate payment systems that handle CBDCs. The net effect of the costs arising from this, and the savings mentioned above, would need to be studied.
- **Unique role of the central bank:** Central banks have gone beyond their traditional role of issuing currency and, in many cases, also serve as retail payment system operators, thus dealing directly with market participants and, in some cases, end users as well. This positions them uniquely to undertake CBDC projects with univer-

sal scope, which require a degree of leadership, cooperation, and interaction with many different stakeholders that no other actor in the economy could replicate. CBDC could even provide an opportunity for central banks in very small and fragile states to issue money where banknotes are not issued due to high expenses or need to be replaced because of vast frauds.

- **Recovered role of state-issued money:** As digital payments (enabled by privately issued payment instruments) may eventually constitute the vast majority of domestic retail payments, the private sector will become the “only” relevant supplier of money. By implementing CBDC, central banks can strategically preserve the role of the state in the provision of money and help to address the risks of new forms of private money and the consequences of a decline in the use of cash. CBDC could improve the effectiveness of monetary policy and play a role in distributing fiscal resources to unbanked and other recipients.

Efficiency gains for government:

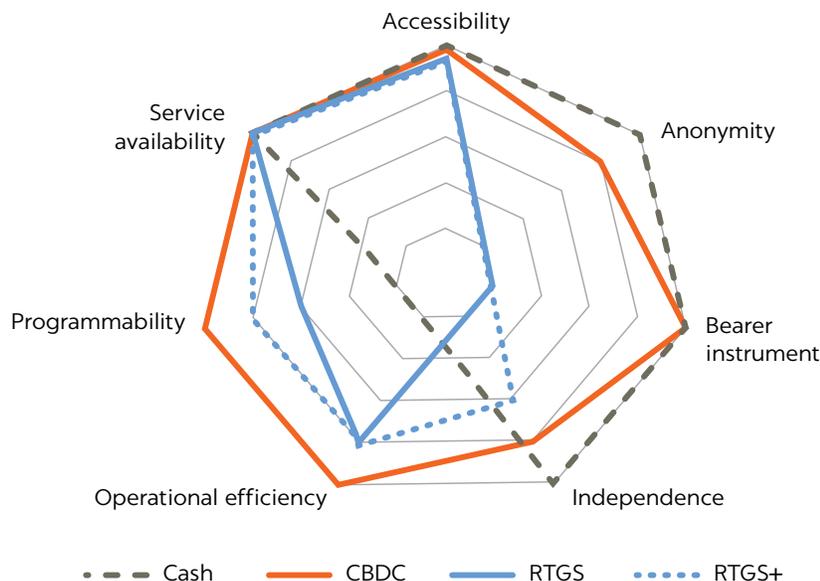
- **Better government payments:** CBDC could provide a very effective mechanism to facilitate payments to all government agencies across a single platform and enable the government to reach every agent everywhere in the economy and at any time, for both regular or ad hoc transfers and payments. This feature would be espe-

cially valuable during certain types of emergencies. While existing payment mechanisms can be leveraged for government payments, significant up-front preparation and coordination are required for executing government relief payments. The universal access to CBDC could simplify the processes and enable faster response times.

- **Improved transparency and tax collection:** Many jurisdictions believe that CBDC can significantly reduce tax avoidance and evasion, as well as money laundering and other illegal activities that are made easier by paper currency (especially large-denomination bills), given that, even under an anonymous CBDC design, transactions can still be tracked.²¹ This assumes that cash-based transactions shift toward CBDC in a big way either by virtue of their ease of use or by government rules requiring usage of CBDC. Similar effect can be achieved if there is large scale shift from cash to other forms of digital payments.

Depending on design, CBDC systems could score high vis-à-vis other systems across a number of categories. As elaborated in a recent study from the US Federal Reserve System, these categories include accessibility, anonymity, bearer instrumentality, independence, operational efficiency, programmability, and service availability.²² The study compares how CBDC, cash, RTGS, and RTGS+ score for each of the categories. (See figure 3.)²³

FIGURE 3 Comparison of Central Bank Payment Mechanisms



*“RTGS+” systems, means RTGS systems designed to maximize their full technological potential, including areas where RTGS systems have been limited for policy reasons (for example, a 24x7 RTGS system that allows non-bank participation).

Source: Wong and Maniff, “Comparing Means of Payment.”

The expected advantages of CBDC outlined above should be weighed against its potential disadvantages. These have been thoroughly discussed in the literature, and this guide discusses the most important ones. The disadvantage that is referred to most often is the potential disintermediation of commercial banks, which would occur if consumers were to move money from bank accounts into CBDC, causing less bank credit at higher interest rates and possibly inviting pressure to be placed on the central bank (including through political interference) to provide additional liquidity to banks and to take on the attendant credit risk. CBDC could create financial instability by disrupting the banks' business models and displacing commercial banks from the retail payments business. The concern for instability could be exacerbated especially at times of market stress, as CBDC could enable customers to make a run on their banks much more easily and rapidly. The instability would be even worse if people could move their funds into a foreign CBDC on the expectation of volatile exchange rates or higher inflation. Also, CBDC might be deployed in direct competition with other existing or planned successful and popular digital payment instruments, raising the concern that CBDC could confuse the market and users and/or represent a duplication of efforts, in particular in some developing countries. The other major risk is that of privacy infringement for users, as CBDC would leave traceable digital footprints, holding none of the anonymity of cash and thus making users identifiable and allowing governments to track payment. While some design options could be adopted, which would limit the privacy risk by allowing for anonymous capabilities, they would increase the risks of money laundering and terrorism financing, thus bringing forth a difficult trade-off between privacy, anonymity, and financial integrity. (See box 4.) Other potential downsides are the reputational risk that the central bank might incur from issuing CBDC if this were subject to glitches, cyberattacks, or human error that could reflect poorly on the central bank. Finally, there are questions concerning capacity: as a country decides to embark on a process to CBDC, would it have the technological infrastructure, regulatory basis, and government institutions necessary to support it? The authorities need to be able to control the process.

B. POLICY RECOMMENDATIONS

In the process of identifying the reasons and objectives that motivate CBDC implementation (*Why?*), the central bank and relevant public authorities should take into account the following three key policy recommendations:



BE INFORMED! *The decision to launch a new CBDC initiative should be based on a clear vision of its benefits and costs relative to alternatives. This requires an extensive knowledge of the NPS, its current and future needs, and the range of alternative solutions to address them.*

The decision should be based on a full understanding of the NPS structure and needs, as well as on reliable and comprehensive data on the NPS. The first step should thus consist of a wide-ranging stocktaking that would enable the central bank and relevant public authorities to have a clear and updated picture of the current status of the NPS, including its various systems, participants, providers, instruments, services, and standards, as well as user needs and stakeholder aspirations. Relevant areas for stocktaking should include access and affordability, availability of a mix of payment instruments, and availability of the infrastructure to process such payment instruments. The stocktaking exercise should be designed to enable a clear understanding of the issues and areas of improvement required for achieving the stated public-policy goals and whether and how CBDC would or could help in the process. The scope of the stocktaking exercise should be broad and developed in close coordination with all stakeholders. The World Bank report on retail payments stocktaking provides useful guidance on retail payment system stocktaking. (See box 5.)²⁴

Relevant data and statistics on the NPS should include a cost analysis of retail payments. These data would be instrumental in guiding strategic decisions on CBDC. The collection, organization, validation, and analysis of data are critical parts of the stocktaking exercise and probably the most resource intensive. Appropriate human and technological resources should therefore be devoted to this element of the exercise, including a strong emphasis on validating the data received from the industry. A retail payment stocktaking exercise is not a one-off exercise; hence, an approach that enables comparison across iterations to measure evolution should also be considered.

The World Bank report *Retail Payments: A Practical Guide for Measuring Retail Payment Costs* is designed to serve as a guide for central banks and other public or private-sector stakeholders interested in studying the costs and potential savings of day-to-day retail payments in their economies.²⁵ To achieve this objective, the guide provides a comprehensive methodology that can be used in its entirety or adopted in module form. The guide also provides for the flexibility needed to adapt certain elements to the specific conditions

BOX 4 TRADE-OFFS BETWEEN PRIVACY, ANONYMITY, AND FINANCIAL-INTEGRITY RISKS**Account-based CBDCs can present higher privacy risks; these can, however, be mitigated.**

There are different levels of privacy and anonymity for CBDC, depending on decisions on whether CBDC is represented in terms of value recorded in an “account” held with the central bank or in the form of tokens that function as bearer instruments. The account-based CBDC option is required to observe the extant customer due-diligence requirements like other account-based payment services, such as mobile money and payment cards, and, at first glance, would appear to have the same level of privacy and lack of anonymity as current payment services. However, as CBDC is a liability of a central bank—irrespective of the distribution model (one tier or two tiers)—the central bank will need to have access to all the account-holder information and the transactions data. This could mean that, unlike in the current context, where each PSP is able to see only a subset of the transactions conducted, in the context of CBDC, one entity—the central bank—can see all the transactions a user makes. In some jurisdictions, this might also mean the government has access to all this information. Hence, in principle, CBDCs could present a higher privacy risk, in particular for account-based designs. However, there could be some design options for minimizing this risk—for example, in two-tier models, the financial service providers would be required to conduct the customer due diligence and can use some virtual identifiers instead of the real-name and ID details of the account holders when sharing information with the central bank. Other options could include limiting the details that the financial service providers share. However, these options would not apply for one-tier models, where the account is maintained directly with central banks.

Token-based CBDC solutions can potentially safeguard privacy but present higher integrity risks.

In contrast to account-based CBDC designs, token-based designs are in principle anonymous and hence could safeguard privacy. However, even for token-based designs, the end user might need to make use of services from PSPs to safeguard and use the tokens, and the same customer due-diligence processes applied for account-based solutions would then be applicable for token-based solutions as well. This is, for example, the case with crypto-asset holdings operated through crypto-wallets.

Higher anonymity by definition will result in increasing attractiveness for money laundering and terrorism financing and hence lead to higher financial-integrity risks.

However, even if tokens can protect anonymity, the transactions can still be tracked and monitored. Further privacy protections can be breached when combined with other information, such as device fingerprints, IP addresses, and other online interactions. Thus, even token-based solutions are not truly anonymous and, in some sense, can provide better protection than cash against risks of money laundering and terrorism financing.

While there are trade-offs between privacy, anonymity, and financial-integrity risks, thresholds can be set for the quantum of CBDC holdings, as well as amount and velocity limits for transactions above which anonymity is not allowed.

In line with the current approach of tiered customer due-diligence requirements followed for account opening, authorities could decide to set limits for token based CBDC options, above which the user will need to convert to an account-based option. However, this still leaves the risk of one entity making use of multiple token-based services to circumvent the limits, as has been observed with anonymous prepaid cards in some contexts.

BOX 5 WORLD BANK PRACTICAL GUIDE FOR RETAIL PAYMENTS STOCKTAKING

GUIDELINE 1: The overall scope and structure of the stocktaking exercise shall be driven by the high-level public-policy goals set forth in the area of retail payments.

GUIDELINE 2: Adequate attention needs to be devoted to the planning and organization of the stocktaking exercise.

GUIDELINE 3: Industry players should be involved from the very early stages.

GUIDELINE 4: Obtaining sufficient high-quality data and other types of information is at the heart of the stocktaking exercise.

GUIDELINE 5: Devote sufficient time to preparing a report and designing a strategy for the wide dissemination of results.

of a national retail payments market. The results of a cost study based on the methodology can help decision-makers to agree on the targeted gains in efficiency in their retail payment system, define an implementation plan for achieving a desired future mix of payment instruments, and provide information for all stakeholders involved in the retail payments market. By applying the methodology for measuring the costs of retail payments, cross-country comparability and benchmarking are possible, and the experience of other countries can be taken into consideration when developing or adjusting the national retail payments strategy based on the results of the cost study. The methodology addresses the following dimensions: (i) the demand side: costs borne by payment service users—that is, consumers, businesses, and government agencies—in their roles as payers and payees; (ii) the supply side: PSPs and payment infrastructure providers; and (iii) the overall economy. It aims to meet the following criteria: applicability, comparability, efficiency, and standardization.



BE STRATEGIC! *The decision to launch a CBDC should be articulated in a broad strategic context regarding the reform of the NPS.*

The central bank and relevant public authorities should decide on CBDC issuance while thinking strategically about its implications for the NPS. The decision to adopt CBDC might be part of an overall reform of the NPS. In such case, its introduction should be in line with the broad objectives of the reform, and careful attention should be given to the potential trade-offs among the different strategic directions of the plan. Integrating CBDC within the set of objectives to guide the development of the NPS would be

useful to ensure that each of the NPS components, including (prospectively) CBDC, is positioned to meet the overall vision. Each component of the NPS, and CBDC as one of the most critical components, would have to adhere to the strategic objectives, which may include, among other things, interoperability in design of retail payment systems that can be broadly adopted by wide customer segments; conformity to applicable international standards (including for risk management); adequate use of clearing and settlement infrastructures, rather than creating parallel processes; and short- to medium-term commercial viability. In other cases, CBDC might be part of an organic developmental process aimed at adding to or improving certain aspects of the NPS—for instance, by adding a new instrument that could be leveraged as a catalyst for NPS innovation and efficiency. In all cases, guidance from the work on NPS development produced by the CPMI and the World Bank could be useful.²⁶ (See box 6.)²⁷

Particularly in the area of retail payment services, the introduction of CBDC should be instrumental to achieving the related public-policy objectives. These objectives should also include the promotion of affordability and ease of access to payment services, the satisfaction of the retail payment needs in the context of fast-evolving economic and social contexts, and the promotion of socially optimal usage of payment instruments, implying the maximization of direct and indirect benefits associated with migration of customers from traditional (cash and checks) to modern (electronic) payment instruments, subject to safety considerations.

Implementing CBDC would require forms of interoperability between the CBDC system and other payment infrastructures. The CBDC system should be integrated with

BOX 6 CPSS GENERAL GUIDANCE FOR NATIONAL PAYMENT SYSTEM DEVELOPMENT**Area A: Banking system**

GUIDELINE 1: Keep the central bank at the center. Due to its overall responsibility for a sound currency, the central bank has a central role in the development of the use of money as an effective means of payment.

GUIDELINE 2: Promote the role of a sound banking system. Payment accounts, instruments, and services available to end users are mainly provided by banks, which compete individually but often need to act cooperatively as a system.

Area B: Planning

GUIDELINE 3: Recognize complexity. Planning should be based on a comprehensive understanding of all core elements of the system and the principal factors influencing its development.

GUIDELINE 4: Focus on needs. Identify, and be guided by, the payment needs of all users in the system and by the capabilities of the economy.

GUIDELINE 5: Set clear priorities. Plan and prioritize the development of the payment system strategically.

GUIDELINE 6: Implementation is key. Ensure effective implementation of the strategic plan.

Area C: Institutional framework

GUIDELINE 7: Promote market development. The expansion and strengthening of market arrangements are key aspects of the evolution of the payment system.

GUIDELINE 8: Involve relevant stakeholders. Encourage the development of effective consultation among relevant stakeholders in the payment system.

GUIDELINE 9: Cooperate with other authorities. Effective payment system oversight by the central bank requires collaborative arrangements with other authorities.

GUIDELINE 10: Promote legal certainty. Develop a transparent, comprehensive, and sound legal framework for the system.

Area D: Infrastructure

GUIDELINE 11: Retail: Give more choice to more people. Extend the coverage and choice of noncash payment instruments and services available to end users by expanding and improving infrastructures.

GUIDELINE 12: Large value: Business case leads; technology follows. Develop a large-value payment system based primarily on the needs of financial markets and the growth in time-critical interbank payments.

GUIDELINE 13: Securities: Plan securities and payment systems together. Coordinate the development of the infrastructures for securities and large-value payments.

GUIDELINE 14: Retail, large-value, and securities: Coordinate settlement. Coordinate effective settlement processes for the core systems to manage the interrelated liquidity needs and settlement risks among them.

existing and prospective payment systems in the country. As the only system that settles CBDC in the jurisdiction, there should be arrangements to allow for the exchange of CBDC with deposits held at the central bank and other PSPs, including commercial banks. The exchange arrangements should ensure settlement based on payment versus payment or delivery versus payment. The central bank may need to enable the exchange of CBDC on existing payments infrastructures, including the automated clearinghouses and fast payment systems. On the retail level, user access to accounts or tokens should be facilitated—to the extent possible—through payment instruments such as cards, e-wal-

lets, and other applications or devices. Similar arrangements would have to be facilitated for merchants and businesses via acquirers, other service providers, or the central bank. The government should hold CBDC accounts on both the wholesale level, to exchange with the financial sector, and the retail level, to make or accept payments from individuals and businesses either directly or indirectly through private-sector service providers. The internet and mobile banking channels and ATM terminals should allow access to CBDC accounts. Merchants could accept CBDC from individuals either through e-wallets or other acceptance tools, and e-wallet applications could be designed to facilitate the

instantaneous exchange of CBDC and funds at the service provider through the wallet.

As a matter of good practice, public-sector interventions need to be predicated on a market failure and on potential private-sector solutions either being unviable or suboptimal. This precept applies to CBDC as well; however, it needs to be seen also through the lens of the unique role and responsibilities of the public sector when it comes to money. As the discussion in this section shows, specific issues with respect to payment services (such as cost, speed, and access) can all be addressed using new technologies and the sound implementation of existing approaches. This also applies for other broader societal gains, such as better tax recovery. However, the efficacy of CBDC versus existing approaches could vary by country context, and, as such, a careful analysis would be warranted before adopting CBDC as a solution to specific problems. That being said, a decision on CBDC is not merely about addressing existing issues and problems; it is equally about preparing for a world in which digital payments take strong hold. New private forms of money are seeking to replace the role of the public authorities in this space, and the possibilities arise that CBDCs open up for the broader economy. Hence, decisions on CBDC might also be seen as creating backup plans for public authorities to intervene in response to certain plausible future market developments.



INSTILL EFFICIENCY! *CBDC should be adopted only if it improves the efficiency of payments while also facilitating competition and innovation.*

The central bank should consider CBDC's capacity to enhance the efficiency of the NPS. This could derive from CBDC's capacity to complement other public and private-sector initiatives to improve payments or to provide unique benefits over and above existing initiatives. The analysis of NPS data would shed light on where to intervene to enhance NPS efficiency and how CBDC could complement and integrate, or supplement, existing solutions and initiatives. Should the analysis reveal, for example, that the costs to produce and handle cash are significant in the economy, and if the cen-

tral bank held doubts about the readiness of the financial sector to foster the use of digital payments on its own initiative, the introduction of retail CBDC could be considered alongside strengthening the other NPS elements. The World Bank's *General Guidelines for the Development of Government Payment Programs* offers advice on how to improve disbursement and collections of government payments. (See box 7.) Finally, the *Principles for Financial Market Infrastructures* (PFMI), published by the CPSS (now CPMI) and the Technical Committee of the International Organization of Securities Commissions (IOSCO), and Principle 21 in particular, provide guidance on how to enhance the efficiency of systemically important payment systems²⁸ (appendix B).²⁹

If introduced, CBDC should aim to promote competition and innovation in the NPS.³⁰ Issuance of CBDC should not be seen as replacing *tout court* physical cash or private-sector monies (including new digital currencies). All these forms of money may well coexist, as each would offer its users various types of services and conveniences (and bearing different risks) that users can choose from based on their different preferences and risk appetite, and CBDC can act as a complementary means of payment. Moreover, CBDC can be introduced for the purpose of allowing the public and the private sector to exploit their comparative advantages. Central banks can focus on ensuring trust, stability, and integrity in payments and let private-sector PSPs keep doing what they should do best: interfacing with customers and competing with each other to win customer preferences and expand the market for digital payments. This coexistence would require a level playing field aimed at ensuring that competition is open and fair, including between market incumbents and new entrants. Open and fair competition in turn will require market protection from abusive and monopolistic practices and the adoption of appropriate rules for handling data as the raw materials of the digital world, from access to sharing, portability, and protection. Finally, interoperability would be important for an environment that needs to be open to innovation, enabling PSPs (acting on their own behalf or on behalf of their customers) to access CBDC via multiple channels, including back-end interfaces and APIs.

BOX 7 WORLD BANK GENERAL GUIDELINES FOR GOVERNMENT PAYMENT PROGRAMS

The general guidelines aim at the following public-policy goals for government payment programs: Payments and collections made as part of existing or new government payment programs should support the sound, efficient, and transparent management of public financial resources. Government payment programs should therefore be safe, reliable, and cost effective. In addition, efforts to modernize government payment programs should be leveraged to accelerate the development of the NPS more broadly and to promote financial inclusion.

A. Governance, Safety, and Efficiency

GUIDELINE 1: Ensure proper program governance and risk management; governance arrangements should ensure accountability, transparency, and effectiveness in managing the risks associated with government payment programs.

GUIDELINE 2: Review and streamline treasury processes, then work on their automation; the treasury should devote extensive efforts to identifying all relevant needs with regard to improved safety, efficiency, and transparency.

GUIDELINE 3: Take full advantage of electronic payment methods; the extensive use of electronic payments in government payment programs can reduce costs and improve transparency and traceability.

GUIDELINE 4: Create appropriate organizational arrangements to foster the continuous development of government payment programs; the national treasury/ ministry of finance should consider engaging in collaborative schemes with the central bank and other stakeholders to identify additional improvement opportunities for these programs and, eventually, facilitate their implementation.

B. Legal and Regulatory

GUIDELINE 5: An appropriate legal framework with specific applicability to government payment programs can further underpin their safe and efficient operation; laws and/or regulations that provide clarity and

certainty to the various parties involved, and that promote effectiveness and transparency in the execution of programs, should be enacted/approved.

GUIDELINE 6: Laws and regulations on payment instruments and systems, competition, and consumer protection can also have an important bearing on government payment programs; the legal basis should support sound and fair practices in the marketplace and be flexible enough to accommodate innovations.

C. Payment Systems Infrastructure

GUIDELINE 7: An appropriate payments infrastructure should be in place; the potential to obtain substantial benefits from migrating government expenditures and collections to electronic payments relies on a payments infrastructure to process such payments safely, efficiently, and at a reasonable cost.

GUIDELINE 8: Maximize the potential of the available infrastructures through interoperability and widespread usage; the ability of PSPs to channel their payment operations through any of the key mainstream infrastructures promotes efficiency, network expansion, and a level playing field for all players.

D. Cooperation and Partnerships to Leverage Government Payment Programs

GUIDELINE 9: Adopt a strategic approach to the development of government payment programs; the reform of government payment programs has the potential to trigger the development of a robust payments infrastructure, which in turn will support the safe and efficient processing of government payments.

GUIDELINE 10: Leverage government payment programs to promote financial inclusion; the large volume of payments issued by governments, as well as the nature of some specific programs, such as social spending programs, represents an opportunity to promote or facilitate financial inclusion on a large scale.



IV. FEATURES THAT CBDC SHOULD HAVE (WHAT?)

A. KEY ASPECTS FOR CONSIDERATION

If improving payment system performance is, indeed, the jurisdiction's primary motive for issuing CBDC, then the CBDC design needs to be consistent with the specific NPS objectives that the central bank intends to pursue. It is thus essential to have a clear understanding of CBDC and how it should be designed (that is, which features it should have) to best serve its function as means of payment. To start with, CBDC would be a new form of digitized sovereign currency, typically denominated in the national unit of account and generally conceived to be equivalent to physical cash or central bank reserves. It would represent a liability of the central bank. It would be central bank money, akin to cash, and, as such, it would be legal tender and a component of the monetary base. It could be either held as an electronic token or stored electronically in a centralized or DLT-based account. Thus, in all respects (except for its material form), CBDC would be identical to cash and could serve as a medium of exchange, settlement means, and store of value, and it would be exchangeable at par. Appendix C describes the various forms of money used worldwide today.

As noted, CBDC could be accessible only by banks and other financial institutions (for wholesale payments), as is the case today with central bank reserves, or it could also be made available to individuals and corporations (as a general-purpose instrument for retail payments). Whereas envisaged forms of wholesale CBDC would possibly not alter the NPS landscape significantly,³¹ retail CBDC would mark a major change from the current status of the NPS, and its design and implementation would need close consideration. Making central bank money accessible in digital form to individuals, merchants, corporations, and financial institutions that usually do not have access to central bank reserves would

mark a major change in the way a central bank operates and provides payment and payment-related services. Also, an international dimension could be factored into CBDC design, thus providing domestic CBDC implementation with the necessary guidance to enable cross-border transactions via access by nonresidents and/or interlinking with international infrastructure.³²

There are important policy trade-offs between anonymity, privacy, and financial integrity, and the design of CBDC should reflect and be consistent with the public-policy objectives, legal framework, and broader societal expectations. Should CBDC users be anonymous, as physical cash users are, or should the digital nature of the instruments make its users' identities known? On the policy level, decisions about anonymity and digital cash use should be driven by principles, not technology. In particular, even if today's digital technologies allow the anonymity intrinsic to the use of physical cash to be overcome, to the extent that a society allows the continued use of cash as a way to protect anonymity in (certain) transactions and even the usage of certain other instruments characterized by anonymity or pseudo-anonymity (for example, bitcoin and other virtual currencies), the same characteristics could be allowed for the use of digital cash, subject to them not increasing the financial-integrity risks. Identification of CBDC users should not be required simply because its underlying technology allows for it; rather, it should be a question of legal rights and opportunity, even more so as CBDC is intended to replicate cash in the digital world.³³ Also, these principles should take into account, as appropriate, the existing AML/CTF-compliance regulations. On the operational level, users of DLT- or token-based CBDC would need access keys whenever they wished to transfer their tokens to other users. A DLT- or token-based system can be designed to be anonymous, so

that the identity of the users having access to the private keys would not be known to the central bank. However, it should be noted that transactions on account- and DLT-based digital systems are traceable, since the history of all transactions is stored on them. Also, it is possible that even in a DLT- or token-based system, regulators would insist that CBDC wallet providers carry out some know-your-customer (KYC) checks for holders.³⁴ On the other hand, with account-based CBDC, the identity of the account holders would typically be checked before opening the accounts, under KYC requirements. However, financial institutions have the flexibility to open accounts with limitations on balances, daily or monthly transactions with minimum identification requirements, or with a full exemption of identification or verification. This flexibility could in principle be built into account-based CBDC systems.

Privacy includes aspects such as determining the amount of data accessible to other counterparts to the transaction and reducing the data potentially exposed in case of security breaches.³⁵ For example, without a legitimate purpose or authorized content, a provider would have access to information about all of a person's transactions and make illegitimate use of this information. Technology allows for the separation of information about the account from information about the account holder. Thus, depending on the choices regarding CBDC design and the degree of intermediation by PSPs, the provider(s) of the payment interfaces could manage the information about the account holders, while the central bank would keep the accounts of all users on its books.³⁶

It needs to be noted that appropriate design and legal safeguards can ensure privacy even when the transactions are not anonymous. This is the case today, for example, in many jurisdictions that have strong privacy laws. In these jurisdictions, while the financial service providers have access to all the transaction and account information, they are legally prohibited from disclosing it without informed customer consent or under specific circumstances—for example, based on a judicial order in the context of law enforcement. Further, as noted in the previous paragraph, the extent of information available with the central bank would depend on the design choices.

Unlike physical cash, CBDC could be interest bearing. While interest-bearing CBDC could be attractive to users, a number of policy issues that transcend the realm of payments would have to be addressed. Central banks would have to consider these issues with particular attention in light of the

potentially significant implications of such CBDC features for monetary policy, financial market structure and competition, and financial stability. These issues are discussed in section V.

CBDC would likely incorporate some form of distributed technology, but DLT is not an essential feature. DLT was designed to shift the ledger from centralized to decentralized control. In a centralized system, a single institution performs clearing and settlement functions. In a decentralized system, multiple institutions (or nodes) might be granted equal and simultaneous control over their own individual copies of the ledger, and in principle any of them could be permitted to perform the clearing and settlement functions, based on consensus with other nodes, and replicate the changes to the other ledgers to keep all of them in synch. The consensus is achieved based on checks of both the previous records and certain cryptographic proofs that are created by the node. (See box 8.) Distributed ledgers are categorized as permissioned or permissionless, depending on whether network participants (nodes) need permission to join and participate in the consensus. Distributed ledgers are categorized as public or private depending on whether the ledgers can be accessed by anyone or only by the participating nodes in the network.³⁷ Clearly, a distributed ledger used for CBDC would most likely be permissioned, by central bank choice, and would be controlled by the central bank. Only some nodes could be operated by select financial institutions participating in the ledger, depending on the design of the CBDC arrangement. However, it needs to be noted that CBDC can be issued using traditional technologies, but it would not be possible to maintain a pure peer-to-peer transaction capability in such a model. Further, the transaction throughput required for a high-performance retail payment system might not be met using current state of DLT, though this could be addressed in the near future.

As per physical cash, CBDC can present significant risks from a security perspective. Cash in the form known and experienced for decades is a convenient means of payment and store of value. However, it presents risks for the security of the bearer due to crime, and for the security and integrity of the instrument due to counterfeiting and to the possibility of being damaged or destroyed. Similar in spirit yet different in nature, risks are present in CBDC due to cyber risk and potential frauds. They should be minimized as a matter of priority in the design and operation of the initiative.

For CBDC to perform efficiently—meaning accessible anytime anywhere and to anyone—users should be able to make transactions regardless of electricity or internet avail-

BOX 8 CONSENSUS MECHANISM IN DLT SYSTEMS

The CPMI describes a consensus mechanism this way: “A consensus mechanism is necessary to establish whether a particular transaction is legitimate or not, using a predefined specific cryptographic validation method. ... The consensus mechanism is also important to handle conflicts between multiple simultaneous competing entries—for example, different transactions on same asset are proposed by different nodes. This mechanism ensures correct sequencing of transactions and prevents take-over by bad actors (in the case of a permissionless distributed ledger). The consensus mechanism and sequencing protect against the... double-spend problem.

“The consensus mechanism is the process by which the nodes in a network agree on a common state³⁸ of the ledger. This process typically relies on cryptographic tools, a set of rules or procedures reflected in the protocol, and either economic incentives (applicable to any network configuration) or governance arrangements. Consensus generally involves two steps:

- **Validation:** each validator identifies state changes that are consistent according to the rules of the arrangement (that is, assets are available to the originator, and the originator and beneficiary are entitled to exchange the assets). In order to do so, each validator needs to rely on a record of previous states, either as a ‘last agreed state’ or as a ‘chain of previous states.’
- **Agreement on ledger updates:** nodes agree to state changes to the ledger. This stage of the consensus process involves mechanisms or algorithms that resolve conflicting changes to the ledger. The key challenge is to ensure that valid changes are made once and only once, by ensuring that state changes are synchronised across the distributed ledger.”³⁹

ability. Especially in developing countries, where electricity and telecom failures happen frequently, it would be necessary to allow CBDC users to execute transactions even in the absence of electricity and internet access. Off-line transactions require the system to store transaction balances, record and update balances, and transfer records of updated balances across transacting users.⁴⁰ Similar to stored-value cards, which allow a limited number of off-line transfers to be performed, CBDC should be designed to enable such functionality. In cases where some users do not have access to the CBDC infrastructure, or when a full or partial failure of the CBDC system occurs, users should still be able to use their CBDC holdings. Including this type of functionality would require considering the risk of fraud on off-line transactions. One can also envisage a solution where an individual can earmark a specific portion of their CBDC holdings for off-line transactions. The privacy treatment for the off-line portion could also be different.

Interoperability is an important design element. Upon developing a CBDC system, the design should make the best use of existing infrastructure. In principle, the system should be able to exchange value with other existing systems, such as the RTGS system and critical retail payment systems; it should be accessible from existing banking and payment

channels, such as internet and mobile banking; and it should make use of existing acceptance infrastructure, such as ATM and point-of-sale terminals and QR code-based merchant acceptance. Also, efforts should be required by PSPs to make CBDC accessible through the day-to-day payment use cases of the customers, merchants, and businesses. The degree of interoperability required will depend on the features chosen for CBDC, and full interoperability might not be required, particularly in the early stages of the CBDC implementation. Finally, it needs to be noted that achieving an acceptable level of interoperability within the NPS is an oversight objective of several central banks, so this principle could be easily leveraged for CBDC.

Finally, technology would allow for endowing CBDC with two important new features: smart contracts and programmable money. CBDC that is transferred directly—say, from the government to citizens—could be “programmed” to accept only certain types of transactions, such as for the purchase of food and medicine, and to reject others, such as gambling or purchases of alcohol, or to link its availability to specific contingencies. (For example, a declaration of a state of emergency—COVID-19, for example—would unlock prearranged relief payments.) Such a feature would turn out to be particularly useful during emergencies. (See box 9.)

BOX 9 CBDC AND PAYMENT SERVICES DURING EMERGENCIES⁴¹

In cases of national emergencies, when governments need to transfer money to people and facilitate their payments activity, CBDC may play a special role. As experience during the COVID-19 pandemic has shown worldwide, public authorities may encounter significant challenges in getting funds to those in need and enabling access to money. Often, the complexity of public funding programs slows down how quickly businesses and citizens receive the money and raises uncertainty as to whether and when the money will actually be made available. Failure to address these challenges aggravates the macroeconomic effects of the crisis and diminishes people's ability to weather them, increasing their frustration.

The use of CBDC, supported with adequate action to make it accessible to all, could be of great assistance in the context of emergencies. The central bank could agree to act as government agent and execute CBDC fund transfers on the government's behalf to individuals and businesses that the government identifies to be in need of financial support. The government could send direct payments through CBDC much more

rapidly than through checks or tax refunds and could provide geographically and temporally targeted relief. The CBDC-supporting infrastructure would also enable fund receivers to make payments and transfers seamlessly to other CBDC holders and/or non-CBDC holders, anywhere and anytime across the economy.

The use of CBDC could reinforce the resilience of a country's retail payment services, especially in cases where private-sector infrastructures are disrupted due to, say, technical problems, personnel unavailability, or inability of service providers to operate. During crises, CBDC could be used as a payment conduit for delivering stimulus packages to households and businesses; this would be especially useful when businesses are at risk of closing because they have run out of money and when people lose their jobs or become ill.⁴²

It should be noted that similar effects could be achieved by using existing payment infrastructures enhanced with fast payment solutions, provided that all parties have access to transaction account facilities.

Programmable money could be implemented via the use of "smart contracts." These would enable the simultaneous transfer of assets on different ledgers in a payment-versus-payment settlement system: A programmable DLT- or token-based CBDC could be transferred from user A to user B on the condition that the transfer of funds on another ledger from user B to user A would take place simultaneously and without the risk of either having all of the funds in the custody of one user at any point of time or having only one leg of the transaction completed.

B. POLICY RECOMMENDATIONS

In the process of determining the type and model of CBDC to be chosen for implementation and the key elements that CBDC should feature (What?), the central bank should take into account the following three key policy recommendations:



BE FAIR! *CBDC, especially retail, should integrate smoothly with other payment instruments or schemes, and its introduction should be consistent with the need to balance competition and cooperation within the NPS.*

The introduction of CBDC should not detract from, and should possibly integrate with, private-sector initiatives. Even if motivated to introduce CBDC, the central bank should not exclude its blessing and even support to solutions that meet similar needs and policy objectives that CBDC aims to achieve and, where possible, should exploit synergies between CBDC and other solutions. This should hold in particular when the solutions under consideration are already known and widely (and successfully) tested and implemented. One such example is fast (also known as instant, real-time, or faster) payments.⁴³ Despite similarities between CBDC and a fast payment system, it is not necessarily an either-or choice, since the two solutions could

coexist (the same way physical cash coexists with other means of payments). For instance, wholesale or retail CBDC could potentially be a settlement asset for fast payments. Also, potential differences in nuances of these instruments regarding finality, anonymity, and credit facilities would most likely justify the coexistence of both CBDC and fast payments.

CBDC could generate competitive pressure, especially on the retail side. Where the market is characterized by the dominance of relatively inefficient payment services provided by less-than-innovative players, the introduction of CBDC could exert pressure on the efficiency of other payment instruments and support a positive disruption in the market. For example, as retail CBDC might be offered in principle at little or zero cost to the payers and payees—much as for cash today—it could improve the overall efficiency of the retail segment of the NPS by pressing private-sector providers to attain greater efficiency on the instruments they issue and to supply customers with higher quality and an expanded range of services.

Balancing cooperation and competition within the NPS should remain a guiding principle when introducing CBDC. Design choices such as the two-tier models discussed in section VI below, where the central bank issues CBDC while PSPs compete to distribute it and to offer CBDC payment services to users, might represent in some jurisdictions an appropriate division of labor across NPS stakeholders based on their different comparative advantages and, hence, less disruptive ways to introduce the new instrument in the payments market. Also, to the extent that CBDC distribution and circulation would open up to non-bank PSPs, its introduction would increase competition within the NPS, with the central bank providing access, settlement, and information services and the private sector competing to meet the last mile. All relevant stakeholders should cooperate to set up an interoperable, scalable, and reliable operational infrastructure (either conventional or DLT based) under appropriate oversight requirements and standards. Box 10 describes a framework developed by the World Bank for balancing cooperation and competition in the context of payment systems that could be relevant also in this context.

BOX 10 WORLD BANK GUIDELINES ON BALANCING COOPERATION AND COMPETITION⁴⁴

- ➔ Market complexities need to be recognized and analyzed in detail before any action is decided on and implemented.
- ➔ Environmental, legal, and legacy factors, and governance of the infrastructure, have a significant impact on cooperation/competition; gaining access to messaging and clearing and settlement services is of capital importance for new entrants in the market.
- ➔ Policy trade-offs are relevant in this domain. Therefore, policy priorities will have to be determined, and the type of public intervention should depend on the main public objective(s) pursued.
- ➔ Public-policy objectives in retail payment systems are multiple. The justification for intervention depends upon the main public-policy objective(s) pursued and evidence of perceived market failure; *ex ante*, transparent determination of policy objectives is desirable.
- ➔ Effective oversight of retail payment systems by the central bank is crucial to balance cooperation and competition issues.
- ➔ Effective oversight is the main tool to achieve an appropriate balance between cooperation and competition, central banks being the “natural” payment system overseers in cooperation with other authorities; the scope of the payment system oversight function should be broad or flexible enough to cover new instruments and players.
- ➔ Institutional mechanisms to promote cooperation and information sharing are essential.
- ➔ Fragmentation of relevant policy makers and scope of their mandates may be an issue; authorities’ cooperation frameworks need to be strengthened/broadened; payment councils, industry associations, and similar bodies should be leveraged.



BE NEUTRAL! *CBDC should at least maintain the same level of market integrity that existed before its introduction.*

CBDC should be compliant with AML/CFT regulations and requirements and guarantee at least the same level of market integrity that is required of the existing instruments. Financial Action Task Force provisions should be applied as needed to the planned CBDC, and compliance with them should be ensured through its entire life cycle. In this context, an analysis of CBDC from an AML/CFT perspective would be necessary. This implies that the identity of CBDC users, at least above certain transaction thresholds, might need to be known to at least some authorities or regulated institutions in the wider CBDC network, which can validate the compliance of these transactions with prevalent laws and regulation. As the Bank of England argues,⁴⁴ one possibility to operationalize this arrangement would be for the core ledger to store only pseudonymous accounts and balances and for each account in the core ledger to be linked to a PSP that knows the identity of each user. The PSP would be responsible for applying AML/CFT checks to users and for reporting suspicious transactions to the relevant authorities.⁴⁵ Based on this solution, the central bank would not hold granular personal data on users (thus reducing the privacy concerns that could arise in connection with holding personal user data), yet AML/CFT requirements could still be met by CBDC. Consistently with the above provisions, payments and balances below certain thresholds might be granted a simplified regime.

However, the adoption of AML/CFT criteria to CBDC should be based on the proportionality principle and risk-based approach. For example, to the extent that retail CBDC would be a direct substitute for physical cash, the same anonymity (with restrictions) that authorities are prepared to accept for the use of cash could identically be accepted for the use of CBDC. Moreover, in the context of cross-border transactions, to the extent that CBDC could expand the pool of entities in a country that can offer services to entities such as remittance service providers, CBDC could contribute to addressing the loss of correspondent banking access that some service providers have experienced—also referred to as “de-risking.” However, these potential advantages are yet to come and will have to be tested.⁴⁷



SUPPORT GLOBAL PAYMENTS! *Where used for cross-border payments such as international remittances, CBDC should enhance the efficiency and safety of the global payments system.*

A general perception is that cross-border payments lag behind domestic ones; CBDC can help make considerable improvements. CBDC models are being designed to facilitate cross-border payments and payments.⁴⁸ A recent assessment by the Financial Stability Board of the existing cross-border payment arrangements identified four types of important challenges: cost, speed, access, and transparency.⁴⁹ These challenges affect a number of different stakeholders on the supply side (bank and non-bank PSPs, payment system operators, and technical service providers) and the demand side (end users composed of individuals, businesses, and government agencies) and affect each of them in different ways. Appendix D considers the specific challenges that fall under each of the four types and indicates how cross-border CBDC could address them.⁵⁰ The CPSS-World Bank *General Principles for International Remittance Services* (see box 11) and the recent CPML report on cross-border payments provide guidance to this extent.⁵¹ The timing of the launch of a cross-border CBDC initiative, if any, should be carefully planned vis-à-vis its domestic implementation, which in most cases would precede it.

Obviously, the recommendation above to avoid missteps remains valid. In a CBDC cross-border scenario, there would be risks, including those of currency substitution, the undesirable effects of monetary policy, and the impact on the central bank’s balance sheet from foreign demand for the monetary instrument. Also, as regards financial stability, the risk of cross-border bank runs would emerge, and both financial stability and the smooth functioning of the payment system could be affected by the disintermediation of the banking system and existing PSPs. Thus, in considering how CBDC could support cross-border payments, very careful consideration should be given to such risks.⁵²

BOX 11 THE CPSS-WORLD BANK GENERAL PRINCIPLES FOR INTERNATIONAL REMITTANCE SERVICES

GENERAL PRINCIPLE 1: Transparency and Consumer Protection

The market for remittance services should be transparent and have adequate consumer protection.

GENERAL PRINCIPLE 2: Payment Systems Infrastructure

Improvements to payment system infrastructure that have the potential to increase the efficiency of remittance services should be encouraged.

GENERAL PRINCIPLE 3: Legal and Regulatory Framework

Remittance services should be supported by a sound, predictable, nondiscriminatory, and proportionate legal and regulatory framework in relevant jurisdictions.

GENERAL PRINCIPLE 4: Market Structure and Competition

Competitive market conditions, including appropriate access to domestic payments infrastructures, should be fostered in the remittance industry.

GENERAL PRINCIPLE 5: Governance and Risk Management

Remittance services should be supported by appropriate governance and risk-management practices.

ROLES: Remittance Service Providers and Public Authorities

Remittance service providers should participate actively in the implementation of the general principles.

Public authorities should evaluate what actions to take to achieve the public-policy objectives through the implementation of the general principles.



V. THE APPROPRIATE TIMING FOR CBDC (WHEN?)

A. KEY ASPECTS FOR CONSIDERATION

Defining the appropriate timing of CBDC implementation—that is, deciding when CBDC should eventually be launched—rests on the existence of sufficient conditions. In addition to the conditions discussed earlier (see section II), the central bank should verify whether the necessary infrastructures are available or need to be developed. These comprise a national information and communications technology system and, depending on the features chosen for CBDC (section IV), may need to include a national ID system and a widespread network of PSPs. A well-functioning and affordable national information and communications technology system, with adequate network coverage, is a critical support for all digital payment instruments and services, and for CBDC as a critical one of them. Furthermore, depending on the KYC regime that will apply to CBDC, the operators and providers involved in its distribution and circulation must be able to access the personal identity information of users. A national ID system would support CBDC by authenticating the identity and uniqueness of its users and by meeting KYC regulatory requirements, and it could be used to cross-reference identities to PSP accounts.⁵³ The use of electronic KYC facilities would allow for digital or online verification of CBDC user identity. Finally, in the context of the two-tier model discussed in section IV, PSPs would have to be engaged to deliver CBDC, offer CBDC payment services to users, and handle relations with users. The central bank might need to enter into contractual agreements with PSPs and design adequate incentives for PSPs to set up the internal systems and procedures to handle CBDC and incorporate CBDC-related service as part of their business concern. These PSPs might further need to engage third-party agents to enable users to deposit and withdraw cash (also referred to as cash in, cash out) and for other agent-assisted services.

Deciding when CBDC should be launched would ultimately depend on the central bank's and relevant public authorities' readiness to deal with its broad array of implications. Here, the use of pilots would prove essential. Pilot programs would allow testing of the relevant aspects of the new currency in a controlled, live environment and enable it to address its potential impact and attendant risks without affecting stakeholders. Countries that are not ready to embark on CBDC initiatives should follow the progress of countries experimenting with CBDC or piloting CBDC programs, learning lessons and building knowledge on the subject. On the other hand, following in the long cooperative tradition of the international central banking community, the central banks and relevant public authorities that are already active on the CBDC front should stand ready to provide guidance or technical assistance to sister organizations that need support.

If motivated by NPS objectives, the central bank should be fully confident that the introduction of CBDC would at least not harm the achievement of other policy objectives and the discharging of its related responsibilities. Critical in this regard are the implications of CBDC for monetary policy and financial stability, especially for countries that might be dragged into currency substitution (for example, substitution with a leading international or regional reserve currency) if CBDC issued by major economies were made accessible to nonresidents. While central to the discussion of CBDC, these aspects have been studied in the context of several contributions by central banks and international organizations.⁵⁴ Given the scope of this guide, they are only summarized in this section (and more extensively discussed in appendix E). As critical is the need for the central bank to understand how the legal basis and the oversight policy framework for the NPS should be adapted before CBDC launch.

Monetary Policy and Financial Stability

The international central banking community generally holds that CBDC would have a limited impact on the effectiveness and implementation of monetary policy.⁵⁵ Such an impact would depend on the design features chosen for CBDC and the attractiveness that CBDC would exert on public preferences for money instruments. If, for instance, CBDC were widely accessible and paid a positive interest rate to its holders, it might prove very attractive to people and make outcomes of monetary policy more pronounced due to stronger substitution effects.⁵⁶ The CBDC interest rate would establish a hard floor under money-market rates, and by exposing a broader section of the economy (households and financial and nonfinancial businesses) to an interest-sensitive instrument, the transmission mechanism of monetary policy could be strengthened. Also, depending on its design, CBDC could lead to stronger and faster exchange-rate movements for given policy interest-rate changes. Furthermore, depending on design features, CBDC issued by a reputable country and available to nonresidents could induce stronger international spillover effects in terms of additional volatility in capital flows, exchange rates, and interest rates.⁵⁷ In addition, countries with weaker monetary-policy tools might find it more difficult to manage any monetary-policy implications of CBDC, and in countries suffering from poor policy credibility, or where the central bank lacks independence, the introduction of CBDC might create incentives for government to abuse the monetary levers.

If widely used, CBDC would add to the central bank's set of monetary-policy tools. If CBDC were interest bearing, the central bank could apply negative (nominal) interest rates as a way to stimulate aggregate demand: in a world without cash or where the use of cash was limited, the public would be discouraged from holding CBDC paying a negative interest rate and would rather spend it. Also, CBDC would enable the central bank to effect "helicopter drops"—that is, to make transfers of funds directly to individual agents (in the form of gifts), possibly in combination with "programmable monetary policy" features (for example, transfers with an "expiry date," or conditional on being spent on certain goods and services). These tools would enable the central bank to execute monetary-policy operations in a more precise and rapid way than with conventional or unconventional types of monetary instruments. Depending on the situation, these tools could be applied universally (that is, on all accounts) or on a selective basis.

CBDC of reserve-currency countries available across borders could facilitate currency substitution in other countries.⁵⁸ If a reserve currency were available in CBDC form, even economies with stable currencies could be digitally dollarized if their citizens found themselves often transacting with users of digital platforms in that currency. This could have monetary-policy implications since currency substitution would weaken and (in the limit case) even neutralize the effects of monetary-policy changes. It could also have financial-stability implications insofar as the national currency of countries suffering from high inflation and exchange-rate volatility might be supplanted more easily and rapidly by CBDC of a reserve-currency country if access to the latter was made available (and authorized) by both the country of issue and the receiving countries.

CBDC could affect financial stability. This would be the case if the availability to the general public of CBDC as the safest and most liquid asset in the economy, as well as its immediate accessibility on demand, were to make it highly preferable to bank deposits. Under such conditions, the resulting loss of funding to banks might jeopardize their money-creation function via lending.⁵⁹ This would reduce the overall elasticity of the money supply in the economy—that is, the capacity of the money supply to satisfy dispersed demands for it, which the banking system typically ensures through its decentralized credit-allocation decision process. Banks would possibly be forced to fund their loans with costlier financing than sight deposits, which would not even be possible in countries with underdeveloped money and capital markets. This might reduce the overall supply of money and require the central bank or government (through the budget) to implement compensatory measures. Finally, CBDC could lead to disintermediation of the private financial system, especially where this is perceived to be undercapitalized and poorly run.

Under extreme circumstances, CBDC might facilitate bank runs and accentuate financial crises.⁶⁰ Although it is already possible for customers to switch to central bank money by having their bank deposits paid out in cash, in practice they are dissuaded by the costs and obstacles involved in holding and handling large amounts of cash. This could change with CBDC, as the flight to CBDC would be immediate and free of charge. CBDC could thus allow for "digital runs" toward the central bank at much greater speed and scale than is possible today or create an exchange rate between CBDC and other forms of central bank money. Introducing limitations to deposit convertibility into CBDC could increase the risk of generalized runs out of the banking sector.

Legal Aspects

The introduction of CBDC might require amending existing legislation.⁶¹ The need for legal adjustments would differ considerably depending on how CBDC were designed and on the existing legal order in the relevant jurisdiction. However, several general legal issues need to be considered for the concrete implementation of any of the described options. These require careful consideration, since legal uncertainty might impair any choice, irrespective of how well pondered and prudent it could otherwise be. In particular, the following general issues should be addressed.

The central bank needs to have the authority to issue CBDC. In general, central banks have the power to issue currency. Unless relevant legislation expressly states otherwise (for instance, by specifically stating that currency can take the form only of banknotes and coins, and so implying that these are paper-based banknotes and metallic coins), the central bank should be able to issue currency also in digital form.⁶²

The issuing of CBDC must not conflict with any of the central bank's statutory objectives, tasks, and assignments. Provided that the central bank can issue currency also in digital form, the kind that the central bank may choose from the options above must be consistent with the recognized objectives of the functions and tasks of the central bank, as stated in relevant central bank and/or monetary legislation. Depending on how the CBDC mechanism is designed, this may mean that the central bank supplies lending or receives deposits from the public, which might be not permitted when addressed to the general public. If the central bank were to supply CBDC accounts, especially if these could accrue interest, these would be regarded as deposits.

Safe and efficient payment systems must be safeguarded. Central banks usually have the task of promoting a secure and efficient NPS. In practice, this entails several subtasks according to relevant legislations, such as providing not only systems for the settlement of payments but also means of payment, both in physical form and as electronic holdings in accounts. If the legislation contains no explicit ban on electronic holdings in accounts, and if the CBDC mechanism contributes to a safer and/or more efficient payments system, CBDC could be deemed consistent with the central bank mandate.⁶³

The CBDC must be considered legal tender under the country's legal order. Normally, only banknotes and coins issued by the central bank are deemed to be legal tender—that is, no one can refuse banknotes and coins as valid payments.

In practice, however, parties can derogate to such principle and be bound to accept bank money by contract. Moreover, in the plurality of countries, it is recognized practice to accept bank money as legal tender (that is, as valid payment that it is believed cannot be refused). It must be ensured that this would also apply to CBDC.⁶⁴

However, if CBDC is legal tender, creditors need to be provided with options for the types of payment instruments they accept, based on the cost, technology, and risk associated with each instrument. Parties to transactions are normally free to agree on the kind of instrument they are ready to accept for payments, based on the cost, needed technology, or risk of the instrument used. Thus, in the absence of legal clarifications to this extent, the introduction of CBDC might raise inconsistencies. For example, whereas CBDC, as a liability of the central bank, would be considered legal tender (and its acceptance would thus be compulsory), creditors might not be equipped to accept it for payments. Similarly, public-policy considerations may lead the central bank (or any other relevant authority, where this is not the central bank) to impose regulatory restrictions on the use of specific payment instruments. (A well-known example is the imposition of limits on the use of cash, checks, or e-money.)

It must be assessed whether relevant e-money legislation applies to CBDC. E-money legislation currently exists in many countries and establishes several specific regulatory requirements for such instruments. However, definitions of e-money differ according to domestic legislation. Consequently, it must be assessed whether such legislation would also apply to digital currency in general and to CBDC in particular. If this is the case, it must be assessed whether all relevant provisions would be appropriate to CBDC.⁶⁵

However, no legal confusion should arise between CBDC and e-money. CBDC would be a liability of the central bank, and CBDC holders would hold claims on the central bank. In contrast, e-money is a liability of its issuer(s), and its holders would hold claims on its issuer(s) even where regulation requires the funds received in exchange for the e-money to be held at the central bank. Also, while a central bank can create additional liabilities—including CBDC—by fiat, e-money issuers may not do the same, since their liabilities must be matched by the funds received in exchange. While concerns about the existence of the underlying matched funds can raise doubts about the value of e-money, this cannot occur with CBDC.⁶⁶

If a central bank issues CBDC to the general public, it should be subject in principle to the same standards and rules as any e-money-issuing PSP.⁶⁷ In addition to AML/CFT regulations (such as KYC regulations and overseeing transactions), these would also include provisions for data protection, consumer protection, responsibility for unauthorized transactions, taxes, provisions on privacy and legal standards on security and protection against cyberattacks, and the like. Any challenge to user data or breach of security leading to misappropriation of funds might affect trust in the instrument and jeopardize the central bank's reputation. Whereas cash entails other risks (including those of forgery or theft), CBDC is subject to risks related to the technology that underpins its use and circulation. Also, in a two-tier system, the failure of a PSP would trigger claims on the intermediated CBDC. The argument could be made, however, that CBDC should fall under the same legislation as physical cash, which normally is not subject to the same legislation as for other payment instruments, or be governed by a different legislation altogether.

The use of CBDC would require data and privacy protection. As for all digital financial services, breaches of privacy and data security may result in identity theft, harm to financial records, fraud, and other risks. Mitigating such risks would necessitate legal and regulatory provisions that, among other things, clarify the rights of users, define data types, give control to users over their personal data, and set out the legal obligations of data controllers and processors when interacting with data users and with each other.

Each option chosen also needs to be carefully assessed under the private law of the relevant country. As declared since the outset, the legal issues identified above are general and are not meant to address individual features of each option or model. However, it must be stressed that any "token-based" model might imply a debate on the legal status of a "token"—that is, whether it is considered a digital asset, implying that it is not a fungible good. Although this would touch on the never fully resolved issue of the legal status of money, which goes beyond the analysis of the specificities of CBDC, legal certainty requires clarity to be made also in relation to this aspect under the relevant legal order.

As regards the use of CBDC for cross-border payments, several critical legal issues must be addressed. First, in a cross-border context, CBDC would be exposed to a variety of legal systems; conflicting laws or regulations might cause the expected effects of a transaction not to materialize or unexpected consequences to occur. Second, situations should not arise where a country would accept a currency under

a specific form (say, cash) from another country but would refuse to accept CBDC from the same country. Third, jurisdictions adopting CBDC for cross-border payments through a common infrastructure should determine what the relevant "applicable law" is and formally recognize it. For instance, in the case of a regional payment system whose cross-border operations were integrated, the applicable law would be the law of the jurisdiction where the processing, clearing, and settlement of payments take place.⁶⁸ Fourth, interjurisdictional differences in data collection and data-protection rules might affect the use of CBDC for cross-border payments. Finally, the cross-border use of CBDC might raise legal issues, as digital transfers might not be fully recognized in all relevant jurisdictions, the transfer of data might not be adequately regulated, data might not be protected in each jurisdiction, and the decentralization of transfers through the progressive record into nodes might challenge the relevance of the applicable law. Overall, if different legal systems govern the same events differently, the resulting fragmentation could affect the legal soundness of cross-border payments.

Even in the presence of an agreement governing a cross-border infrastructure, the legal system of each jurisdiction participating in the agreement would have mandatory rules that might not be superseded by way of agreement or contract. Conflicts between the legal systems involved could not be fully resolved by agreements or the selection of the applicable law. Rules that are considered mandatory, irrespective of the applicable law, should be applied. Thus, participating jurisdictions would need to try to adopt some key common rules and standards to the extent possible. Particularly in the case of cross-border CBDCs, each participating jurisdiction should recognize digital transfers as enforceable for CBDC to be accepted and to be protected from legal risk. In the same vein, participating jurisdictions should share the same standards for verification and enforceability of the final execution of transfers under all circumstances, and similarly for cybersecurity and protection from foreign-exchange risk.

Oversight of the NPS

Today, central banks hold significant oversight powers over their NPS.⁶⁹ As discussed, these powers (legally recognized either in new payment system laws or through amendments to existing laws) do not necessarily capture the likely development, deployment, and use of CBDC as either a retail payment instrument or a wholesale settlement asset, given that this is an issue that has gained traction only recently.⁷⁰ Nonetheless, it is critical to analyze how the concept of oversight can be applied to CBDC.

A CBDC system would be classified as a systemically important financial market infrastructure. This is because it would be presumed to be used for processing and settling time-critical, high-value payments in the economy, among others.⁷¹ On this premise, a CBDC system should be subject to the relevant PFMI. The oversight unit would be responsible for ensuring that the CBDC system functions safely and efficiently and would be tasked with implementing the five responsibilities under the PFMI. To this end, it should cooperate with other regulatory entities domestically as well as internationally if CBDC were used for cross-border payments.

If retail CBDC were DLT or token based, it could be conceptualized as a bearer instrument akin to cash. Thus, drawing a parallel, the central bank should determine how CBDC issuance, circulation/distribution, redemption, destruction, operational reliability, security, and customer-redress issues should be organized internally from an operational perspective. From an oversight perspective, a good practice is to separate the policy and control activities from operations of payment systems and services managed by the central bank. The same principle should apply to CBDC. Currently, it is a fact that the NPS overseer in many central banks does not devote significant time to steering and controlling cash production and distribution, while the audit functions over cash are delegated to other units. On the contrary, the NPS overseer would need to oversee CBDC in all its components, and this need might also change the way NPS overseers handle physical cash-related matters moving forward.

Central bank oversight would be critical for the safe and efficient functioning of the infrastructures where CBDC circulates. This would hold equally whether the CBDC system were operated by the central bank or a market entity. In either case, the oversight unit of the central bank should be fully involved in the process. Also, the unit should contribute to the design features and overall security of CBDC.⁷² In particular, oversight would have to consider the security aspects involved in constructing and deploying CBDC and in running the CBDC system. In addition to securing the underlying storage and transfer of value, security involves aspects of privacy and resilience. Threats must be mitigated to protect the integrity of funds and the confidentiality of users. A secure CBDC system will retain public trust in the central bank.⁷³

Going forward, it is likely that certain oversight aspects would gain criticality. Emphasis will be greater on higher operational reliability, cyber resilience, cybersecurity (especially in DLT platforms where there might be no single point of failure but vulnerable points for cyberattacks), and inter-

dependencies and linkages with other financial market infrastructures. A well-functioning CBDC system will require an extremely resilient, secure, and performant new infrastructure that possesses the ability to onboard, authenticate, and support users on a massive scale. It will necessitate an architecture simple enough to support modular design and rigorous security analysis and flexible enough to accommodate current and future functional requirements and use cases. The CBDC system will also need to address the innate tension between privacy and transparency, protecting user data from abuse while selectively permitting data mining for end-user services, policy makers, and law-enforcement investigations and interventions.⁷⁴

The relevance of central bank oversight would be evident in the context of CBDC clearing and settlement. This is because payment clearing and settlement systems facilitate the exchange of money for goods, services, and financial assets, and their inefficiency or failure would cause money not to fulfill its purpose effectively and to impair public confidence in money and the systems used to transfer it.

B. POLICY RECOMMENDATIONS

In the process of determining the timing for implementing CBDC (When?), the central bank and relevant public authorities should take into account the following three key policy recommendations:



AVOID MISSTEPS! *At a minimum, CBDC issuance for NPS purposes should not exceed the existing infrastructure capacity and should not negatively affect the other critical central banking functions: monetary policy and financial stability.*

The central bank should decide to proceed with CBDC only when it is confident that the infrastructure needed to support it is adequate. In addition to a well-functioning and affordable national information and communications technology system, as discussed, CBDC may require an effective national ID system and a widespread network of PSPs and reliable payment systems. CBDC features that would exceed the existing infrastructure capacity or that would not be accompanied by sufficient capacity buildup would result in inefficient and unsafe CBDC services and would negatively affect the economy and reflect badly on the central bank's reputation and public trust in the currency.

Also, the central bank in co-ordination with relevant public authorities should decide to proceed with CBDC after gaining a clear understanding of user needs. This would hold, for instance, where the central bank aimed at achieving rapid and large diffusion of the new instrument across the public, especially in the absence of an adequate supply of digital payment services from the private sector. In other cases, however, the central bank might not necessarily see an immediate, pressing need for CBDC or a potential demand for it, yet it may foresee that need or demand to arise at some point in the future and accordingly may want to provide for CBDC as an option for public use, should the need for it eventually emerge. In any case, the central bank will have to apply Lean and Agile principles to issue an instrument that is intended to support (potential) user needs and to do so in an effective and efficient way.⁷⁵

Furthermore, the central bank and relevant public authorities should decide to proceed with CBDC only when it is confident that the design chosen for it would not harm the effectiveness and implementation of monetary policy and that it will not affect financial stability and other policy objectives. The risks discussed above could be avoided if CBDC purchases were subject to quantitative limits, analogous to the limits applicable in many jurisdictions on cash withdrawals from commercial bank deposits. Under such limits, deposit holders would not be allowed to convert their deposits into CBDC beyond a certain threshold, thereby preventing dangerous hemorrhages from the banking system, particularly during times of stress. Imposing limits, however, would also bear negative consequences.⁷⁶

As an alternative, the central bank could consider adopting a dual remuneration regime. According to this regime, a relatively attractive remuneration would apply to CBDC up to a quantitative ceiling and a lower interest rate would apply to larger amounts.⁷⁷ This would allow CBDC holdings below the threshold to serve as means of retail payments, while those beyond would act as a store of value. However, with a dual regime, a relatively high first-tier remuneration could be used to encourage below-threshold CBDC holdings, while a relatively less attractive second-tier remuneration could be used to discourage above-threshold CBDC. This way, CBDC would not become a large-scale store of value, and the risks discussed earlier would be prevented. Finally, this regime would preserve the ability to apply negative rates, since remuneration could always be applied in a way that does not undermine the monetary-policy stance. It must be noted, however, that for this regime to be effective, the central bank should have a way to ensure that one person/entity maintains only one account or should be able to tie all

the accounts of the individual/entity. This would necessarily require a universal identity system. Further, specific country contexts need to be taken into account, and the potential for other unintended consequences should be evaluated.



FIX THE LAW! *Launching CBDC should be preceded by the necessary legal and regulatory changes to ensure that the rights and obligations of its stakeholders are legitimately recognized and enforced.*

The central bank and relevant public authorities should decide to proceed with CBDC only when all relevant legal aspects have been resolved or clarified. Although constraints could exist in national legal orders to CBDC, they might not necessarily impede its establishment. Yet they could require some significant amendments to extant legislation and new regulations to be issued. The legal basis should be tightly framed to give the necessary support for the CBDC initiative; the mere tweaking of the existing legal framework might not suffice. As the legal basis is assessed, it should be borne in mind that legal and economic concepts do not always match each other exactly; consequently, the scope of the definitions adopted should be considered carefully to translate the policy objectives of CBDC in correct legal and regulatory terms. In the process of adapting the legal basis for CBDC, it will be critical to make sure that legislation permits the central bank to issue CBDC as legal tender and to endow it with the design features that the central bank deems desirable. More broadly, consideration could be given to the idea of establishing CBDC under a stand-alone regulation. Especially in light of the noted differences between e-money and CBDC and the policy considerations discussed earlier, and taking into account the relevant responsibilities (as well as the risks) falling upon the central bank from CBDC issuance and management, CBDC could be regulated separately from other payment instruments that are issued by private-sector entities. In addition, the aspect of “anonymity” in the usage of CBDC and addressing any data and privacy risks might require adaptations of the legal framework.

When central banks are involved in cross-border arrangements, they can stipulate agreements subject to international law side-stepping domestic laws; however, these can have negative consequences. If an infrastructure is planned for the operation of cross-border CBDC, it can be established by way of international agreement and made subject to international law to side-step any constraint imposed by domestic law. An infrastructure that would be subject to international law would be governed independently of the national laws of the participating countries. However, this

solution might have its own drawbacks, since central banks offering services under international law, which compete with services supplied by the private sector under national law, would risk distorting competition. Moreover, if international law applies, it is still common practice to respect high standards. Especially when domestic rules derive from the application of international standards, central banks found not to be fully compliant with such standards face reputational risk.



STRENGTHEN OVERSIGHT! *The central bank's NPS-oversight policy and activities should be strengthened as needed to ensure that CBDC is fully consistent with public-policy objectives.*

The central bank should decide to proceed with CBDC only when its oversight framework is ready to handle it. The central bank will have to gear up to take on this new challenge while adhering to the time-tested principles of effective oversight of the NPS. Oversight capacity will have to be at par with the difficulties and uncertainties of the new task. As in the case of any payment instrument and system, the degree of emphasis on the various aspects of CBDC might require different specific efforts, but the basic tenets of oversight would continue to apply to ensure its safe and efficient operation.

Some of the other issues that overseers could be confronted with would depend on the type of CBDC adopted. Illustratively, this would include the use cases of CBDC. (For

example, would CBDC be used only for person-to-person payments or for various other use cases, such as among persons, businesses, and government agencies?) Depending on the use cases, the central bank may have to decide on the account-holding structure it would have to adopt and the distribution model for CBDC. Another issue is how easily users would be able to convert CBDC into commercial bank money and vice versa, and the interlinkages between the two, while at the same time addressing issues of interoperability. The fee structure (if any) would also have to be devised by central banks for CBDC use. The central bank would have to account for the likely impact on private-sector innovation and competition in the payments arena. Also, the central bank should consider the need to reskill its staff to carry out the oversight function effectively. Finally, central bank management should ensure a high level of coordination between various central bank units involved in all material aspects concerning CBDC management.

In the operation of cross-border CBDC payment systems, cooperative oversight mechanisms would need to be strengthened (where they already exist) or established anew. The CPMI and IOSCO recently evaluated several ways in which authorities have established cooperative oversight frameworks.⁷⁸ Though such frameworks largely cover oversight arrangements for financial market infrastructures with cross-border activities, select elements of such frameworks could be used for designing and establishing cooperative oversight arrangements for cross-border CBDC payments as well.



VI. THE RIGHT INFRASTRUCTURE FOR CBDC (WHERE?)

A. KEY ASPECTS FOR CONSIDERATION

Once the central bank in co-ordination with relevant public authorities chooses the design features that CBDC should have, it must consider “Where?”—that is, in which type of infrastructure—CBDC should be issued and circulated. In doing so, the central bank should be guided by considerations of the efficiency and safety of such infrastructure. Three models are here discussed: wholesale, one-tier retail, and two-tier retail. A wholesale CBDC model, similar to existing RTGS systems, would be operated by the central bank and accessible only by a set of banks and non-bank financial institutions based on appropriate, fair, and transparent risk-based considerations.

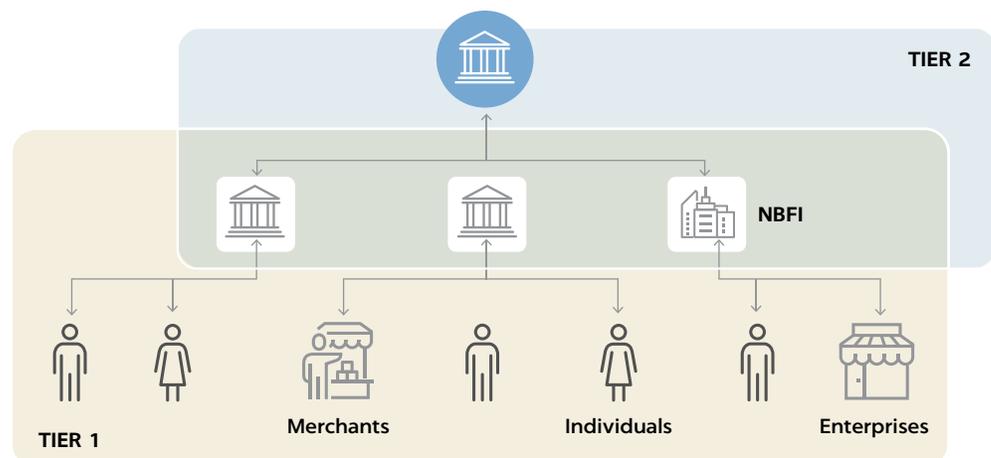
Wholesale CBDC

The central bank would perform multiple roles in the context of wholesale CBDC. The central bank would manage the issuance and redemption of CBDC; manage system participation and enable participants’ access to the system; administer the transfer of CBDC among participants; create linkages with other financial market infrastructures, stablecoin arrangements, and digital asset platforms; and oversee the system.

Retail CBDC

Retail CBDC could potentially be made accessible to all individuals, enterprises, and other entities. Retail CBDC could be arranged in one or two tiers. (See figure 4.) In a one-tier retail CBDC, the central bank would operate the CBDC infrastructure, distribute CBDC directly to the public, and manage the accounts of all users (individuals and enterprises), keeping records of all balances and updating them with every transaction. In this type of model, the central bank could outsource some operations, such as the user interface, call center, and the handling of user complaints. In a two-tier model, the central bank would distribute CBDC to the public via intermediaries, typically referred to in this guide as PSPs, which could be banks or non-bank entities and would be licensed and overseen by the central bank. In a two-tier system, the first tier could have functions similar to those of a wholesale CBDC system. In both models, the central bank would be the issuer of CBDC, and CBDC would be a liability of (claim on) the issuing central bank.

FIGURE 4 One-Tier and Two-Tier Models



Source: Own elaboration

In light of the strategic objectives of the central bank, the two models might need to coexist. As the central bank will hold the responsibility to make CBDC available to all the economy's agents (as this is the case for physical cash), it will have to mobilize all the resources needed to this end. In practice, this means that, where feasible, the central bank will have to leverage private-sector PSPs, which are best positioned to interface with customers, to deliver CBDC services. Also, if necessary, the central bank will have to use alternative solutions, including creating dedicated capacity or using agent networks, to ensure that CBDC is made available to customers of regions that are not reached by private-sector providers.

One-Tier Model

In a one-tier model, access to the system could either require identification and verification or be anonymous. It would be technically possible to separate personal information of account holders or access to tokens from the system itself. Accordingly, the system would hold references to personal information that could be stored in a different system and managed by a different organization. This solution provides two major advantages: the first is hiding personal information from financial transactions and hence protecting privacy; the second is preventing personal information from being accessible by multiple institutions, thereby allowing for stronger protection from cyberattacks. Another option includes having an anonymous account below a certain balance or transaction limit and requesting identification above this threshold. And a third option is providing users with the ability to control access to their own personal information based on their choice and subject to AML/CFT requirements.

Two-Tier Model

A two-tier model may feature different allocations of CBDC functionalities to the central bank and PSPs. There are activities that can be done only by the central bank, that the central bank can either execute directly or delegate to PSPs, and that are typical of PSPs and that PSPs would have a comparative advantage in performing. The level of decentralization chosen will depend on several factors, including the level of market competitiveness and the extent to which the central bank should compete with, complement, or supplement private-sector PSPs; the level of maturity of the PSPs and the retail payments ecosystem more broadly; the approach that best allows the central bank to achieve its objectives of issuing CBDC; the need to maintain an efficient interplay between CBDC and all other payment instruments, including physical cash; and the ability of the central bank to manage and mitigate the risks associated with providing service. (See figure 5.)

A two-tier model could feature different levels of decentralization of CBDC functionalities. As for the management of user accounts, the central bank could choose from different options. It may elect to manage all user accounts directly in its books, letting PSPs be in charge only of enrolling users. Alternatively, the central bank may elect to manage omnibus/pool accounts for the PSPs, while each PSP would manage the accounts of its own users without providing to the central bank details of individual users' accounts. In yet another variant, the central bank would manage the PSP accounts, and PSPs would manage the user accounts *and* periodically feed information on user balances to the central bank. Both variants fall within a model called a "hybrid CBDC."⁷⁹ The last variant would enable the central bank to transfer CBDC

FIGURE 5 Distribution of Activities between the Central Bank and PSPs in a Two-Tier Retail CBDC System

Central bank activities	Licensing and oversight of PSPs		
	Issuing and redeeming CBDC	Enrolling PSPs and managing PSP accounts	Providing APIs or messaging protocols
	CBDC distribution to PSPs		
Activities that can be done by the central bank or PSPs	Operating the core infrastructure	Providing access to accounts or access keys	Management of accounts or tokens
PSP activities	Providing users interfaces and wallets	KYC and enrollment of users	
	User interfacing, call centers, and managing complaints	Providing add-value services	
		CBDC distribution to users	

Source: Own elaboration

holdings from one PSP to another in the event of a technical failure. This would in turn require (i) a legal framework that allows for portability of CBDC balances in bulk (that is, one that gives the central bank the power to switch retail customer relationships from a failing PSP to a fully functional one) and (ii) the technical capability to do so promptly when necessary. (See figure 6.)

User-interface applications could be designed to link users directly to the central bank system or PSP systems. Regardless of whether the central bank has a mobile, card, or web application developed by one of the licensed PSPs, it could either allow the payment instrument to have direct access to the central bank system or limit access to only the PSPs’ back-end systems. In the latter case, the user application would access the PSP systems and the PSP back-end systems would communicate with the central bank system. In a system where the user accounts were managed by the PSPs, it would be mandatory for the user application to communicate with the PSP systems, whereas in cases where all accounts or tokens were managed directly by the central bank, both options would be applicable (that is, the user application would access either the PSPs’ or the central bank’s systems).

The central bank could choose to manage its own central CBDC ledger or share the ledger operations with other PSPs. A distributed ledger among multiple operators would increase the resilience of the system and increase its availability. The DLT could operate based on different modalities. According to one modality, all data would be made accessible by all PSPs, which could then validate the transactions and reach consensus. Alternatively, PSPs could be permitted to access only their own users’ data, while the central bank would be able to access all transactions of all users. As a third modality, all transaction data would be shared among all PSPs, while each PSP would keep and not share its own users’ personal information. For instance, the central bank could provide the core settlement function and APIs that are accessible by PSPs, and each PSP could develop its applica-

tions to users, add features and facilities to the application, and compete with other PSPs on the quality of services provided to the end users. However, all PSPs would be accessing the same APIs and the settlement function supplied by the central bank. According to a third modality, the central bank would supply a settlement function and a messaging application. In the case of centralized management of accounts or tokens, the central bank might need to provide authentication, and with programmable CBDC, the central bank may provide a layer or function to allow PSPs to add further functionalities or specific controls on or limitations to CBDC use.

The contractual arrangement between the central bank and PSPs could be framed in different ways. The arrangement would change depending on whether PSPs would be in charge of service provision as principal providers or whether they would act as agents to the central bank. Whatever the arrangement, the responsibilities and liabilities of the central bank and PSPs should be reflected clearly in the contractual arrangement, including in exceptional circumstances. For example, the arrangement should enable the central bank to redeem the claims of users in the case of PSP insolvency. This would require the central bank either to have direct access to user accounts or to receive reports from the PSPs (on a regular basis or in the event of failures). Finally, the arrangement should clarify the liability and responsibility of the central bank and the PSPs in the event of fraud, non-compliance, or services underperformance.

The introduction of DLT-based CBDC could improve the efficiency and quality of supervision and the collection of statistics on payments. A DLT-based CBDC could allow for “embedded supervision”—that is, a regulatory framework that provides for compliance to be automatically monitored by reading directly from the ledger, thus reducing the need for firms to collect, verify, and deliver data actively.⁸⁰ By the same fashion, a DLT-based CBDC could improve the speed and reduce the cost of the collection process of PSP data for statistical purposes.

FIGURE 6 Options of Decentralization within Two-Tier CBDC Model

Users account management	Central bank manages all accounts PSPs handle user enrollment	Central bank manages PSP accounts PSPs manage user accounts	PSPs manage user accounts Central bank keeps copies
User interface	Central bank avails APIs PSPs provide interface	Central bank avails messaging PSPs provide interface	PSPs provide interface and back-end settlement
Access to ledger	Data is accessible by all PSPs	Each PSP accesses only its own data	Restrictions apply to data subsets (that is, personal information)
Contractual relationship	PSPs are principal providers		Central bank outsources activities to PSPs

Source: Own elaboration.

B. POLICY RECOMMENDATIONS

As the central bank is engaged in the process of determining the infrastructure on which CBDC should be issued and circulated (Where?), it should take into account the following three key policy recommendations:



DON'T FORGET WHOLESALE! *Since launching retail CBDC would absorb considerable resources, the central bank should not lose sight of the wholesale systems and should keep improving them, as needed.*

Even if the central bank and relevant public authorities were strongly motivated to pursue retail CBDC and its attention and resources were attracted to such an endeavor, they should not lose sight of the need (and responsibility) to keep wholesale systems at their highest-possible levels of safety and efficiency. Central banks can still do much to strengthen their existing RTGS systems further and to expand their services in parallel with their plan to launch retail CBDC. Whether it will be for the central bank (in consultation with NPS stakeholders) to make the strategic decision to retain or abandon legacy systems, it will be for the central bank to make sure that, whatever choice is made and whichever solution is adopted, critical issues concerning governance, access and participation, risk management, default management, service performance of wholesale systems, and, in general, their capacity to satisfy the changing needs of fast-evolving economies, both at the domestic and cross-border level, receive priority attention and resources. If the central bank were to involve itself in the complex task of running a retail CBDC model (in particular, adopting a two-tier model), it should ponder the risk of diverting resources to the new task at the expense of the safe and efficient execution of wholesale payment activities and services.

Currently, several central banks are considering enhancing their existing (typically, RTGS) systems for payments and settlement of transactions in central bank reserves. Enhancements include making systems capable of operating around the clock and opening them up to participation by broader classes of institutions.⁸¹ This could go a long way to address some of the gaps in the NPS of many jurisdictions. The replacement cycle also opens opportunities to evaluate the relevance of wholesale CBDC in the jurisdiction's context. Moreover, in any case, careful analysis of the evolving landscape is required to ensure that the new investment in RTGS is future proofed. In particular, it would be useful to study (i) the suitability of new technological models, (ii) features

and capabilities required for offering settlement services in a digital asset context, and (iii) other features that might be needed in case CBDC is to be introduced in the future. The introduction of DLT-based wholesale CBDC could facilitate delivery-versus-payment settlement for platforms that trade tokenized securities and support use of central bank money by systems adopting distributed ledgers, such as for crypto-assets or stablecoin arrangements.⁸² Some central banks are replacing their RTGS systems or never established one; hence, developing a new wholesale payment system using new technologies and business models could be a driver to implement wholesale CBDC. Moreover, the existing payment systems—in particular, the RTGS systems—would have a critical role in enabling an efficient process for converting traditional central bank and commercial bank money to and from CBDC.



BE SAFE! *Even if the prime motive for issuing CBDC is achieving greater NPS efficiency, safety must remain a central bank's overarching concern, and it should guide the choice of the underlying infrastructure for CBDC, which should adhere to the strictest international standards.*

CBDC should adhere to the highest standards of safety, in line with the central bank's oversight objectives discussed earlier. The infrastructure used for CBDC should fully observe all relevant international standards, and implementation should take place in accordance with the best international practices currently in use for wholesale and retail systems. In setting up the necessary infrastructure, central banks and relevant authorities should be advised not to accept "black box" solutions that they would not understand fully, and not to resort to "turnkey" solutions that would create critical path dependence. Vendors should be selected very carefully; only reputable and reliable providers that meet the standards and bear solid medium-term market prospects should be considered.

The central bank should exercise caution in deciding which CBDC model to adopt. In addition to considering what would ultimately be best, in principle, for users, the decision should reflect a realistic evaluation by the central bank of its own capacity. The central bank should not take on undue tasks and responsibilities, or tasks and responsibilities that it might not be able to fulfill. Operating a one-tier CBDC model-based system would require the central bank to run a large set of entirely new activities. The central bank should consider, from all possible angles, whether it would be able to do so, which additional capacity it would need to build for it to be able to do so, and whether it could credibly build

and use the needed capacity. The central bank should thoroughly evaluate the risks for the NPS and its own reputation of failing to deliver as expected.

Should the central bank in co-ordination with relevant public authorities decide to issue retail CBDC, a sound principle to ensure NPS safety and efficiency would be for the central bank to supply the infrastructure and for PSPs to provide CBDC services to users. An approach where the central bank would exclusively provide all CBDC-related services is less likely to achieve the intended objectives, might strain the resources of the central bank, and could create risks for the NPS and the central bank itself. Besides, exclusive central bank involvement might compromise competition and innovation. On the other hand, adopting a “division of labor” between the public and private sectors in line with the above principle would better exploit the comparative advantage of the central bank and private sector and reduce the disruptive potential of CBDC. Accordingly, the central bank could supply core settlement functions and APIs that would be accessible by PSPs, while each PSP would develop and supply its own application to users, add features and facilities to the application, and compete with other PSPs on the quality of the services provided to users, like the two-tier

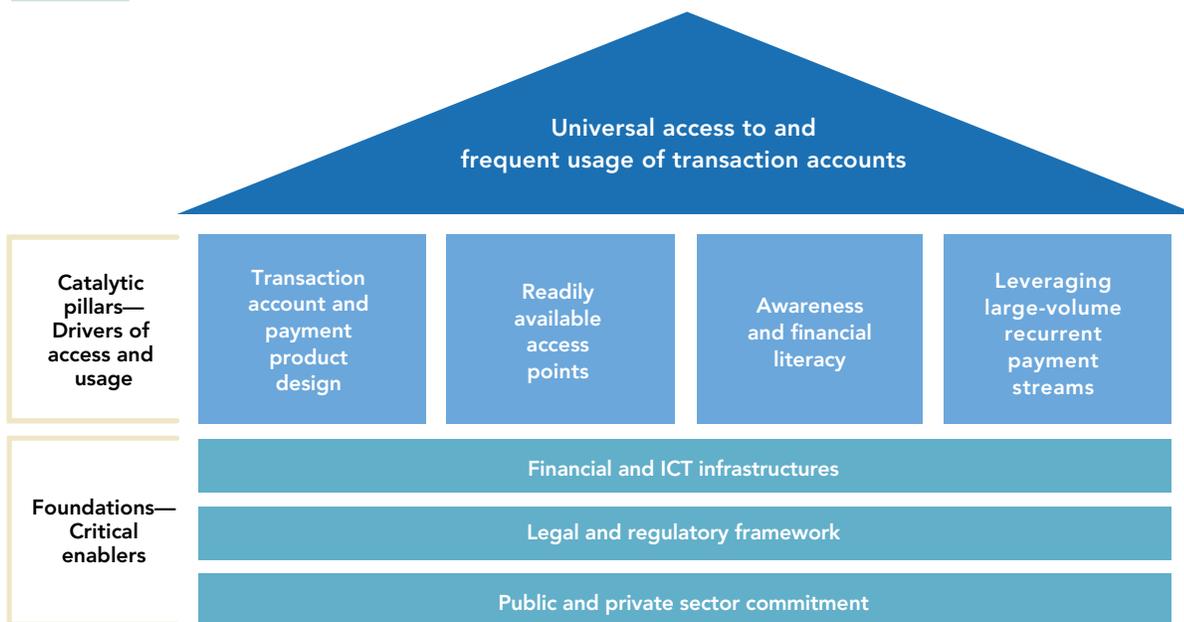
model discussed above. However, as noted, should the central bank decide to issue retail CBDC, it should be ready to take any measure necessary to enable its use by those who are not reached by PSPs.



BE INCLUSIVE! Issuing CBDC would add to the central bank’s and relevant public authorities responsibility for financial inclusion, and the underlying infrastructure should be able to accommodate widespread access to the service.

CBDC per se is not the solution to advancing financial inclusion in a country. However, CBDC—if introduced—would inevitably raise the profile of financial inclusion as a national priority. Considering it as a new form of cash and legal tender creates an even more pressing obligation for the central bank to make sure that CBDC access is guaranteed everywhere, always, and to everybody across the national jurisdiction, hence raising the profile of financial inclusion as a national policy priority. The central bank should be responsible for facilitating CBDC distribution and expanding its use cases by acting directly and/or through the support of service providers.

FIGURE 7 The PAFI Framework



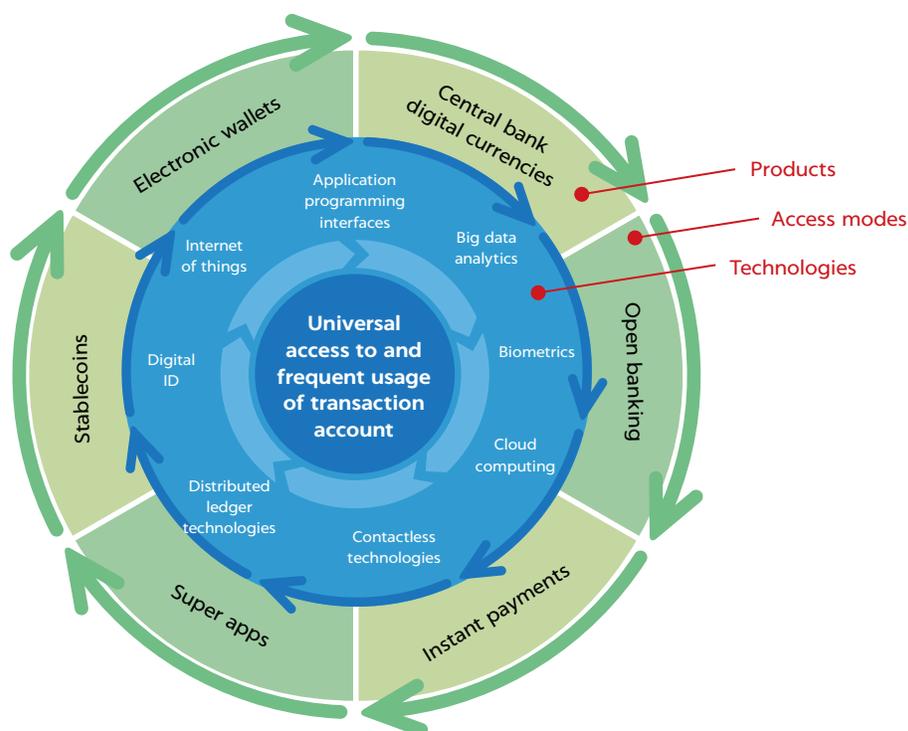
The PAFI framework analyzes how payment systems and services promote access to and use of financial services. It examines what elements of retail payments are critical to financial inclusion and how improving the payments infrastructure and services could accelerate access to and use of transaction accounts. It also discusses the relevance and importance of measuring the effectiveness of financial-inclusion efforts from a payments perspective. The framework outlines seven guiding principles and suggests key actions that countries could take to advance access to transaction accounts, which then can serve as a gateway to broader financial inclusion.

Especially in jurisdictions with a lower level of financial inclusion, authorities introducing CBDC need to ensure that the critical enablers and catalytic pillars in the CPMI-World Bank PAFI framework are in place. In this area, authorities could draw useful policy guidance from the cited PAFI work by the CPMI and World Bank (figure 7 and 8) but might even go beyond the PAFI approach to ensure that CBDC is available to all agents in the economy. While financial inclusion is a state-level responsibility, CBDC should receive the same level of commitment from all stakeholders, including the government and financial and private sectors. Particularly where financial inclusion is a national priority and the private sector is not responsive enough to the financial-inclusion agenda, the introduction of CBDC could be one of the available options to expedite the process, precisely because of the special responsibility falling upon the central bank to facilitate CBDC access to all individuals and businesses across the country. It is also to be noted that why the private sector is unresponsive should be studied carefully; indeed, the conclusion might accelerate CBDC adoption. Alternatively, it could also mean that fundamental gaps exist in the critical enablers of financial inclusion—for example, with respect to legal and regulatory frameworks and financial and ICT infrastructures. Further, CBDC introduction would require the central bank to activate the four PAFI “catalytic pillars,” which act as drivers of access to and usage of basic

transaction instruments, by (i) designing CBDC transaction functionalities in ways that are convenient for even unsophisticated users; (ii) creating a network of readily available access points as part of the provision of CBDC as a “public utility,” directly and/or through PSPs; (iii) supporting awareness and financial literacy as necessary for the dissemination of knowledge of the new instrument across the population and country; and (iv) leveraging streams of large-volume recurrent payments.

To meet the financial-inclusion challenge, CBDC will need to take into account the specific context of the individuals and businesses currently lacking access to digital payment services. CBDC design aspects that encourage financial inclusion would include cost of onboarding, cost of transaction, off-line transactions, anonymity and privacy, and remuneration. These considerations would hold, *a fortiori*, if CBDC were established as legal tender. A CBDC system needs to be easy to access through a simple user-enrollment process, convenient to use through a large network of agents and service providers, acceptable for daily-life use cases at merchants, billers, and by the government, and available 24 hours a day, possibly even during electricity or mobile network failures, through appropriate and secure off-line features.

FIGURE 8 The PAFI Wheel





VII. DEFINING THE ROLE OF STAKEHOLDERS IN CBDC IMPLEMENTATION (WHO?)

A. KEY ASPECTS FOR CONSIDERATION

Implementing CBDC would involve several stakeholders beyond the central bank. Involvement should start at the early stage of the process, as the central bank engages NPS stakeholders in a policy dialogue and solicits their views and feedback, which it would then use to answer the “why,” “what,” “when,” and “where” questions discussed above and the overarching question of “whether.” Involvement would then continue at the implementation stage and depend on the type of CBDC selected and the arrangement chosen for it. Whereas a relatively small number of subjects would be involved in the case of wholesale CBDC, the number would multiply if the central bank were to opt for a two-tier type of retail CBDC model.

Developing CBDC (especially retail) would entail cooperation at many levels. Cooperation within the central bank would be necessary, since the potential implications of CBDC for other critical central banking functions would require all relevant central bank units to be involved at the appropriate level to ensure that risks are evaluated and managed effectively. Cooperation between the central bank and NPS stakeholders would be necessary at the design, implementation, and operation stages of CBDC, and while cooperation for wholesale CBDC would be similar to that required for RTGS systems, broader cooperation would be required for retail CBDC, in light of the complexity and the involvement of a much more extended and varied set of participating entities.

Furthermore, cooperation between the central bank and other authorities would be required. The coexistence of institutions of diverse legal nature and the variety of policy dimensions involved in the issuance of CBDC (for example,

consumer protection, market conduct, market integrity, data integrity and information security, financial inclusion, financial stability, payment-system modernization, economic and financial-sector development, and so on) would cross the interest and mandate of several public authorities. Finally, cooperation might be required between central banks in the event of cross-border use of CBDC. This would especially be the case if domestic infrastructures were to be linked with non-domestic ones or if plans were deployed for cross-border CBDC initiatives.

Implementing CBDC is neither easy nor resource free. How such costs would be distributed, and whether they would be sustainable, are relevant issues to be addressed and would determine the different roles played by the stakeholders in the initiative. While a CBDC system would be owned and operated by the central bank in coordination with all relevant stakeholders, consideration should be given to how to support the substantial resource commitment that it would require. The following two general types of costs, beyond recurring operational expenditures, would have to be shared (directly or indirectly) by participants and other stakeholders:

- **Development and set-up costs**, which in general terms include project planning costs, legal costs, software and hardware costs (including deployment and testing), and other vendor costs for business solutions and technologies. These costs raise the issue of funding, considering that these costs are borne over the up-front planning and implementation stages of the initiative. The costs and the funding schemes will vary according to the core infrastructure, the architecture, and the level of services to be provided. For example, central banks and relevant authorities will need to decide whether the initial cost of establishing the core infrastructure is to be cov-

ered initially out of public funds and eventually recovered, based on some agreed-upon cost-recovery policy, through access and transaction fees. Private stakeholders will likely be willing to absorb only the development and set-up costs of market-led initiatives, if there is the expectation that those costs will be recovered through a combination of cost savings and user fees.

- **Migration, marketing, and awareness-building costs** resulting from the need to transfer operations, participants, and users from the existing arrangements to CBDC. It should be noted that CBDC uptake might not necessarily evolve quickly, since it would involve switching costs from the preexisting arrangements, and even more so if the net benefits of switching were not self-evident or certain to all stakeholders. Due to slow migration, the expected cost savings for participants and users and/or any additional revenues would emerge only slowly. This is a common feature to most innovation and especially for innovations that build on networks that require minimum participation and volume thresholds. The migration of transactions toward CBDC would require active management and marketing efforts to build demand for CBDC. Costs would include presentations at stakeholder meetings, training for all relevant business stakeholders on the supply and demand side, education and awareness about services and benefits to specific groups of stakeholders, and websites with organizational, service, membership, sponsor, and regulatory accreditation information.

Taking costs into consideration, and to the extent that the private sector should play an important role in CBDC implementation, an important question is whether there would be enough incentives for PSPs to supply the required CBDC-related services. PSPs should have viable opportunities to develop value-add services and generate revenues from CBDC-related activities. While it should not be for the central bank to decide the revenue model for private-sector firms, the central bank should be sensitive and open to this aspect, as this would be critical both to the success of CBDC and the financial sustainability of the payments-industry business overall. PSPs could generate revenue directly by providing CBDC payment services—for example, by charging transaction fees or monthly account fees. Some PSPs might provide CBDC-related services at cost or even at a loss if this can help them expand other business opportunities by, say, attracting new customers or cross-supporting other products they offer, or if these services bear synergies with their wider business model.

From the point of view of business sustainability, the cost-recovery strategy that the central bank decides to pursue would be most relevant. Insofar as the central bank has a strategic interest in promoting CBDC's widespread use, in particular as regards the financial-inclusion aspects discussed earlier, it should be prepared to take upon itself a significant share of the cost burden, either by delaying its cost-recovery program, by considering a large portion of investment as sunk costs, or by subsidizing, at least for a period, part of the bill. To a minimum, the central bank should be prepared to support CBDC as it has historically done with physical cash and other large-value payment and settlement systems. Whatever the decision, the issue of cost and business viability should be the subject of an open and transparent dialogue between the central bank and the relevant stakeholders, and a strategy should be set that would give clear and certain signals over time to all involved.

B. POLICY RECOMMENDATIONS

In the process of defining the different roles for the implementation of CBDC (Who?), the central bank should take into account the following three key policy recommendations:



BE COLLEGIAL! *The decision to issue CBDC and its implementation should follow a structured process of policy dialogue with all relevant stakeholders that will also determine how each relevant stakeholder will contribute to the effort.*

Central banks should engage all relevant stakeholders in a cooperative undertaking on CBDC, possibly in the context of the NPS strategy. An ongoing and structured policy dialogue should take place with the stakeholders, also including users' representatives. The dialogue should consist of consultations and regular and ad hoc discussions on issues of common interest to stakeholders and joint work on technical issues. The policy dialogue would enable the central bank to align stakeholder expectations around shared goals and offer a channel for the central bank to communicate its policy orientation, solicit stakeholder views and feedback, and share knowledge on CBDC issues. The policy dialogue should take place in a dedicated forum, such as a national payments council or payments association, and the creation of a dedicated working group should be considered.

It would also be important for all relevant authorities to cooperate with each other on CBDC matters. Cooperation should foster efficient and effective communication and consultation for the authorities involved to support each other while fulfilling their mandates. Such cooperation would need to be effective in normal circumstances and should be adequately flexible to facilitate effective communication, consultation, or coordination, as appropriate, during periods of market stress and crisis situations. Responsibility E under the CPMI-IOSCO PFMI would offer useful guidance to this effect.



CHECK RESOURCES! *The central bank should carefully check on the resources needed for implementing CBDC and vis-à-vis the other NPS projects underway; resource availability will determine how to allocate responsibilities in the design and implementation of CBDC.*

The complexity and cost of implementing CBDC should not be underestimated. All the necessary resources, financial and human, internal and external to the central bank, should be made available and ready to be deployed effectively. In particular, the central bank should have sufficient resources to fulfill its regulatory, supervisory, and oversight responsibilities. Sufficient resources include adequate funding, qualified and experienced personnel, and appropriate ongoing training. The central bank might also consider revisiting its own governance arrangements, risk-management framework, and capacity to manage CBDC-related tasks and risks effectively. Principles 2 and 3 and Responsibility B of the PFMI offer useful guidance to this effect.

Sufficient financial, human, and, above all, “political” resources would be necessary to implement CBDC. Although the introduction of CBDC would be expected to generate important efficiency gains in the NPS, carrying out the process would require significant investment. Thus, the implementation of CBDC should be supported by adequate resources, including those needed to build capacity. For instance, in the process of supporting the widest possible distribution of CBDC across the country, central banks might have to leverage private-sector PSPs, which are best positioned to interface with customers. That, however, would not relieve central banks from creating dedicated capacity (internally or through outsourcing solutions) to ensure that CBDC would be made available to those segments of the population, or areas of the country, that are not served by private-sector entities. Adequate human resources are instrumental to drive this process and would need to be devoted to the task for the duration of the project. In some countries, these resources might lie outside

of the national jurisdiction and would need to be attracted to the initiative. Finally, country financial and other authorities would have to spend political capital to ensure CBDC acceptance throughout the economy and circumvent the unavoidable difficulties that will arise through the process.



MIND THE STEPS! *CBDC should be subject to rigorous planning, careful definition of the responsibilities of the different stakeholders, and project discipline and management, bearing in mind that delays and failures would harm the reputation of the central bank.*

This would be no different than for any other NPS projects, with the caveat of possibly an even stronger reputational risk for the central bank. Useful practical guidance could be drawn from the World Bank work on regional infrastructures,⁸³ which provides important insights on how to structure decision-making and implementation processes in the field of payments. (See box 12.)

The central bank should elaborate a realistic action plan, identifying relevant milestones for the implementation of CBDC. The action plan should include a feasibility phase, a pilot phase, and the (potential) full-scale implementation phase. In the feasibility phase, the central bank should consider the various design options for CBDC, analyze the relevant data, compare them with the needs, and elaborate a model for CBDC in the country, including through a properly elaborated proof of concept. The pilot phase should be accurately designed in terms of geographic, demographic, and economic representation and should be regarded as critical for the success of the project. The central bank should be open to any outcome of the pilot, including the possibility of significantly changing the original design as well as dropping the project entirely if the pilot is not successful. Pilot phases will have to be supported by a good data-collection and analysis plan. After careful evaluation of all data and lessons emerging from the pilot phase, the central bank and other relevant stakeholders should diligently execute the action plan, respecting all agreed-upon responsibilities and roles, and meeting—to the extent possible—the timetable for implementation. Appropriate checkpoints to fine-tune the plan should be embedded in the program based on the feedback received on the ground.

Putting together a strong business case is probably the most crucial step in early project development, as it specifically aims at identifying and substantiating the (net) benefits of a project and the elements and factors that generate them.

BOX 12 WORLD BANK GUIDELINES FOR SUCCESSFUL REGIONAL INTEGRATION OF FINANCIAL INFRASTRUCTURES

The G25 Panel of Experts led by the World Bank drafted 19 guidelines to provide high-level guidance to principal policy makers and stakeholders in the development of regional or cross-regional integration of financial infrastructures. The guidelines belong to the following categories:

Enabling and institutional guidelines

Outline the set of institutional arrangements that enable a proposed regional integration of financial infrastructures to move forward from its preliminary vision to an actual operational arrangement in an effective fashion.

Planning guidelines

The basis for determining if regional integration of financial infrastructures is necessary and justifiable for the stakeholders in the region at that particular time. This is the make-or-break stage at which regional integration initiatives either move forward or are postponed.

Design guidelines and implementation guidelines

Deal with the heart of the program to integrate regional financial infrastructures. It is at these stages of the integration initiative that leadership, commitment, consultation, and effective management become most crucial.

Sustainability guidelines

Help establish a strategic direction and sound business culture for the regional arrangement that, together with the continuous oversight from public-sector authorities, will help ensure that it will continue to evolve and develop to meet future stakeholder needs, legal and regulatory requirements, and policy standards affecting its operations, and do so in a transparent and credible fashion.

A business case would also be useful for other related purposes and activities. For example, it would set a baseline for what is to be achieved, by whom, and at what cost. It would prevent scope drift, and, at a general level, it would identify the roles and responsibilities to arrive at a shared vision of the project to be realized. Even if the *ex ante* business case were successful and stakeholders decided to move forward with the project, its soundness would need to be confirmed once CBDC became operational. At this stage, the business case might prove faulty *ex post* for a variety of reasons, such as an erroneous estimation of the net benefits or the non-materialization of the expected support from stakeholders, and corrective measures should be taken based on an assessment of the observed outcomes.

Broad support from private-sector stakeholders would usually follow from a strong business case. Regarding public-sector support, the elimination of legal, regulatory, and other policy barriers would influence the business case for CBDC. In addition, as a participant in the CBDC system or CBDC user, the public sector could play a key role in helping to achieve the expected benefits needed for the new arrangement to materialize. On the other hand, the business case might be exposed to the risk of insufficient public-sector support. While the benefits and costs of CBDC could be identified qualitatively with relative ease, their quantitative valuation and estimation could turn out to be extraordinarily difficult and subject to considerable forecast errors. The valuation exercise would also most likely face methodological difficulties and data-availability problems.



APPENDIX A

A SHORT HISTORY OF THE LAST 50 YEARS OF NATIONAL PAYMENTS SYSTEM DEVELOPMENT

Payment and settlement systems and services (PSSS) have become vital components of the economic life of contemporary societies. They consist of integrated networks of institutions involved in the execution and delivery of fund-transfer services across the economies. Their smooth functioning is essential to the overall efficiency and stability of the financial sector and market economies as a whole. To promote such smooth functioning, national oversight authorities have been strengthened worldwide, and oversight activities have been developed to take account of the growing interconnectedness and mutual interdependence of PSSS, which are the core of what is often referred to as the national payments system (NPS) of each country. NPSs encompass all payment, settlement, and depository activities, processes, mechanisms, infrastructure, institutions, and users in a country or an integrated region (for example, common economic area). NPSs are also mutually interconnected in what can be referred to as the global payment system.

PSSS have gone through several waves of reforms that have changed the landscape of the NPS in virtually every country in the world. Historically, PSSS have lain at the heart of banking. As more and more countries centralized money-issuing activities within single commercial banking institutions in the 19th and early 20th century, the deposit liabilities issued by these institutions were used as means to settle commercial banks' payment obligations. As central banks took on their role at the center of domestic interbank market systems, the provision of clearing and settlement services to serve as backbone for settling certain types of payments delivered by commercial banks evolved into a core central banking activity. As a consequence, the promotion of efficient and safe payment arrangements became one of the central banks' *raison d'être*.⁸⁴

Yet, in the middle of the 20th century, as payment technology became relatively more stable, senior central bank and commercial bank leaders still considered PSSS issues less relevant than other aspects of the financial system. They were seen mostly as technical matters ("plumbing") to be dealt with by subunits of IT departments at both the central banks and commercial banks. It was not until the mid-1980s that the debate on PSSS modernization strategies and policies took on greater weight in countries with more advanced financial systems. Liberalization of financial markets led private-sector agents and national regulators to identify technical and institutional solutions for serving the increasing demand for new payment services while protecting the economy from risks originating out of rapidly growing volumes of financial transactions. Also, internationalization of financial markets and episodes of severe financial crisis around the world fostered closer cooperation among more economically advanced countries, and between the latter and emerging market economies, on how to set up and enforce standards to improve PSSS performance in terms of risk control and shock resilience.

In more recent years, several countries have realized that the NPS lies at the core of economic and financial activities and needs constant attention and improvements. In the mid-1990s, countries started to upgrade their central systems by introducing real-time gross settlement (RTGS) systems that addressed the need for increased safety in wholesale transactions. In parallel, they went through profound reforms of the legal and regulatory framework, introducing key legal concepts in their laws and regulation, such as settlement finality, protection of creditor rights against bankruptcy procedures, and the notion of NPS oversight. In the middle of the first decade after 2000, also due to the widening of the oversight role of central banks to serve as catalysts for

change and the emergence of new players in the payments space, the focus of the global payment system community has been enlarged to cover retail payment systems, the provision of payment services, international remittances and cross-border payments, and financial inclusion, also triggered by technological developments and enhancements. Different forms of e-money were introduced, with a growing use of payment cards and batch-based transactions and the development of new channels (internet and mobile).

Impressive progress has indeed been achieved to enhance the safety and efficiency of payment services, both enabling financial institutions to exchange large-value (wholesale) payments safely through sophisticated infrastructures and allowing more and more customers to make and receive small-value (retail) payments digitally and on a nearly real-

time basis. In the last few years, the emergence of so-called fast (also known as instant, faster, or real-time) payment systems, the spread of additional access channels and enabling environments that accommodate the use of digital payments such as QR codes and application programming interfaces (APIs), and the launch of payment means based on new technologies such as blockchain (for example, crypto-assets, stablecoins) have all pushed the frontier of payments technology further ahead. Despite all the noted progress, however, evidence suggests that in most countries cash—in the form of physical banknotes and coins issued by the central bank or government—still remains the prevalent retail payment instrument and, in some cases, store of value, indicating that further efforts are needed to understand user preferences and advance the widespread adoption and usage of more efficient digital payment instruments.



APPENDIX B

CPMI-IOSCO PRINCIPLES FOR FINANCIAL MARKET INFRASTRUCTURES⁸⁵

GENERAL ORGANIZATION

Principle 1: Legal Basis

A financial market infrastructure (FMI) should have a well-founded, clear, transparent, and enforceable legal basis for each material aspect of its activities in all relevant jurisdictions.

Principle 2: Governance

An FMI should have governance arrangements that are clear and transparent, promote the safety and efficiency of the FMI, and support the stability of the broader financial system, other relevant public interest considerations, and the objectives of relevant stakeholders.

Principle 3: Framework for the Comprehensive Management of Risks

An FMI should have a sound risk-management framework for comprehensively managing legal, credit, liquidity, operational, and other risks.

CREDIT AND LIQUIDITY RISK MANAGEMENT

Principle 4: Credit Risk

An FMI should effectively measure, monitor, and manage its credit exposures to participants and those arising from its payment, clearing, and settlement processes. An FMI should maintain sufficient financial resources to cover its credit exposure to each participant fully with a high degree of confidence. In addition, a central counterparty (CCP) that is involved in activities with a more-complex risk profile or that is systemically important in multiple jurisdictions should maintain additional financial resources sufficient to cover a wide range of potential stress scenarios that should include,

but not be limited to, the default of the two participants and their affiliates that would potentially cause the largest aggregate credit exposure to the CCP in extreme but plausible market conditions. All other CCPs should maintain additional financial resources sufficient to cover a wide range of potential stress scenarios that should include, but not be limited to, the default of the participant and its affiliates that would potentially cause the largest aggregate credit exposure to the CCP in extreme but plausible market conditions.

Principle 5: Collateral

An FMI that requires collateral to manage its or its participants' credit exposure should accept collateral with low credit, liquidity, and market risks. An FMI should also set and enforce appropriately conservative haircuts and concentration limits.

Principle 6: Margin

A CCP should cover its credit exposures to its participants for all products through an effective margin system that is risk-based and regularly reviewed.

Principle 7: Liquidity Risk

An FMI should effectively measure, monitor, and manage its liquidity risk. An FMI should maintain sufficient liquid resources in all relevant currencies to effect same-day and, where appropriate, intraday and multiday settlement of payment obligations with a high degree of confidence under a wide range of potential stress scenarios that should include, but not be limited to, the default of the participant and its affiliates that would generate the largest aggregate liquidity obligation for the FMI in extreme but plausible market conditions.

SETTLEMENT

Principle 8: Settlement Finality

An FMI should provide clear and certain final settlement, at a minimum by the end of the value date. Where necessary or preferable, an FMI should provide final settlement intraday or in real time.

Principle 9: Money Settlements

An FMI should conduct its money settlements in central bank money where practical and available. If central bank money is not used, an FMI should minimize and strictly control the credit and liquidity risk arising from the use of commercial bank money.

Principle 10: Physical Deliveries

An FMI should clearly state its obligations with respect to the delivery of physical instruments or commodities and should identify, monitor, and manage the risks associated with such physical deliveries.

CENTRAL SECURITIES DEPOSITORIES AND EXCHANGE-OF-VALUE SETTLEMENT SYSTEMS

Principle 11: Central Securities Depositories

A central securities depository (CSD) should have appropriate rules and procedures to help ensure the integrity of securities issues and minimize and manage the risks associated with the safekeeping and transfer of securities. A CSD should maintain securities in an immobilized or dematerialized form for their transfer by book entry.

Principle 12: Exchange-of-Value Settlement Systems

If an FMI settles transactions that involve the settlement of two linked obligations (for example, securities or foreign exchange transactions), it should eliminate principal risk by conditioning the final settlement of one obligation upon the final settlement of the other.

DEFAULT MANAGEMENT

Principle 13: Participant-Default Rules and Procedures

An FMI should have effective and clearly defined rules and procedures to manage a participant default. These rules and procedures should be designed to ensure that the FMI can take timely action to contain losses and liquidity pressures and continue to meet its obligations.

Principle 14: Segregation and Portability

A CCP should have rules and procedures that enable the segregation and portability of positions of a participant's customers and the collateral provided to the CCP with respect to those positions.

GENERAL BUSINESS AND OPERATIONAL RISK MANAGEMENT

Principle 15: General Business Risk

An FMI should identify, monitor, and manage its general business risk and hold sufficient liquid net assets funded by equity to cover potential general business losses so that it can continue operations and services as a going concern if those losses materialize. Further, liquid net assets should at all times be sufficient to ensure a recovery or orderly wind-down of critical operations and services.

Principle 16: Custody and Investment Risks

An FMI should safeguard its own and its participants' assets and minimize the risk of loss on and delay in access to these assets. An FMI's investments should be in instruments with minimal credit, market, and liquidity risks.

Principle 17: Operational Risk

An FMI should identify the plausible sources of operational risk, both internal and external, and mitigate their impact through the use of appropriate systems, policies, procedures, and controls. Systems should be designed to ensure a high degree of security and operational reliability and should have adequate, scalable capacity. Business continuity management should aim for timely recovery of operations and fulfillment of the FMI's obligations, including in the event of a wide-scale or major disruption.

ACCESS

Principle 18: Access and Participation Requirements

An FMI should have objective, risk-based, and publicly disclosed criteria for participation, which permit fair and open access.

Principle 19: Tiered Participation Arrangements

An FMI should identify, monitor, and manage the material risks to the FMI arising from tiered participation arrangements.

Principle 20: FMI Links

An FMI that establishes a link with one or more FMIs should identify, monitor, and manage link-related risks.

EFFICIENCY

Principle 21: Efficiency and Effectiveness

An FMI should be efficient and effective in meeting the requirements of its participants and the markets it serves.

Principle 22: Communication Procedures and Standards

An FMI should use, or at a minimum accommodate, relevant internationally accepted communication procedures and standards in order to facilitate efficient payment, clearing, settlement, and recording.

TRANSPARENCY

Principle 23: Disclosure of Rules, Key Procedures, and Market Data

An FMI should have clear and comprehensive rules and procedures and should provide sufficient information to enable participants to have an accurate understanding of the risks, fees, and other material costs they incur by participating in the FMI. All relevant rules and key procedures should be publicly disclosed.

Principle 24: Disclosure of Market Data by Trade Repositories

A trade repository (TR) should provide timely and accurate data to relevant authorities and the public in line with their respective needs.

RESPONSIBILITIES OF CENTRAL BANKS, MARKET REGULATORS, AND OTHER RELEVANT AUTHORITIES FOR FINANCIAL MARKET INFRASTRUCTURES

Responsibility A: Regulation, Supervision, and Oversight of FMIs

FMIs should be subject to appropriate and effective regulation, supervision, and oversight by a central bank, market regulator, or other relevant authority.

Responsibility B: Regulatory, Supervisory, and Oversight Powers and Resources

Central banks, market regulators, and other relevant authorities should have the powers and resources to carry out effectively their responsibilities in regulating, supervising, and overseeing FMIs.

Responsibility C: Disclosure of Objectives and Policies with Respect to FMIs

Central banks, market regulators, and other relevant authorities should clearly define and disclose their regulatory, supervisory, and oversight policies with respect to FMIs.

Responsibility D: Application of Principles for FMIs

Central banks, market regulators, and other relevant authorities should adopt, where relevant, internationally accepted principles for FMIs and apply them consistently.

Responsibility E: Cooperation with Other Authorities

Central banks, market regulators, and other relevant authorities should cooperate with each other, both domestically and internationally, as appropriate, in promoting the safety and efficiency of FMIs.



APPENDIX C

FORMS OF MONEY IN TODAY'S WORLD

In today's world, money takes many different forms. The forms of money described below are differentiated by five questions: (i) Who is the issuer? (ii) Is it token, DLT, or account based? (iii) Is it backed by reserves or other forms of value? (iv) Does it allow for peer-to-peer transfer? (v) Does it allow for anonymous holders and users?⁸⁶

Money Issued by the Central Bank

Cash: Cash takes the form of coins and banknotes. In some countries, coins are issued by the national treasury. In most countries, coins and banknote are issued by the central bank, but in a few countries, select commercial banks are the issuers of banknotes. Cash is a liability of (claim on) the issuer. Cash can be transferred from peer to peer on an anonymous basis, interest free, and is the only non-digital form of money discussed here.

Central bank reserves: Central banks typically can open accounts only to financial institutions and, in some cases, the government. The public usually does not have access to a central bank's accounts. Thus, central bank reserves are the deposits of commercial banks at the central bank. These reserves are risk free and a liability of (claim on) the central bank. These reserves are used for interbank settlement typically through RTGS systems at the central bank. Central bank reserves are the only wholesale money, as it is not accessible by the public. Reserves are typically interest bearing.

Central bank digital currency (CBDC): CBDC is issued by and is a liability of (claim on) the central bank; hence, it does not need to be backed by reserves. CBDC can be offered under different models: wholesale or retail; token, DLT, or account based; interest free or interest bearing; identifying the user or preserving user anonymity.

Money Issued by Commercial Banks and Other Deposit-Taking Institutions

Deposits: Deposits are liabilities of (claims on) commercial banks or deposit-taking institutions that entitle their holders to redeem them in cash or to transfer them to other deposit holders on demand. Deposits are exposed to liquidity and credit risk, including the risk of insolvency of the issuing institution. Deposit-issuing institutions typically hold a percentage of their deposit liabilities as reserves with the central bank, based on regulatory requirements (which may vary across jurisdictions) or for liquidity-management purposes. Thus, in general, deposits are at least partially backed by reserves. In several countries, commercial bank deposits are protected by insurance or guarantee schemes that protect deposit holders (at least up to a share) against credit risk on their deposit holdings. Commercial bank deposits are retail, account based, mostly interest bearing, and non-anonymous.

Money Issued by Non-Bank and Non-Credit Institutions

Electronic money (e-money): Electronic money means electronically (including magnetically) stored monetary value as represented by a claim on the issuer that is issued on receipt of funds for the purpose of making payment transactions, and that is accepted by a natural or legal person other than the e-money issuer. In many jurisdictions, e-money can be issued by credit institutions as well as other financial and nonfinancial institutions. E-money institutions are typically licensed by the central banks. Central banks, in most jurisdictions, require the e-money institutions to deposit 100 percent of the e-money value as reserves in one or more commercial banks or other deposit-taking institutions. The reserve requirement is associated with safeguarding the funds received in exchange of e-money issuances.

Further requirements apply in some jurisdictions, including ensuring the safeguarding of funds, naming the account to the e-money holders, and, sometimes, distributing the funds at multiple commercial banks. In most jurisdictions, it is prohibited to pay interest to e-money holders, as this would be equivalent to creating money. Despite the peer-to-peer nature of e-money transfers, they require intermediation by the e-money issuer system. E-money products are mostly retail, account based, non-interest bearing, and non-anonymous.

Synthetic central bank digital currency (sCBDC): Synthetic CBDC is a special type of e-money, where the e-money issuer deposits the required reserves at the central bank, rather than at a commercial bank, as in the typical e-money model. However, the liability of sCBDC still rests with the e-money issuer, not the central bank. The term *synthetic* means that the e-money replicates CBDC features, although it is not real CBDC. sCBDC provides better safeguarding compared to typical e-money; however, credit risk still exists.

Cryptocurrencies: Cryptocurrencies are a subset of crypto-assets. They are digital representations of value and are not issued by a central bank, deposit-taking institution, or

e-money institution. In some circumstances, they can be used as an alternative to money,⁸⁷ issued by private developers, and denominated in their own unit of account.⁸⁸ Mostly, they are not pegged to a fiat currency and are issued by unregulated issuers. Cryptocurrency arrangements could be account, DLT, or token based and could be anonymous or identified. Cryptocurrencies such as Bitcoin, Ether, Litecoin, and others are built on DLT. However, they can be built on different technologies. There could be huge fluctuations in the cryptocurrency values. If they are based on stability arrangements, they turn into stablecoins.

Stablecoins: Stablecoins are considered a subset of cryptocurrencies. Stablecoins are marketed as having less price volatility than other cryptocurrencies. Stablecoin initiatives aim to create stores of value and means of exchange that are global, efficient, and accessible. They could be pegged to and/or backed by specific assets such as a fiat currency, commodities, or other crypto-assets; they could be controlled by employing an algorithm to adjust supply to match demand; or their value can float freely.⁸⁹ All characteristics of cryptocurrencies are applicable to stablecoins.



APPENDIX D

HOW CROSS-BORDER CBDC CAN ADDRESS EXISTING CHALLENGES

CORRESPONDENT BANKING	CROSS-BORDER CBDC
CHALLENGE 1: High Cost	
Supply Side	
<ul style="list-style-type: none"> • High operational cost • High barrier to entry and unwillingness to do business with less profitable customers • Smaller banks and non-bank payment service providers (PSPs) may need to rely on other banks in foreign jurisdictions, with accompanying liquidity and credit risk. Others may not be able to find correspondents or bank partners. • Multinational PSPs offering services in various countries and currencies need liquidity access in several currencies and face related foreign-exchange (FX) risk 	<ul style="list-style-type: none"> • Lower cost due to scale and network economies • Direct participation available to all applicants compliant with access requirements • Direct participation avoids the need for individual participants to rely on others. • Individual PSPs manage their own liquidity needs (in the relevant countries and currencies) and the associated FX risk. (In particular, the Project Inthanon-Lionrock and R3 models provide powerful ways to reduce or remove FX risks for PSPs.)
Demand Side	
<ul style="list-style-type: none"> • Individuals and micro, small, and medium enterprises (MSMEs) are affected by high transaction fees in relation to smaller-value payments. • High costs for maintaining an account or for individual transfers may discourage use of the regulated financial system for cross-border transfers, exacerbating financial exclusion and driving some payment flows underground. In other cases, individual users may be discouraged from making cross-border payments at all. 	<ul style="list-style-type: none"> • PSPs' lower access cost to a cross-border CBDC infrastructure, and the transparency of the access cost structure, should discourage PSPs from adopting unfair pricing practices with service users.⁹⁰ • Lower costs should encourage PSPs to pass them on (at least partly) to individual and MSME customers.
CHALLENGE 2: Low Speed	
Supply Side	
<ul style="list-style-type: none"> • Speed is affected by the dependence on several correspondents/providers, cut-off times, asynchronous opening times, or regulatory checks. • When processing speed is low, the cost for liquidity and FX settlement risk increase, and liquidity management becomes more complex • Lack of system interoperability slows transactions • Non-harmonized messaging and processing standards further reduce speed. 	<ul style="list-style-type: none"> • A single infrastructure would eliminate speed limitations.
Demand Side	
<ul style="list-style-type: none"> • Low speed of cross-border payments brings delays and thus increases uncertainty and liquidity and credit risk, affecting all customers. Moreover, it can harm business and investments, especially where payments are time critical. 	<ul style="list-style-type: none"> • Higher speed would enhance certainty and facilitate business and investment.

CORRESPONDENT BANKING	CROSS-BORDER CBDC
CHALLENGE 3: Limited Access	
Supply Side	
<ul style="list-style-type: none"> Challenges to access to payment systems and wholesale services can occur on the supply side owing to technical and financial entry barriers, regulatory requirements, or liquidity access limitations. PSPs may not be able to access directly local and foreign payment systems and possible funding in foreign currencies. This may make them dependent on other providers, affecting their cross-border payments offerings. 	<ul style="list-style-type: none"> Open, transparent, and risk-based access criteria governing participation in a cross-border CBDC infrastructure, and their consistent application, would facilitate direct or indirect participation from PSPs, thereby removing all such challenges.⁹¹
Demand Side	
<ul style="list-style-type: none"> Access limitations may exist for MSMEs and individuals, possibly limiting financial inclusion and pushing customers toward inefficient or costly third-party services. When unregulated payments channels are used instead, this can exacerbate financial-integrity risks. 	<ul style="list-style-type: none"> Higher speed would enhance certainty and facilitate business and investment.
CHALLENGE 4: Limited Transparency	
Supply Side	
<ul style="list-style-type: none"> Limited transparency can lead to uncertainty and missed service levels to customers. Dependence on third parties can lead to difficulty in controlling the payments process and tracking the status of payments and resolving disputes. Information gaps can create a lack of transparency for anti-money-laundering and countering the financing of terrorism and other purposes. 	<ul style="list-style-type: none"> As a central bank’s standard-compliant infrastructure, a cross-border CBDC would mitigate, if not eliminate, such risks.
Demand Side	
<ul style="list-style-type: none"> Limited transparency concerns all stakeholders on the demand side due to the uncertainty it causes. For corporations, lack of information about the speed, fees, and FX rates of payments in process leads to uncertainties over the timing and amount of payments and can affect business service levels and may lead to hedging and insurance costs to address the risks. Limitations may exist for MSMEs and individuals, possibly limiting financial inclusion and pushing customers toward inefficient or costly third-party services. 	<ul style="list-style-type: none"> As above.



APPENDIX E

SUMMARY OF EXISTING LITERATURE ON IMPACT OF CBDC ON MONETARY POLICY AND FINANCIAL STABILITY

CBDC AND MONETARY POLICY

It is held that CBDC would have a limited impact on monetary-policy implementation.⁹² Flows into CBDC would drain the amount of reserves in the system in exactly the same way as flows into banknotes and central bank deposits held by nonmonetary counterparties (for example, the treasury, foreign central banks, or FMIs), and the central bank would not need to change its *modus operandi*; demand for CBDC would be just another factor to consider for policy responses to be consistent with continued control over short-term interest rates. The central bank would retain discretion in choosing the assets required as collateral to accommodate the demand for CBDC. Subject to the overall supply of such collateral, the central bank would make available all the demand for CBDC, as is the case with banknotes.

However, CBDC might affect the effectiveness of monetary policy, depending on its design features. If, for instance, CBDC were widely accessible and paid a positive interest rate to its holders, it might prove very attractive to people and make monetary-policy outcomes more pronounced due to stronger substitution effects. In particular, the introduction of CBDC would change the demand for, and composition of, base money and increase the elasticity of the demand for money to interest rates. Moreover, by exposing a broader section of the economy (households, financial and nonfinancial businesses) to an interest-sensitive instrument, the transmission mechanism of monetary policy could be strengthened. Also, if bank deposit holders considered CBDC to be a good alternative to deposits, banks would have less scope for independently setting the interest rate on retail deposits and would have to follow central bank decisions to change the CBDC rate. Thus, changes in the policy rate would be transmitted more directly to bank depositors, thus enhancing pass-through. The same would

hold through the foreign-exchange channel, as the use of CBDC facilitated currency management, thereby leading to stronger and faster exchange-rate movements for given policy interest-rate changes. An attractively remunerated CBDC could also be attractive to professional financial-market participants. It might therefore substitute for money-market instruments (for example, government bills, reverse repos, central bank bills, and foreign-exchange swaps) and would make a most liquid and safest (default-free) asset to be used as settlement instrument. The CBDC interest rate would establish a hard floor under money-market rates.

CBDC would add to the central bank's set of monetary-policy tools. These include the ability to apply negative interest rates on CBDC and to carry out "helicopter drops." If CBDC were interest bearing, the central bank could apply negative (nominal) interest rates (implying that CBDC holders would actually pay the central bank for storing their currency). In a world without cash, or where use of cash is limited, this would discourage the public from holding CBDC and push the public into spending them. Since cash pays zero nominal interest, negative interest rates on CBDC would push holders to move funds into cash. This would set a natural lower interest-rate boundary equal to zero, thus limiting the extent to which negative interest rates can be used to stimulate spending. In fact, the "effective" lower boundary is less than zero, considering storage, insurance, and transport costs associated with cash and the loss of convenience associated with cashless payments. Ways to make holding cash less attractive would include terminating its legal tender status and applying a discount on its face value or abolishing high-denomination notes. Notice, however, that if CBDC did not bear interest, it might limit the scope for monetary policy undesirably. This is because holding it would be less costly than holding cash, thus

effectively setting the effective lower boundary to zero and preventing short- and long-term interest rates from descending into negative territory.

An increasing number of central banks are struggling with the lower boundary limit on interest rates, including the Bank of Japan and European Central Bank. As the global neutral rate is trending down,⁹³ more and more countries will encounter this barrier, including emerging markets and developing economies, where inflation has been trending lower.⁹⁴ This trend has been accelerated by the shock from COVID-19. Removing the impediment of the lower boundary on interest rates through a CBDC could increase the effectiveness of central bank policy and help avoid global deflation and secular stagnation.⁹⁵ As constraints on changes to the policy rate have mounted, many central banks have turned to quantitative easing, including most recently in emerging markets and developing economies. These purchases are currently made through the financial system but with a CBDC could be channeled directly to individuals. (See below.) This would help allay some of the concern about inequality that accompanies central bank asset purchases⁹⁶ while potentially also making them more effective as stimulus. In fact, CBDC would enable central banks to effect “helicopter drops”—that is, to make transfers of funds directly to individual agents (in the form of gifts).⁹⁷ Depending on the situation, helicopter drops could be done universally, on all accounts, or on a selective basis. It should also be noted that no central bank has used helicopter money to date.

CBDC might affect the overall process of money supply. This would be the case if the availability to the general public of CBDC as the safest and most liquid asset in the economy, as well as its immediate accessibility on demand, were to make it highly preferable to bank deposits. Under such (admittedly extreme) conditions, the resulting loss of funding to banks might jeopardize their money-creation function via lending. This would reduce the overall elasticity of the money supply in the economy—that is, the capacity of money supply to satisfy dispersed demands for it, which the banking system typically ensures through its decentralized credit-allocation decision process. Banks would possibly be forced to fund their loans with costlier finance than sight deposits, which might reduce the overall supply of money and require the central bank or government (through the budget) to implement compensatory measures.

CBDC ON FINANCIAL STABILITY

CBDC could affect financial stability. If CBDC proved very attractive and were to be highly preferred to bank deposits, banks would face competition from the central bank and, as discussed, they would have to raise their deposit rates to remain competitive. This would reduce their profits and/or the demand for their loans. In turn, they might take on more risk. Banks could also increase their reliance on wholesale funding, but this might raise their cost of funding, with similar implications. Bank funding could also become more volatile, causing banks to hold more liquid assets and/or to cut back on lending.

CBDC might facilitate bank runs and accentuate financial crises. Considering that flight to safety has happened already twice in just over a decade (in 2008 as well as 2020), this issue is far from hypothetical. Although it is already possible for customers to switch to central bank money by having their bank deposits paid out in cash, they are in practice dissuaded by the costs and obstacles involved in handling and holding large amounts of cash (for example, storage and insurance, transport, limitation to availability, and so on). All this could change with CBDC, and the flight to CBDC could be easy and virtually free of charge. CBDC could thus allow for “digital runs” toward the central bank with unprecedented speed and scale. The switch could indeed be large, especially in times of stress, and the incentives to run could be sharper and more pervasive than is currently the case if bank deposits were not insured or deposit insurance was limited. In fact, even in the presence of deposit insurance, limited coverage ratio and long claim-settlement procedures in case of bank insolvencies might reduce the effectiveness of the insurance mechanism in dissuading runs. It should be noted that in cases of individual bank insolvency, immediate runs from the insolvent bank to other banks are already technically possible. In such cases, therefore, CBDC is not likely to affect the likelihood of runs. However, introducing limitations to deposit convertibility into CBDC could increase the risk of generalized runs out of the banking sector. The consequences of introducing such limitations are not clear in terms of the issuing central bank’s ability to guarantee the one-to-one convertibility of CBDC into cash and reserves, under the given limitations.

Also, CBDC of reserve-currency countries available across borders could increase currency substitution (“dollarization”) in other countries. In particular, the national currency of countries suffering from high inflation and exchange-rate

volatility might be supplanted by the CBDC of a reserve-currency country. A reserve-currency country is typically home to large digital networks that would facilitate such kinds of currency substitution, and private networks could be created that would give access to new and specific units of account

to people in many countries. In fact, if a reserve currency were available in CBDC form, even economies with stable currencies could be digitally dollarized if their citizens find themselves often transacting with users of a digital platform in that currency.



ENDNOTES

1. While a review of this literature is beyond the scope of this guide, a recent comprehensive review is reported in O. G. J. Brokke and N.-E. Engen, "Central Bank Digital Currency (CBDC): An Explorative Study on Its Impact and Implications for Monetary Policy and the Banking Sector" (master's thesis, Norwegian School of Economics, Bergen, fall 2019). On retail CBDC, references are contained in J. Kiff, J. Alwazir, S. Davidovic, A. Farias, A. Khan, T. Khiaonarong, M. Malaika, H. Monroe, N. Sugimoto, H. Tourpe, and Peter Zhou, "A Survey of Research on Retail Central Bank Digital Currency," IMF Working Paper WP/20/104 (International Monetary Fund, June 2020).
2. Although in most countries central banks would be in the driver's seat in the decision-making process on CBDC initiatives, other authorities can play a significant role. This could include, for example, the ministry of finance, the national treasury, other ministries, and, ultimately, the government as a whole. Moving forward in this guide, the involvement of other relevant authorities, where appropriate, is intended when reference is made to central banks.
3. Throughout the guide, the expression "national payments system" (NPS) refers to the systems operating within a national jurisdiction for the execution, clearing, settling, or recording of payments and securities trades and includes system platform, operators, and participants; bank and non-bank providers of payment and payment-related services; payment instruments and channels; legal and governance rules; and operations and procedures. Operating in a jurisdiction as part of the NPS does not necessarily mean that the system components, operators, and service providers are physically located in that particular jurisdiction.
4. See M. Linnemann Bech, U. Faruqui, F. Ougaard, and C. Picillo, "Payments Are A-Changin' but Cash Still Rules," *BIS Quarterly Review*, March 2018; and T. Khiaonarong and D. Humphrey, "Cash Usage across Countries and the Demand for Central Bank Digital Currency," IMF Working Paper WP/19/46 (International Monetary Fund, March, 2019).
5. CPMI, "Digital Currencies" (Bank for International Settlements [BIS], Basel, 2015).
6. CPSS, "Innovations in Retail Payments" (BIS, Basel, 2012), footnote 76.
7. In 2014, the Committee for Payment and Settlement Systems (CPSS) was given an expanded mandate and a new name: Committee for Payments and Market Infrastructures (CPMI).
8. It should be noted that even existing RTGS systems could be built on decentralized solutions such as DLT. Projects Stella, Jasper, and Ubin are studying how DLT can be used to settle wholesale transactions on an RTGS basis. See ITU-T Focus Group Digital Currency including Digital Fiat Currency, *Reference Architecture and Use Cases Report*, Focus Group Technical Report 07/2019 (International Telecommunication Union, July 2019). See also box 11.
9. DLT- and token-based currency allows for peer-to-peer transactions using private and public cryptographic keys to access and mobilize value and without the transacting parties holding accounts with any entity. This distinction is very important especially as regards issues of anonymity and AML/CFT policy. So far, there have been no wide-scale token-based digital currency implementations, but the Bank of Canada is working on so-called universal access devices (<https://www.bankofcanada.ca/2020/06/staff-analytical-note-2020-10>), and a number of firms have developed promising prototypes (<https://www.whisper.cash/whispercash-20201102.pdf>).
10. An alternative framework under which central banks could encourage the use of digital currencies would be for private-sector PSPs to issue liabilities fully matched by funds held at the central bank. Such an approach has been suggested by Tobias Adrian and Tommaso Mancini Griffoli in *The Rise of Digital Money*, FinTech Notes 19/01 (International Monetary Fund, July 2019) and goes under the name of "synthetic CBDC" (or sCBDC). PSPs would act as intermediaries between the central bank and the users, and their liabilities would share some of the characteristics of CBDC. Yet these liabilities would not be CBDC, as users would not hold a claim on the central bank. They would essentially be a form of "narrow-bank" money; see B. Bossone, "Should Banks Be Narrowed?," IMF Working Paper WP/01/159 (International Monetary Fund, October 2001).
11. In line with accounting theory and practice, this guide does not draw any distinction between "direct" and "indirect" central bank liabilities; liabilities are only between their issuer and their holders.
12. B. S. C. Fung and H. Halaburda, "Central Bank Digital Currencies: A Framework for Assessing Why and How," Staff Discussion Paper 2016-22 (Bank of Canada, 2016).
13. M. K. Brunnermeier and D. Niepelt, "On the Equivalence of Private and Public Money," *Journal of Monetary Economics* 106 (2019): 27-41.
14. See CPMI and World Bank Group, *Payment Aspects of Financial Inclusion* (BIS and World Bank Group, April 2016) and *Payment Aspects of Financial Inclusion in the Fintech Era* (BIS and World Bank Group, April 2020).
15. In 2018, the IMF and the World Bank Group launched the Bali Fintech Agenda, a set of 12 policy elements aimed at helping member countries to harness the benefits and opportunities of rapid advances in financial technology that are transforming the provision of banking services while at the same time managing the inherent risks; see *The Bali Fintech Agenda*, IMF

- Policy Paper (International Monetary Fund, October 2018). The agenda proposes a framework of high-level issues that countries should consider in their own domestic-policy discussions and aims to guide staff from the two institutions in their own work and dialogue with national authorities. The 12 elements were distilled from members' own experiences and cover topics relating broadly to enabling fintech, ensuring financial-sector resilience, addressing risks, and promoting international cooperation.
16. See C. Barontini and H. Holden, *Proceeding with Caution—A Survey on Central Bank Digital Currency*, BIS Papers No. 101 (BIS, Basel, January 2019).
 17. *Ibid.*
 18. See C. Boar, H. Holden, and A. Wadsworth, "Impending Arrival—A Sequel to the Survey on Central Bank Digital Currency," BIS Papers No. 107 (BIS, Basel, January 2020).
 19. See *Overview of Saudi Arabia's 2020 G20 Presidency: Realizing Opportunities of the 21st Century for All* (2020 Riyadh Summit, December 1, 2019) and *Enhancing Cross-Border Payments: Stage 3 Roadmap* (Financial Stability Board, October 13, 2020).
 20. Delivery-versus-payment settlement should be applicable even if one leg of the transactions were not tokenized. However, the non-tokenized system should be able to exchange messages with the system of tokens. See, for instance, SIX, "SIX Digital Exchange (SDX) Launches DLT-Based Trading and Settlement Prototype," media release, September 23, 2019, <https://www.six-group.com/en/newsroom/media-releases/2019/20190923-six-sdx-update.html>, or "Accelerating Collateral Mobility" (web page), HQLAx, <https://www.hqla-x.com>.
 21. See, for instance, K. Rogoff, "The Curse of Cash, Princeton" (Princeton University Press, New Jersey, 2016). It should be noted, however, that these benefits would not be unique to CBDC but a feature of any currency technology that crowded out cash-based informal economy transactions.
 22. See P. Wong and J. L. Maniff, "Comparing Means of Payment: What Role for a Central Bank Digital Currency?," FEDS Notes (Board of Governors of the Federal Reserve System, Washington, DC, August 13, 2020). In the study, **accessibility** in payments is defined as consumer access to a payment mechanism. (For example, cash is typically available to everyone, whereas access to an RTGS system is typically limited to eligible financial institutions.) **Anonymity** refers to the anonymous conduct of private transactions. (For example, cash allows consumers to transact anonymously in the physical world, whereas most electronic-payment systems do not allow for anonymity due to regulatory requirements.) **Bearer instrument** refers to an instrument that is payable to anyone in possession of it. (For example, cash is a bearer instrument, while a purely digital payment mechanism relies on an accounting record maintained by a third party.) **Independence** refers to the degree of intermediation needed to use a payment mechanism. (For example, the exchange of cash requires a physical exchange between two parties, while electronic transfers require to access a network.) **Operational efficiency** refers to the central bank costs associated with the investment and operating cost of money and to the societal costs of accepting and holding money. **Programmability** refers to an instrument that performs a number of programmable action and may be designed to have certain constraints on automated execution (for example, time-based gating of certain payments). **Service availability** refers to the time interval during which a payment service is available to make and receive fund transfers. As the study notes, these categories are not exhaustive and focus on the areas with the potential for greater differences.
 23. As explained in the study, the points on the radar chart represent the potential maximum value in a particular category for each payment mechanism; the points are illustrative of relative qualitative comparisons and not quantitative scores. In this assessment, CBDC scores higher than cash and RTGS on programmability because smart contracts can be built into a CBDC platform; it scores higher than cash and RTGS on potential operational efficiency; it scores lower than cash on anonymity and independence; and it scores close to RTGS and cash on service availability and accessibility. The points, however, do not consider trade-offs between categories. A CBDC that is a bearer instrument designed with off-line capability, for example, is less likely to have the same level of programmability than a CBDC that relies on a connected network.
 24. See World Bank, *A Practical Guide for Retail Payments Stock-taking*, Financial Infrastructure Series, Payment System Policy and Research (World Bank, October 2012), https://web.worldbank.org/archive/website01530/WEB/IMAGES/WB_2012_.PDF.
 25. The World Bank has developed a methodology to run such an analysis. See *Retail Payments: A Practical Guide for Measuring Retail Payment Costs* (World Bank, November 2016), <https://openknowledge.worldbank.org/handle/10986/25861>. For an application of this methodology, see *The Retail Payment Costs and Savings in Albania* (Bank of Albania and World Bank, June 2018).
 26. See World Bank, *Developing a Comprehensive National Retail Payments Strategy*, Financial Infrastructure Series, Payment System Policy and Research (World Bank, October 2012), <http://documents1.worldbank.org/curated/en/839121469729131991/pdf/84076-REPLACEMENT-FILE-PUBLIC-Developing-comprehensive-national-retail-payments-strategy.pdf>.
 27. See CPSS, *General Guidance for National Payment System Development* (BIS, Basel, January 2006). On September 1, 2014, the Committee on Payment and Settlement Systems was renamed the Committee on Payments and Market Infrastructures.
 28. See World Bank, *General Guidelines for the Development of Government Payment Programs*, Financial Infrastructure Series, Payment System Policy and Research (World Bank, July 2012), <https://openknowledge.worldbank.org/handle/10986/22127>.
 29. Principle 21 in CPSS and Technical Committee of the International Organization of Securities Commissions (IOSCO), *Principles for Financial Market Infrastructures* (BIS, Basel, April 2012).
 30. This section draws on "Central Banks and Payments in the Digital Era," chapter 3 in *Annual Economic Report* (BIS, Basel, June 2020), 67–95.
 31. For instance, this would be the case for the pilots being conducted by some leading central banks. In general, the tokenization of central bank money and/or the adoption of a decentralized technology, which would likely be incorporated into wholesale CBDC systems, would not per se prompt major changes in the NPS, and, as noted, even existing RTGS systems could be built on decentralized technology solutions like DLT. However, one could think of examples where wholesale CBDC tokens could change the NPS landscape in a major way—for instance, if they were distributed to non-banks via banks and if non-banks were enabled to settle obligations, say, in the context of securities market transactions, without going back to banks.
 32. This would be fully in line with the G20 global road map for enhancing cross-border payments. See CPMI, *Enhancing Cross-Border Payments: Building Blocks of a Global Roadmap; Stage 2 Report to the G20* (BIS, Basel, July 2020). The World Bank will also publish a report dedicated to ideas and experiments on the cross-border use of CBDC.

33. On this issue, the Bank of England says: “The appropriate degree of anonymity in a CBDC system is a political and social question, rather than a narrow technical question. As discussed above, CBDC would need to be compliant with AML regulations, which rules out truly anonymous payments. However, CBDC could be designed to protect privacy and give users control over who they share data with, even if CBDC payments are not truly anonymous (or secret). For example, a user may legitimately want to make a payment to a supermarket without sharing their identity with the supermarket, as this would allow the supermarket to build a picture of their shopping habits. In most cases, the payer should be able to pay without revealing their identity to the payee. In this sense, they could have anonymity with regards to other users, without having anonymity with regards to law enforcement.” See *Central Bank Digital Currency: Opportunities, Challenges and Design*, Discussion Paper (Bank of England, March 2020).
34. Financial Action Task Force guidelines would be relevant in this regard. See *Guidance for a Risk-Based Approach: Virtual Assets and Virtual Asset Service Providers* (Financial Action Task Force, June 2019).
35. See R. Auer and R. Böhme, “The Technology of Retail Central Bank Digital Currency,” *BIS Quarterly Review*, March 2020.
36. See Bank of England, *Central Bank Digital Currency*.
37. See World Bank, *Distributed Ledger Technology (DLT) and Blockchain*, FinTech Note No. 1 (World Bank, 2017).
38. See World Bank, *Distributed Ledger Technology*.
39. See CPMI, *Distributed Ledger Technology in Payment, Clearing and Settlement: An Analytical Framework* (BIS, Basel, February 2017).
40. For an interesting contribution on off-line payments, see C. Sheffield, “Central Bank Digital Currency and the Future: Visa Publishes New Research,” *Visa*, December 17, 2020, <https://usa.visa.com/visa-everywhere/blog/bdp/2020/12/17/central-bank-digital-1608165518834.html>.
41. This box draws on B. Bossone and H. Natarajan, “Getting Funds to Those in Need and Enabling Access to Money during COVID-19, Part 3: Central Bank Digital Currencies and Other Instruments,” *VoxEU* and CEPR, July 15, 2020, <https://voxeu.org/article/covid-19-central-bank-digital-currencies-and-other-payments-instruments>.
42. An example is the emergency COVID-19 stimulus bill proposed in the US House of Representatives, which referred to creating a “digital dollar” to get stimulus payments to unbanked Americans.
43. According to the CPMI, fast payments are defined as “payments in which the transmission of the payment message and the availability of final funds to the payee occur in real time or near-real time and on as near to a 24-hour and 7-day (24/7) basis as possible.” See CPMI, *Fast Payments—Enhancing the Speed and Availability of Retail Payments* (BIS, Basel, November 2016). Currently, more than 60 countries across the globe have a fast payment system in place, and several others have announced their plans to implement such systems. Fast payment systems have helped improve the efficiency of the financial system by unlocking funds, given the 24/7/365 operation; reducing systemic risk by providing instant access of funds to beneficiaries; improving oversight by enabling the central bank to have instant access to PSP data; reducing costs for end users; helping drive financial inclusion; and reducing dependence on cash for retail payments.
44. See M. Guadamillas, study coord., *Balancing Cooperation and Competition in Retail Payment Systems: Lessons from Latin America Case Studies*, Financial Infrastructure Series, Payment Systems Policy and Research (World Bank, November 2008).
45. See Bank of England, *Central Bank Digital Currency*.
46. As the Bank of England further discusses, AML/CFT responsibilities could be handled entirely by the payment interface providers, much as new business models could emerge with dedicated firms that verify users’ identity and use new techniques to identify suspicious activity.
47. Relevant sources on “de-risking” include “De-Risking in the Financial Sector” (web page), World Bank, October 7, 2016, <https://www.worldbank.org/en/topic/financialsector/brief/de-risking-in-the-financial-sector>; World Bank, *Report on the G20 Survey on De-Risking Activities in the Remittance Market* (World Bank, October 2015), <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/679881467993185572/report-on-the-g20-survey-in-de-risking-activities-in-the-remittance-market>; World Bank, *The Decline in Access to Correspondent Banking Services in Emerging Markets: Trends, Impacts, and Solutions; Lessons Learned from Eight Country Case Studies* (World Bank, 2018), <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/552411525105603327/the-decline-in-access-to-correspondent-banking-services-in-emerging-markets-trends-impacts-and-solutions-lessons-learned-from-eight-country-case-studies>; Financial Stability Board, “FSB Reports on Correspondent Banking and Remittances” (Financial Stability Board, March 16, 2018), <https://www.fsb.org/2018/03/fsb-reports-on-correspondent-banking-and-remittances/>; M. Erbenová, L. Yan, N. Kyriakos-Saad, A. López-Mejía, G. Gasha, E. Mathias, M. Norat, F. Fernando, and Y. Almeida, “The Withdrawal of Correspondent Banking Relationships: A Case for Policy Action,” IMF Staff Discussion Note SDN/16/06 (International Monetary Fund, June 2016); and “De-risking” (web page), Council of Europe, <https://www.coe.int/en/web/moneyval/implementation/de-risking>.
48. A forthcoming World Bank study, *Central Bank Digital Currencies for Cross-Border Payments: A Review of Current Experiments and Ideas*, discusses the use of CBDCs for cross-border payments and reviews the models that have been developed for this purpose to date.
49. See Financial Stability Board, *Enhancing Cross-Border Payments: Stage 1 Report to the G20* (Financial Stability Board, April 9, 2020).
50. The analysis supporting the table assumes that central banks would run a CBDC facility as a financial market infrastructure (FMI) or payment scheme and apply to it all relevant international standards. Also, the analysis assumes that central banks running a CBDC facility would adopt cost-recovery rules and pricing criteria that would take into account the volumes and values of the transactions ordered by participants but would apply no surcharges aimed to extract extra profits from its operation.
51. See CPMI and World Bank, *General Principles for International Remittance Services* (BIS, January 2007), and CPMI, *Cross-Border Retail Payments* (BIS, February 2018).
52. A comprehensive and systematic treatment of the challenges to be overcome in cross-border payment is presented in CPMI, *Enhancing Cross-Border Payments: Building Blocks of a Global Roadmap* (BIS, July 2020). See also Bank of Canada, European Central Bank, Bank of Japan, Sveriges Riksbank, Swiss National Bank, Bank of England, Board of Governors Federal Reserve System, and BIS, *Central Bank Digital Currencies: Foundational Principles and Core Features* (BIS, 2020), box 2.
53. An effective national digital ID system should cover all of a country’s citizens (as well as resident individual and legal persons), should be able to issue uniquely numbered IDs that are not easy to falsify or duplicate, should be easily queried, and should support quick and easy account opening. The availabil-

- ity of robust and easily verifiable digital ID (whether biometric or another type of data-based form) can be used to facilitate access to digital financial services.
54. See CPMI and Markets Committee, *Central Bank Digital Currencies* (BIS, Basel, March 2018) and the literature referred to therein; and see also F. Carapella and J. Flemming, “Central Bank Digital Currency: A Literature Review,” FEDS Notes (Board of Governors of the Federal Reserve System, November 9, 2020).
 55. See CPMI and Markets Committee, *Central Bank Digital Currencies* (cit.).
 56. A remunerated CBDC could be attractive to professional financial-market participants and might substitute for money-market instruments (for example, government bills, reverse repos, central bank bills, and foreign-exchange swaps) and would make the country’s most liquid and safest (default-free) asset to be used as a settlement instrument for domestic transactions.
 57. See M. Ferrari, A. Mehl, and L. Stracca, “Central Bank Digital Currency in an Open Economy,” Discussion Paper DP15335 (Centre for Economic Policy Research, October 2020).
 58. See C. Viñuela, J. Sapena, and G. Wandosell, “The Future of Money and the Central Bank Digital Currency Dilemma,” *Sustainability* 12, no. 9697, November 2020.
 59. If CBDC proved very attractive and were to be highly preferred to bank deposits, banks would face competition from the central bank and would have to raise their deposit rates to remain competitive. This would reduce their profits and/or the demand for their loans. In turn, they might take on more risk. Banks could also increase their reliance on wholesale funding, but this might raise their cost of funding, with similar implications. Bank funding could also become more volatile, causing banks to hold more liquid assets and/or to cut back on lending. See B. Bossone, “Banks Create Money (but Only to a Point): The ‘Payments Perspective,’” *Journal of Payments Strategy and Systems* 14, no. 3 (2020): 286–304.
 60. Some authors claim that CBDC would mitigate the risk of a bank run in times of crisis (see, for instance, L. Bitter, “Banking Crises under a Central Bank Digital Currency (CBDC),” VFS Annual Conference 2020). It should be noted, however, that the concern expressed in this guide does not build on specific theoretical assumptions or modelling hypotheses but reflects the general consideration that, all else being equal, digital movements of funds between accounts are much easier, speedier, and less costly to execute than movements of funds out of accounts and into cash.
 61. In October 2020, the Bahamas launched the Sand Dollar, making it the first country in the world to officially release CBDC beyond the testing phase. To that end, the Central Bank of the Bahamas Act was amended to enable the central bank to issue digital currency (e-money) as legal tender. Sections 8 and 12 of the act establish that the currency of the Bahamas may include e-money issued by the central bank (“The currency of The Bahamas shall comprise notes, coins and e-money issued by the Bank under the provisions of this Act”) and that e-money issued by the central bank is legal tender in the Bahamas (“All notes and electronic money issued by the Bank are legal tender in The Bahamas at their face value for the payment of any amount”). Section 15 of the act empowers the central bank to issue regulations for the purpose of prescribing the framework for the issue of e-money (“The Bank shall make regulations for the purpose of prescribing the framework under which electronic money issued by the Bank as legal tender may be held or used by the public in keeping with best international practices for the development and functioning of the payment system”). Section 8(3) refers to the definition of “electronic money” as contained in Section 29 of the Payment System Act of 2012. Finally, Section 14 sanctions counterfeiting and reproduction of currency, including in the form of e-money.
 62. In the case of the Bahamas—apparently the first country that has introduced CBDC beyond a pilot phase—the fact that the Central Bank of the Bahamas Act specifically mentions that currency comprises notes and coins has required amending the act expressly to recognize that the digital currency (more correctly, e-money) issued by the central bank is indeed currency.
 63. In line with this argument, the recently amended Central Bank of the Bahamas Act contains a specific section empowering the central bank to prescribe the framework under which e-money issued by the bank as legal tender may be held or used by the public in keeping with best international practices for the development and functioning of the payment system.
 64. To that end, the mentioned amendment to the Central Bank of the Bahamas Act explicitly affirms that digital currency is legal tender. Although the relevant section (Section 12) establishes thresholds for coins as legal tender, no qualification is made for digital currency. On the opposite, it is affirmed that the central bank may issue notes and coins and e-money simultaneously or issue e-money in the place of notes and coins.
 65. While the amended Central Bank of the Bahamas Act specifically refers to the definition of e-money contained in the Payment System Act of 2012, there is no reference to the requirements established for e-money in such earlier act. However, it is assumed that the central bank may govern these aspects, as well as any protection of customers for digital currency to be accepted as legal tender, by way of regulation.
 66. Unless, obviously, the central bank was (perceived) to abuse its power to issue CBDC:
 67. In addition to anti-money-laundering regulations, such as KYC regulations and overseeing transactions, these would also include provisions for data protection, consumer protection, responsibility for unauthorized transactions, taxes, and the like. The argument could be made, however, that CBDC should fall under the same legislation as physical cash, which normally is not subject to the same legislation as for other payment instruments.
 68. This is not always the case, however. See, for instance, the case of EBA Clearing’s payment systems.
 69. The “oversight of payment and settlement systems is a central bank function whereby the objectives of safety and efficiency are promoted by monitoring existing and planned systems, assessing them against these objectives and, where necessary, inducing change.” See CPSS, *Central Bank Oversight of Payment and Settlement Systems* (BIS, Basel, May 2005). Over the years, following the dramatic development of retail payment systems and service, additional public-policy objectives have become integral to the scope oversight, such as financial inclusion, consumer protection, and standards for payment instruments.
 70. See, for instance, the public consultation launched by the European Central Bank to extend the scope of payment system oversight in the euro area: *Eurosystem Oversight Framework for Electronic Payment Instruments, Schemes and Arrangements: Draft for Public Consultation* (European Central Bank, October 2020).
 71. FMI are considered systemically important. “In general a payment system is systemically important if it has the potential to trigger or transmit systemic disruptions; this includes, among other things, systems that are the sole payment system in a country or the principal system in terms of the aggregate value of payments; systems that mainly handle time-critical, high-value payments; and systems that settle payments used to effect settlement in other systemically important FMIs.” See CPSS and IOSCO, *Principles for Financial Market Infrastructures*.

72. These could include CBDC's availability (as a card or as an app through a smart phone, online, and so on), technology neutrality, modalities of issuance, access and interoperability, competition, and consumer protection.
73. See C. Minwalla, *Security of a CBDC*, Staff Analytical Note 2020-11 (Bank of Canada, June 2020), <https://www.bankofcanada.ca/2020/06/staff-analytical-note-2020-11/>, and see also Kiff et al., cit.
74. See S. Allen, S. Capkun, I. Eyal, G. Fanti, B. Ford, J. Grimmelmann, A. Juels, K. Kostianen, S. Meiklejohn, A. Miller, E. Prasad, K. Wüst, and F. Zhang, "Design Choices for Central Bank Digital Currency: Policy and Technical Considerations," *Global Economy and Development Working Paper 140*, v1.0 (Brookings, July 23, 2020).
75. For an illustration of Lean and Agile methodologies, see "Visual Guide to Agile Methodologies for Modern Product Management," *Miro* (blog), <https://miro.com/blog/choose-between-agile-lean-scrum-kanban/>.
76. The use of limits could create price deviations between types of central bank money ("discounts"), negating the principle of money being exchangeable at par and hampering the conduct of monetary policy. For instance, limits that would apply to the total supply of CBDC might be highly destabilizing if CBDC attractiveness were high, or highly erratic, and would risk undermining the 1:1 convertibility of CBDC vis-à-vis other types of money liabilities in the country, most notably at times of stress.
77. See U. Bindseil and F. Panetta, "Central Bank Digital Currency Remuneration in a World with Low or Negative Nominal Interest Rates," *VoxEU* and CEPR, October 5, 2020, <https://voxeu.org/article/cbdc-remuneration-world-low-or-negative-nominal-interest-rates>.
78. See CPMI and Board of IOSCO, *Responsibility E: A Compilation of Authorities' Experience with Cooperation* (BIS and IOSCO, Basel, December 2019). The report includes illustrative effective practices that may inform authorities in their development of, and improvements on, cooperative arrangements for all FMI types. The examples show how authorities have approached cooperation in domestic and cross-border settings, bilateral and multilateral formats, formal and informal settings, routine and ad hoc engagement, and business-as-usual and crisis scenarios.
79. See Auer and Böhme, "The Technology of Retail Central Bank Digital Currency," and from the same authors, "CBDC Architectures, the Financial System, and the Central Bank of the Future," *VoxEU* and CEPR, October 29, 2020, <https://voxeu.org/article/cbdc-architectures-financial-system-and-central-bank-future>.
80. See R. Auer, "Embedded Supervision: How to Build Regulation into Blockchain Finance," BIS Working Papers No. 811 (BIS, Basel, September 2019).
81. See B. Bossone, G. Srinivas, and H. Banka, "Granting Access to Real-Time Gross Settlement Systems in the FinTech Era," *Journal of Payment Strategy and Systems* 14, no. 4 (winter 2020–21).
82. It must be noted, however, that issuing wholesale CBDC would not be necessary to this end, since the same outcome can be achieved using API interfaces between RTGS and other systems, increasing access to RTGS services and extending RTGS system operations to 24/7.
83. See World Bank, *Guidelines for the Successful Regional Integration of Financial Infrastructures*, Financial Infrastructure Series, Payment Systems Policy and Research (World Bank, January 2014).
84. See T. Padoa-Schioppa, "Payments and the Eurosystem" (speech, SIBOS, Munich, September 13, 1999).
85. Source: CPSS and Technical Committee of IOSCO, *Principles for Financial Market Infrastructures*.
86. This appendix draws on M. Bech and R. Garratt, "Central Bank Cryptocurrencies," *BIS Quarterly Review*, September 2017, 55–70.
87. European Central Bank, *Virtual Currency Schemes—A Further Analysis* (European Central Bank, Frankfurt, February 2015).
88. See D. He, K. Habermeier, R. Leckow, V. Haksar, Y. Almeida, M. Kashima, N. Kyriakos-Saad, H. Oura, T. Saadi Sedik, N. Stetsenko, and C. Verdugo-Yepes, "Virtual Currencies and Beyond: Initial Considerations," IMF Staff Discussion Note SDN/16/03 (International Monetary Fund, January 2016).
89. See Board of IOSCO, *Global Stablecoin Initiatives: Public Report*, OR01/2020 (IOSCO, March 2020).
90. This (realistically) assumes that central banks would run a CBDC facility as public utility, possibly under cost-recovery rules and pricing criteria that would take into account transaction volumes and value by participants, but with no surcharges aimed to extract extra profits from its operation.
91. It is (realistically) assumed that central banks would run a CBDC facility as an FMI or payment scheme and apply to it all relevant international standards.
92. See CPMI and Markets Committee, *Central Bank Digital Currencies* (cit.) and the literature therein referred to.
93. See L. Rachel and L. H. Summers, "On Falling Neutral Real Rates, Fiscal Policy, and the Risk of Secular Stagnation," BPEA Conference Drafts (Brookings, March 7–8, 2019).
94. See J. Ha, M. Ayhan Kose, and F. Ohnsorge, eds., *Inflation in Emerging and Developing Economies: Evolution, Drivers and Policies* (World Bank Group, 2019).
95. See R. Agarwal and M. Kimball, "Breaking Through the Zero Lower Bound," IMF Working Paper WP/15/224 (International Monetary Fund, October 2015), and M. D. Bordo and A. T. Levin, "Central Bank Digital Currency and the Future of Monetary Policy," NBER Working Paper 23711 (National Bureau of Economic Research, August 2017).
96. See V. Selezneva, M. Schneider, and M. Doepke, "Distributional Effects of Monetary Policy," 2015 Meeting Papers No. 1099 (Society for Economic Dynamics, 2015), and M. Lenza and J. Slacalek, "How Does Monetary Policy Affect Income and Wealth Inequality? Evidence from Quantitative Easing in the Euro Area," ECB Working Paper Series No. 2190 (European Central Bank, October 2018).
97. Notice that the expression "helicopter drops" derives from the expression "helicopter money," coined by Milton Friedman in *The Optimum Quantity of Money and Other Essays* (Chicago: Aldine, 1969) when writing about the parable of dropping money from a helicopter to indicate a large economic stimulus through the issuance and distribution of money directly to people. According to S. Grenville ("Helicopter Money," *VoxEU* and CEPR, February 24, 2013, <https://voxeu.org/article/helicopter-money>), the image of the central bank helicopter-dropping currency onto the eager public below is misleading: only governments can give away either cash or, more realistically, checks, and—as he argues—this is fiscal policy, not monetary policy; central banks have no mandate to give away money. (They can only exchange one asset for another, as they do in quantitative easing.) Decisions like this are backed by the usual budget-approval process. Thus, Grenville concludes, it is a government helicopter that does the drop, and it is called fiscal policy.



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