



WHITE PAPER

**Laying the Foundations of Interoperable
Wholesale Central Bank Digital Currencies
in the Asia-Pacific Region**

Asia-Pacific Financial Forum Financial Market Infrastructure Network

Table of Contents

Executive Summary	3
1. Overview of the current environment	4
a. High-level background on CBDC	4
b. CBDC projects globally	6
2. Overview of the 2021 APFF-IIF Symposium on CBDCs	11
3. Key issues	15
a. Objectives of the public sector	15
b. Use cases and design considerations for wholesale CBDCs	21
c. The intersection between CBDC and growth of the digital economy	23
4. Recommendations	26
a. Common principles on CBDC development	26
b. Capacity building	27
c. Laying a foundation for interoperability	28
d. Timeline considerations	28

Laying the Foundations of Interoperable Wholesale Central Bank Digital Currencies in the Asia-Pacific Region

A White Paper produced by the Asia-Pacific Financial Forum (APFF) Financial Market Infrastructure Network

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Executive Summary

Central Bank Digital Currency (CBDC) is a novel form of digital liability that has received increasing interest as experience with digital ledgers, blockchain, cryptocurrencies and digital assets expands globally. While there are a number of different models in how a CBDC may exist in the future, the primary attribute is that any CBDC implementation would represent an issuance of currency in a digital form by a Central Bank. This may or may not require some form of a distributed ledger technology (DLT), but DLT is not a requirement.

Reasons for implementation vary, with one primary differentiator being between retail (rCBDC) and wholesale (wCBDC) applications. This paper seeks to explore wCBDC. While there may be some references to rCBDC, where certain aspects may overlap or to provide contrast, the aim of this White Paper is to provide an overview of wCBDC research and the APFF FMI network experts' views and analysis. It also provides ideas that the APEC Business Advisory Council may consider in formulating its recommendations to the APEC Finance Ministers and other interested parties involved in policies, decision-making, and other activities related to domestic and cross-border wCBDC implementation.

Some limited tests on interoperability exist, but there is a need to lay an interoperable foundation as key component of even local CBDC. Current payment systems suffer from interoperability issues, so future CBDC implementations should look to counteract potential technological and policy barriers that may be caused by initial decisions.

1. Overview of the current environment

High-level background on CBDCs

CBDCs are a form of digital liability on the books of the central bank (CB), typically expected to be denominated in and exchangeable at par with other units of the domestic currency. CBDCs have been conceived in two distinct use cases, where existing CB liabilities include cash for general use (retail) and central bank reserves/settlement balances for wholesale settlement and implementation of monetary policy. Wholesale liabilities are already digital and typically operate on a centralized ledger at the CB on a real-time gross settlement (RTGS) basis.¹

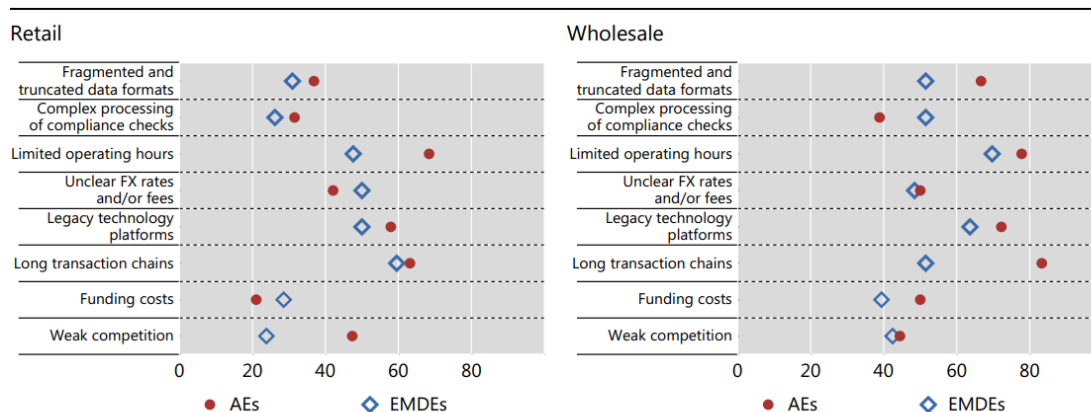
Because wholesale central bank liabilities are already digital, wCBDC generally refers to a liability that is issued and could be transacted using DLT.² Retail central bank liabilities are not currently digital and their digital ledger infrastructure would include RTGS or DLT models.

A majority of CBs in economies representing almost all of global GDP³ are actively exploring CBDCs, concentrating primarily on the retail form for domestic use. However, a majority of recent BIS survey respondents indicate they are considering cross-border interoperability in their design.⁴

Retail CBDC can potentially address a range of policy goals identified by the BIS (e.g. see graph 5 below), including cross-border use for trade and remittances.⁵

Figure 1: Cross-border frictions that a CBDC could address¹

Share of respondents



¹ The sample includes jurisdictions that consider efficiency in cross-border payments as a somewhat important, important, and very important driver of their CBDC engagement.

Source: 2021 BIS central bank survey on CBDCs and digital tokens.

¹ In line with [Principles for Financial Market Infrastructures \(PFMI\)](#) developed by the Committee on Payments and Market Infrastructures (CPMI) and the International Organization of Securities Commissions (IOSCO)

² See e.g. <https://kiffmeister.com/what-is-and-isnt-a-wholesale-central-bank-digital-currency/>

³ See BIS: [Gaining momentum – Results of the 2021 BIS survey on central bank digital currencies](#) (May 2022)

⁴ *Ibid.*

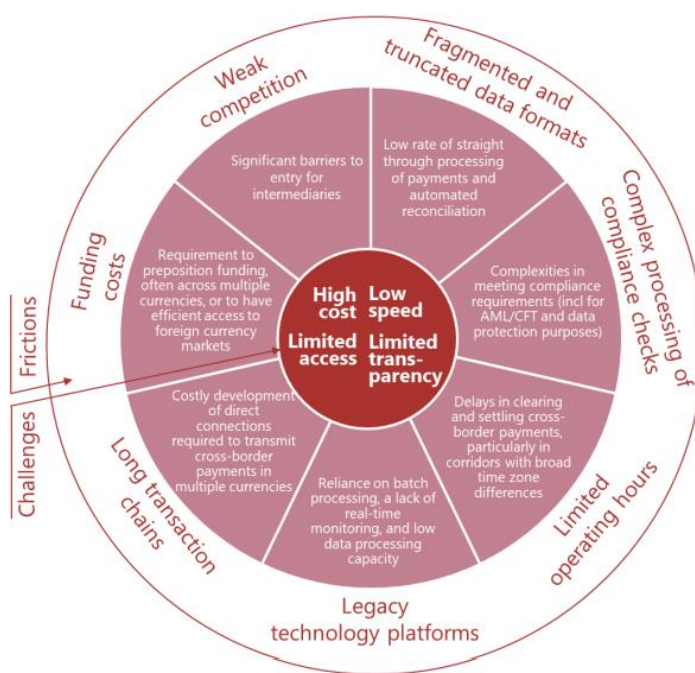
⁵ *Ibid.*

Meanwhile, a number of economies⁶ have explored the use of a domestic wCBDC, with primary use cases being atomic settlement of tokenized securities and expanded access to settlement in CB money. However, most domestic projects have found the case for DLT-based domestic wCBDC unconvincing given the efficiency of tiered access to the centralized RTGS system as well as regulatory and technical links between securities depositories and settlement activities.⁷

This has been exemplified by various annual [surveys](#) of CBDC developments that show work on retail projects outpacing wholesale projects and at earlier stages of development. Less than 10 percent of CBs plan to issue wholesale CBDCs in the next 3 years and about 20 percent within 6 years although this ticked up during the pandemic. Where there is wholesale interest though it is focused on cross-border benefits.⁸

At the same time, cross-border wCBDC using DLT has the potential to reduce frictions, given that no international centralized RTGS ledger exists. The resulting chain of correspondent bank transactions introduces well-known risks, costs and exclusions (see Figure 2 below).⁹ A number of cross-border wCBDC models and interoperability integrations between them are being explored (see section on interoperability below). The BIS has explored the potential role cross-border CBDCs could play in alleviating international payments frictions (see Figure 3 below).¹⁰ However, easing of cross-border capital flows, including DLT artifacts, introduce new risks and complexities, particularly around governance.¹¹

Figure 2: Challenges and frictions in cross-border payments



Source: CPMI based on FSB (2020b).

⁶ See [spreadsheet maintained by BIS](#) (updated Jan 2022) for list of recent wholesale CBDC projects.

⁷ See e.g. [Canada's Project Jasper – Phase 3](#)

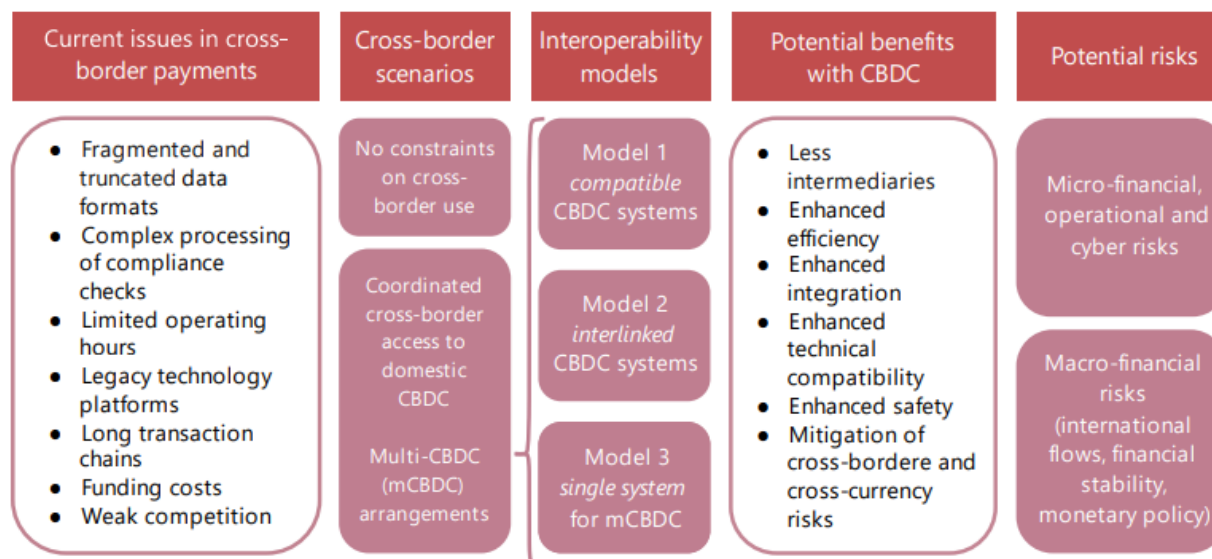
⁸ See BIS: [Gaining momentum – Results of the 2021 BIS survey on central bank digital currencies](#) (May 2022)

⁹ E.g. CPMI/FSB: [Enhancing cross-border payments: building blocks of a global roadmap](#) (July 2020)

¹⁰ CPMI, BIS, World Bank, IMF: [Central bank digital currencies for cross-border payments](#) (July 2021)

¹¹ See e.g. IMF: [Digital Money Across Borders: Macro-Financial Implications](#) (Oct 2020)

Figure 3: Summary of the potential to enhance cross-border payments with CBDCs



Source: CPMI; BIS Innovation Hub; IMF; World Bank.

CBDC projects globally

List of recent cross-border wholesale CBDC projects¹²

Project Name	Participants	Summary	Interoperability ¹³
Dunbar	BIS Innovation Hub (Singapore), Central banks: Australia, South Africa, Malaysia, Singapore + 2 commercial banks each	Proof of concept for settlement payments of wholesale (between banks) CBDCs in different currencies on the same distributed ledger. Banks hold foreign currency CBDCs through sponsorship from CBDC-domestic banks	Integrated
Jura	BIS Innovation Hub (Switzerland), Banque de France, Swiss National Bank	Foreign exchange of wholesale CBDCs against a financial security asset held on a DLT between French and Swiss banks	Interlinked
Project multiple CBDC (mCBDC) Bridge	BIS Innovation Hub (Hong Kong, China), Hong Kong Monetary Authority, Bank of Thailand, Digital Currency Institute of the People's Bank of China,	Using multiple jurisdiction CBDCs to settle with FX on a common platform for multiple use cases with an immediate focus on cross-border trade between corporate end users	Integrated

¹² See e.g. CPMI, BIS, World Bank, IMF: [Central bank digital currencies for cross-border payments](#) (July 2021), [Atlantic Council CBDC tracker](#) (on-going), World Bank Group: [Central Bank Digital Currencies For Cross-Border Payments: A Review of Current Experiments and Ideas](#) (Nov 2021)

¹³ See BIS: [Multi-CBDC arrangements and the future of cross-border payments](#) (Mar 2021); CPMI, BIS, World Bank, IMF: [Central bank digital currencies for cross-border payments](#) (July 2021)

	<i>Central Bank of the United Arab Emirates</i>		
<u>Inthanon-LionRock</u>	<i>Hong Kong Monetary Authority, Bank of Thailand</i>	<i>PoC for shared-governance integrated wholesale cross-border CBDC</i>	<i>Integrated</i>
<u>Aber</u>	<i>Saudi Central Bank and Central Bank of the U.A.E</i>	<i>Joint Digital Currency and Distributed Ledger Project to explore the viability of a single dual-issued digital currency on DLT as an instrument of domestic and cross-border settlement</i>	<i>Integrated</i>
<u>Jasper-Ubin</u>	<i>Monetary Authority of Singapore and Bank of Canada</i>	<i>PoC: Interoperation of MAS Project Ubin (phase 4) and BoC Project Jasper DLT platforms for atomic cross-border central bank settlement</i>	<i>Interlinked</i>
<u>Stella</u>	<i>Bank of Japan and European Central Bank</i>	<i>Multi-phased investigation exploring domestic high-value payment, DvP for securities settlement, reducing settlement risk in cross-border payments (Phase 3), and privacy preservation techniques</i>	<i>Interlinked</i>
<u>Ubin (Phase 4)</u>	<i>Monetary Authority of Singapore, Bank of England and Bank of Canada</i>	<i>Phase 4: models for cross-border payments using wholesale central bank digital currencies.</i>	<i>Interlinked</i>
<u>Multi-currency Corridor Network</u>	<i>Banque de France, Monetary Authority of Singapore</i>	<i>PoC for a shared governance/rulebook multi-currency (Euro to SDG) cross-border CBDC payment on JP Morgan's Onyx Quorum-based DLT</i>	<i>Integrated</i>
<u>R3 blockchain models for wholesale CBDC</u>	<i>R3</i>	<i>Analysis of models for cross-border settlement on a DLT by allowing global banks access to a domestic CBDC or through synthetic CBDCs based on currency pairs</i>	<i>Integrated</i>

Interoperability considerations between central bank efforts

BIS work¹⁴ suggests that interoperability may be accomplished by allowing non-domestic wholesale and/or retail parties to hold domestic CBDC or designing systems around three models for interoperability:

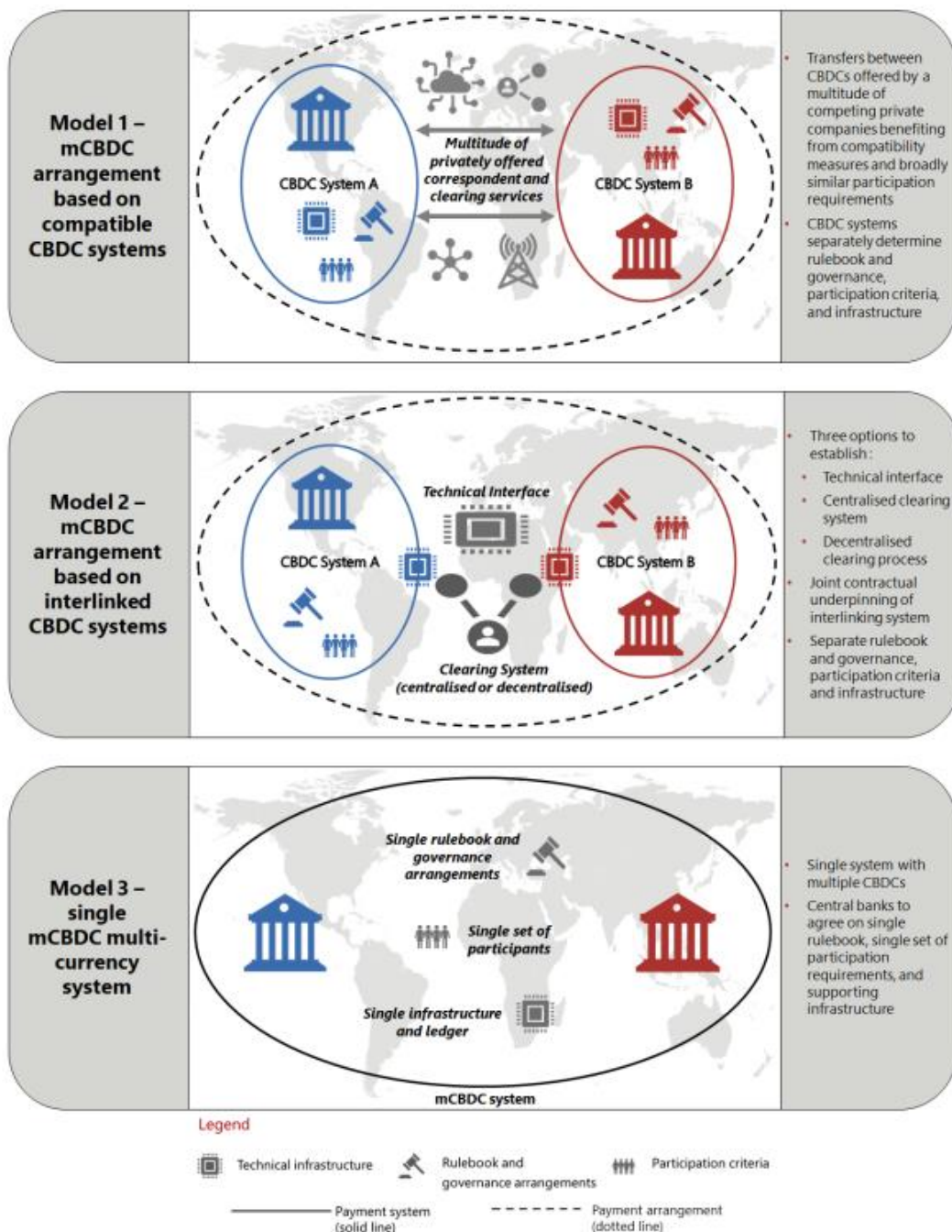
- Compatibility – e.g. standards (e.g. ISO 20022), technical architecture and interfaces, rulebook etc. to facilitate institutional participation in multiple systems. Most domestic retail and wholesale CBDC exploration already considers these factors, in alignment with more general global efforts to harmonize payments infrastructure.¹⁵

¹⁴ See BIS: [Multi-CBDC arrangements and the future of cross-border payments](#) (Mar 2021) CPMI, BIS, World Bank, IMF: [Central bank digital currencies for cross-border payments](#) (July 2021)

¹⁵ See CPMI, FSB: [G20 Roadmap for enhancing cross-border payments: First consolidated progress report](#) (Oct 2021); CPMI, BIS, World Bank, IMF: [Central bank digital currencies for cross-border payments](#) (July 2021)

- Interlinking – shared technical interface or common clearing mechanisms, corridors and atomic cross-platform transactions to reduce risk and facilitate FX¹⁶
- Integration – multiple CBDC currencies settling on common platform. Common governance and technical system.

Figure 4: Interoperability can be enabled via “multi-CBDC arrangements”



Source: R Auer, P Haene and H Holden, "Multi-CBDC arrangements and the future of cross-border payments", *BIS Papers*, no 115, March 2021.

¹⁶ See table above for alignment of interoperability models with cross-border wCBDC experiments

Below are selected government/CB signals on cross-border wholesale CBDCs: It should be noted that most government and central bank analysis and communication focus on retail domestic CBDC. However, key signals include:

- [G7 Ministers](#): high-level support for the exploration of CBDCs for cross-border payments. However, likely at a retail CBDC level (para.14). (May 2022)
- [UK](#): Bank of England Governor signals that domestic and cross-border CBDCs unlikely, but “omnibus” central bank accounts that expand access by co-mingling tokenized and non-fungible institutional funds could reduce cross-border frictions. (Nov. 2021)
- [US](#): Federal Reserve discussions around CBDC have been focused at the domestic and retail level, implying low likelihood of movement in the wholesale cross-border CBDC space (Jan 2022). The Presidential [Executive Order](#) to coordinate policy on digital assets suggests consideration of factors applicable mainly to a retail CBDC. However, it also mentions participation in international and cross-border experiments, interoperability and payment system efficiency which could imply a role for a wholesale CBDC. A response to the executive order has been directed to be prepared by Sept. 2022 (Mar 2022)
- [Financial Action Task Force \(FATF\)](#): Focus on risks of commercial stablecoins and retail CBDCs. Wholesale CBDCs may pose lower ML/TF risks depending on design (para 92). (June 2020)
- Eurosystem: [ECB](#) has signaled that the function of a wholesale CBDC in the domestic market is served through the RTGS infrastructure (e.g. TARGET2, TIPS) and [emphasis is on retail CBDC](#). At the same time, ECB and constituent [member economies’ banks](#) continue to explore domestic and cross-border use cases for wholesale CBDC using DLT.

Policy, consultation and technical papers from other entities

- [SWIFT](#) is exploring integration of wholesale CBDC services into the expanding Transaction Management (TM) suite. [New experiments](#) with CapGemini plan to explore ways to link CBDCs systems. A [2021 PoC](#) with Accenture demonstrated that a DLT-based CBDC and a traditional RTGS system could be linked for a successful transaction. Key SWIFT roles (with examples) include:
 - Cross-network support (transaction orchestration, liquidity)
 - Applications (payment apps, KYC)
 - Network services (identity, routing)
 - Technical operator (DLT node operator/ infrastructure provider)
- G7 central banks (plus BIS) (retail focus): [Central bank digital currencies - executive summary](#) (Sep 2021); [System design and interoperability](#) (Sep 2021)
- Bank for International Settlements (in addition to those already referenced): [Central bank digital currencies: motives, economic implications and the research frontier](#) (Nov. 2021); [The technology of retail central bank digital currency](#) (Mar 2020); [CBDCs: an opportunity for the monetary system](#) (June 2021); [CBDCs beyond borders: results from a survey of central banks](#) (June 2021)
- World Bank Group: [Central Bank Digital Currencies For Cross-Border Payments: A Review of Current Experiments and Ideas](#) (Nov 2021); [Central Bank Digital Currency: Background Technical Note](#) (Nov 2021)
- International Monetary Fund: [Fintech Notes: Behind the Scenes of Central Bank Digital Currency](#) (Feb 2022); [Digital Money Across Borders: Macro-Financial Implications](#) (Oct 2020)

- Centre for Economic Policy Research: [Central Bank Digital Currency: Considerations, Projects, Outlook](#) (Nov 2021)

Other resources tracking developments in CBDC (retail/wholesale, domestic, cross-border):

- BIS maintains a periodically updated [spreadsheet of activities, projects, sentiment](#) regarding domestic and cross-border retail and wholesale CBDCs¹⁷
- The US-based Atlantic Council maintains an [interactive map](#) and analyses of ongoing retail and wholesale CBDC projects as well as an inventory of cross-border experiments
- [CBDC Insider](#) monitors industry coverage of key issues in digital currencies and CBDC, maintains a [reading library](#) of key CBDC thought pieces, is home to the [CBDC Think Tank](#), an industry and academic consortium.
- [CBDC Tracker](#): open-source project providing information on world CBDC initiatives with focus on DLT/blockchain infrastructures. Includes: Dashboard, CBDC Information Card, Timelines and Time Slider, News Aggregator, Watchlist Tool. [Whitepaper](#).
- [Kiffmeister Chronicles](#): Managing Director of the [CBDC Think Tank](#), John Kiff, has maintained a blog for several years monitoring developments in CBDC and fintech, including a running enumeration [of DLT-based cross-border wCBDC experiments](#)

¹⁷ See also BIS: [Rise of the central bank digital currencies: drivers, approaches and technologies](#) (Aug. 2020) for a description of the BIS tracker

2. Overview of the 2021 APFF-IIF Symposium on CBDCs

In December 2021, the APFF FMI Network, in partnership with the Institute of International Finance (IIF), held a Symposium on CBDCs. The goal of the Symposium was to examine the current landscape for CBDCs, key challenges and solutions, and include the perspectives of the financial industry and private sector concerning challenges and enablers in advancing CBDC efforts.¹⁸

Following were the highlights of the first session:

Project Inthanon-LionRock: This is a THB-HKD cross-border corridor network prototype that was developed¹⁹. This proof-of-concept (PoC) illustrated the following:

- There is a danger of the corridor network, which is on DLT for our wholesale CBDC, which has 24/7 nature of the network effects the existing operations of legacy systems of commercial banks.
- There is a need for a liquidity provider or liquidity saving mechanism to help solve shortage of effects arise from eliminating correspondent banks in PVP transactions.
- DLT has scalability and performance limitations.

From a securities and futures exchange perspective, assets are being tokenized and new exchanges are being created in tokenizing assets such as securities, currencies, art, real estate, among others. Hence, enabling settlements in CBDCs is only a part of the equation. With the tokenization of securities, there are whole sets of participants making a living out of these T+0 settlement cycles (against T+2 in traditional securities). Before addressing cross border payment systems and facilitating the FX market, it needs to be considered whether it will be more efficient than the current foreign exchange market. In the mBridge project²⁰, there are many applications including cross border payments and cross border purchases, including goods and securities. In the case of the PBOC project, the implication is obviously on promoting RMB internationalization.

In the second session that focused on challenges and solutions for CBDCs,²¹ key highlights covered the following:

- The Digital Dollar Project (DDP): This set out to explore the thesis that a tokenized US dollar will provide societal and economic benefits while continuing to identify challenges and merits of alternative models. The DDP champion model is a tokenized form of the US dollar that operates alongside existing money, which is primarily distributed through the existing two-tiered architecture of commercial banks and regulated money transmitters. When done correctly, the structure of DDP pilot should enable the private sector to bring capabilities and expertise that permits collaborative engagement without impinging upon IP rights and commercial intents.

¹⁸ Mr. Hiroshi Nakaso, 2022 Chair, ABAC Finance and Economics Working Group and Chairman, Daiwa Institute of Research provided introductions to the first session. Moderated by Mr. Bob Trojan, Sherpa, APFF Data Ecosystem Working Group, President and CEO, Token Insights and Senior Advisor, International Law Institute, the first session included an overview of the CBDC landscape by Mr. Wee Kee Toh, Advisor, Bank for International Settlements and Head of Project Dunbar at BIS Innovation Hub Singapore Centre. This was followed by a fireside chat with Mr. Naoto Shimoda, Associate Director-General, Payment and Settlement Systems Department, Bank of Japan and Dr. Thammarak Moenjak, Chief Representative, London Representative Office, Bank of Thailand and a panel discussion with Mr. R. Jesse McWaters, Global Head of Regulatory Advocacy and Senior Vice President, MasterCard and Mr. Julien Martin, Managing Director and Head, Digital, Data and ESG, HKEX.

¹⁹ <https://www.hkma.gov.hk/eng/news-and-media/press-releases/2020/01/20200122-4/>

²⁰ https://www.bis.org/about/bisih/topics/cbdc/mcbdc_bridge.htm

²¹ The second session focused on challenges and solutions for CDDBC was moderated by Mr. Conan French, Senior Advisor, Digital Finance, Institute of International Finance and featured a panel between Ms. Jennifer Lassiter, Executive Director, The Digital Dollar Project, Dr. Taiji Inui, Advisor to the Central Bank of Myanmar, Japan International Cooperation Agency (JICA); and Consultant, Asian Development Bank (ADB), Mr. Douglas Elliott, Partner, Oliver Wyman and Prof. David Lee, Professor, Singapore University of Social Sciences and Shanghai University of Finance and Economics.

- Proposed Asia Digital Common Currency (ADCC): This concept, which is being proposed for adoption by ASEAN+3, has the following elements: (1) CBs in the region provide government bonds to an international organization; (2) an international organization issues ADCC bonds backed by government bonds; and (3) CBs issue ADCC backed by the ADCC bonds. The ADCC is not a single currency but a common currency co-existing with the local currencies (LCYs) managed by all member economies in the region.
- There were also discussions on rCBDC and Project Dunbar²² as an example of multi-CBDC arrangements in this region.

The session talked about becoming frictionless, better, cheaper and faster, while going beyond exchange policy and disintermediation, which are challenges being discussed in some of the white papers of Asian CBs, as well as smart contracts, which is seen as a low-hanging fruit.

For the final session,²³ the key highlights were as follows:

- Domestic payment infrastructures, real time payments and RTGSs, by large are already very efficient, although some argue that there are remaining challenges with respect to financial inclusion.
- There is a USD 100 billion opportunity to reduce fees and create value by shortening transaction chains on corridors using wholesale CBDCs. However, this amount is largely coming out of commercial banks' profits and losses.
- There will be opportunities for the private sector in distribution: undertaking AML and KYC, market making between different CBDCs/currencies), and providing value added services, such as allowing for conditional payments and dynamic cash concentration on top of CBDCs.
- CB money and commercial bank money coexist. There are certain use cases that require CB (credit risk free) money, when it comes to securities settlement. On the other hand, commercial payments on a cross border basis settle on commercial bank money.
- Corridor networks and wCBDCs provide a very interesting alternative on emerging market currencies, with which much more trade is happening. The pathway to expand the currency coverage of CLS is long for various reasons. Settlement risk could be reduced by executing on payment versus payment (PvP) basis (by atomic settlement).
- There is much to consider regarding what will happen in the FX markets, such as the case of Uniswap, automated market making systems prevailing (on crypto assets), and traditional over-the-counter (OTC) FX markets, such as the request for quote (RFQ) process, competing with the new ones.
- There is a need to solve interoperability when introducing wholesale CBDCs. Otherwise it will just end up recreating the world of today. Solutions should create interoperable cross border infrastructure based on commercial money to begin with, and secure interoperability, both vertically (between central bank money and commercial bank money) and horizontally (among different currencies).

Overall, following were the key findings:

- The level of interest in CBDCs is very high, with around 60 percent of CBs undertaking active research. The latest available statistics (as of the writing of this paper) from the [Atlantic Council](#)

²² A panelist from a central bank participating in Project Dunbar, said in another symposium that it is crucial to maintain sovereignty at the multi-CBDC exploration.

²³ The final session, moderated by Mr. Richard Robinson, Sherpa, APFF Financial Market Infrastructure Network; and Chief Strategist, Open Data and Standards, Bloomberg LP, discussed the financial industry and private sector perspectives regarding CBDC between Mr. Naveen Mallela, Global Head of Coin Systems, Onyx by J.P. Morgan, Mr. Andres Wolberg-Stok, Head of Strategy, Office of the CTO, Citi, and Mr. Josh Lipsky, Director, GeoEconomics Center, Atlantic Council.

show that 105 economies, representing over 95 percent of global GDP, are exploring a CBDC, while 50 economies are already in an advanced phase of exploration (development, pilot, or launch). According to the latest BIS CB survey²⁴, over 90 percent of central banks are exploring CBDCs, primarily at a retail level with over half of CBs at an experimental stage of development or beyond.

- With respect to wCBDCs, there are approximately 19 domestic projects ([BIS Tracking spreadsheet](#)²⁵). Cross-border projects include approximately nine projects undertaken by CBs, as listed earlier in this document.²⁶ Private entities, including R3, JPM, Fidelity (UBS), are experimenting with private wholesale stablecoin solutions. They are also partnering on some wholesale CB experiments such as the Riksbank eKrona, Banque de France and MAS projects.
- On design choices for wholesale or retail CBDCs in relation to single- or two-tier issuance models, most retail CBDCs are pursuing a 2-tier issuance model, similar to cash, but with wider access for intermediaries. Wholesale CBDC models would have direct issuance from the CB to participants but could also support tiered access for other entities, as with current RTGS systems, depending upon access model.
- Regarding definitions of assets or currency as well as liability, CBDC is a liability of the CB in most models.²⁷ As a CB liability, the issuance of a CBDC is by the CB in all models under consideration. In rCBDCs, distribution could be direct from the CB to end users (unilateral model) but almost all jurisdictions intend to distribute via intermediaries (intermediated model). Wholesale CBDC would be issued directly to participants who may distribute to indirect participants in a tiered design. An alternative model, “synthetic” CBDC, would be privately issued but fully backed by CB money. However, it is not being seriously considered in most jurisdictions and applies more closely to the retail space. Generally a synthetic CBDC is not considered a true CB liability.²⁸ Also discussed was the inclusion of private sector key.
- The distinction between token- and account-based has become a contentious and confusing issue.²⁹ This is because traditional token vs account definitions are evolving towards new conceptual models, such as “claims-based” vs “object-based”³⁰ distinction and a “hybrid” definition.³¹
- As an asset, there is some debate about whether CBDC is currency in the traditional sense, as it straddles the role of cash and wholesale reserves, particularly for a wCBDC.³² Depending on the issuance model (eg. account based versus token based), the legal treatment of the CBDC may be different. In cases of token-based methodologies, this would currently fall under the definition of an asset and/or commodity as opposed to treatment as a currency. This does not preclude some agreed remedy to adjust this treatment, but this definitional issue would need to be addressed to prevent complications.
- With regard to domestic and cross-border interoperability, several cross-border experiments listed earlier have extended domestic wCBDC PoCs into the cross-border space.³³ Project Jasper-Ubin explicitly tested the interlinkages between two different DLT platforms (Corda and Quorum). The BIS

²⁴ BIS: [Gaining momentum – Results of the 2021 BIS survey on central bank digital currencies](#) (May 2022)

²⁵ See BIS: [Rise of the central bank digital currencies: drivers, approaches and technologies](#) (Aug. 2020) for a description of the BIS tracker

²⁶ Also e.g. [Atlantic Council](#), CPMI, BIS, World Bank, IMF: [Central bank digital currencies for cross-border payments](#) (July 2021)

²⁷ See BIS: [The technology of retail central bank digital currency](#) (Mar 2020) for a description of issuance models

²⁸ E.g. BIS et al. [Central bank digital currencies: foundational principles and core features](#) (June 2020)

²⁹ See e.g. <https://kiffmeister.com/the-account-versus-token-based-digital-currency-taxonomy/>,

³⁰ IMF: [The rise of digital money](#)

³¹ See e.g. <https://libertystreeteconomics.newyorkfed.org/2020/08/token-or-account-based-a-digital-currency-can-be-both/>

³² See e.g. IMF: [Digital Money Across Borders: Macro-Financial Implications](#) (Oct 2020) for an examination of the issue

³³ E.g. [Project Jasper-Ubin](#), [Project mCBDC Bridge](#), [Project Dunbar](#)

interoperability taxonomy listed earlier is relevant to the discussion on compatibility, inter-linking and integration. There is also ongoing work on bilateral and multilateral CBDC and stablecoin projects. Project Ubin (Singapore) has extended their CBDC exploration to integration of private DLTs and stablecoins.³⁴ Banque de France and Monetary Authority of Singapore are exploring wCBDC transactions across JP Morgan's Onyx platform developed to transact the entity's proprietary stablecoin. The [Onyx Settlement Platform](#) and [Finality's payments consortium](#) (formerly Utility Settlement Coin or USC) are notable examples of privately issued wholesale stablecoins.

- Discussions also focused on implications for financial system integration³⁵ and financial stability.
 - Three overarching principles of retail CBDC³⁶ have been widely adopted, which are: (a) do no harm to monetary and financial stability (i.e. a central bank's mandate); (b) co-exist with existing private and public forms of money; and (c) promote innovation and efficiency.
 - In the retail space, there is considerable analysis of effects of deposit substitution³⁷, facilitated bank runs³⁸ and loss of monetary sovereignty.³⁹ Policy actions to mitigate this risk include a zero or non-competitive interest rate on CBDC deposits, transaction and holding limits, and limited international use.
 - In the wholesale space, a CBDC used for domestic settlement is seen as having limited risk to financial stability as it would be a variation of existing settlement systems, with perhaps wider access. However, there is significant concern with both the impact of a cross-border CBDC⁴⁰ within and outside the issuing jurisdiction. Key concerns include: (a) eased currency substitution; (b) loss of monetary policy control; and (c) problems with governance of cross-border DLT mechanisms.
- Customer protection/privacy/security: User privacy is primarily a concern on the retail CBDC space, where various forms of privacy preservation are being explored for DLT models. However, data protection is also a strategic consideration on the wholesale space⁴¹ and various DLT designs incorporate "partitioning" of key data while preserving the integrity of the ledger.⁴²

³⁴ See [Project Ubin – Phase 5](#)

³⁵ See discussion of domestic integration at a retail level in the Group of seven Central Banks whitepaper on [System design and interoperability](#); see also wholesale domestic interoperability considerations in OMFIF: [Central Bank Digital Currencies](#) (2018); SWIFT also explores integration of RTGC, real-time and DLT systems across borders in a [2019 PoC](#); several domestic and cross-border experiments discussed in this doc explore integration of payment and asset delivery legs in the domestic and cross-border space; interoperability of cross-border wCBDC is also discussed in this doc

³⁶ See e.g. BIS et al. [Central bank digital currencies: foundational principles and core features](#) (June 2020)

³⁷ E.g. Bank of Canada: [Resilience of bank liquidity ratios in the presence of a central bank digital currency](#) (May 2022)

³⁸ E.g. BIS: [Central bank digital currencies: motives, economic implications and the research frontier](#) (Nov. 2021)

³⁹ See e.g. BIS et al. [Central bank digital currencies: foundational principles and core features](#) (June 2020)

⁴⁰ See e.g. Official Monetary and Financial Institutions Forum (OMFIF): [Central Bank Digital Currencies](#) (2018)

⁴¹ E.g. for liquidity, portfolio positions

⁴² E.g. R3 Corda DLTs use notary nodes to preserve ledger integrity while allowing transaction data to be visible bilaterally to the parties/agents involved. See e.g. Official Monetary and Financial Institutions Forum (OMFIF): [Central Bank Digital Currencies](#) (2018) for a deeper look at privacy preservation in wCBDC DLT models.

3. Key issues

Objectives of the public sector

This section focuses on the different needs of jurisdictions and different goals for the use of CBDC. It also touches on the contrast between goals of rCBDCs and wCBDCs and relevance of interoperability, although the focus will be primarily on different objectives specific to wCBDC.

Objectives of wCBDCs

Domestic:⁴³ Key objectives of a wholesale CBDC for domestic use include:

- Improved efficiency of settlement with respect to speed, cost and back office and manual interventions for errors and exception handling.
- Atomicity of DvP and PvP transactions resulting in settlement risk reduction

“Smart contracts – self-executing contracts with the terms of the agreement between buyer and seller being directly written into lines of code that exist across a distributed, decentralised blockchain network – can increase the functionality and simplicity of processes, given that mutual agreements and the code for execution of multiple tasks are self-contained in the blockchain. This increases the utility of this form of money”⁴⁴

- Tokenized assets (e.g. securities, derivatives) can settle on the same system as tokenized money (i.e. wCBDC). This notion can be extended further in the corporate space to tokenization of invoices and payments⁴⁵. Several experiments have also explored the coordination of DvP and PvP transactions across ledgers via, for example, hashed time-lock contracts (HTLC)⁴⁶ The added utility of multiple tokenized assets on the same or linked ledgers could result in more effective use of CB liabilities (e.g. through atomicity, contracts) than simple cash balances and credit held in RTGS systems.
- The bearer-like qualities of a DLT-based wCBDC as well as its ability to operate 24/7 without the CB necessarily being online could facilitate expanded access to domestic and cross-border settlement mechanisms.
- A DLT with multiple validating nodes may offer better system resilience than a centralized RTGS.
- A more efficient and accessible wholesale mechanism could facilitate broader financial and social inclusion as well as payments innovation at the retail level, particularly in emerging and developing economies.⁴⁷

Cross-border. The strongest use cases for a wCBDC exist in the cross-border space where no international settlement RTGS exists and there is significant settlement risk in delivery versus payment (DvP) and PvP transactions and where there is considerable room to improve speed, cost efficiency, security and resilience.⁴⁸

⁴³ See e.g. Official Monetary and Financial Institutions Forum (OMFIF): [Central Bank Digital Currencies](#) (2018)

⁴⁴ Official Monetary and Financial Institutions Forum (OMFIF): [Central Bank Digital Currencies](#) (2018) p.11

⁴⁵ *ibid*

⁴⁶ See e.g. Project Jasper-Ubin

⁴⁷ See e.g. BIS: [Central bank digital currencies: motives, economic implications and the research frontier](#) (Nov. 2021)

⁴⁸ OMFIF: [Central Bank Digital Currencies](#) (2018)

“A system based on distributed ledger technology, enabled with smart contracts trading a tokenized bearer asset, can reduce the number of steps in the overall process.”⁴⁹

- The G20 roadmap to improve international payments specifically identifies cross-border CBDC exploration as a building block in its five-pillar strategy.⁵⁰
- Interoperable wCBDC systems could offer improved liquidity efficiency as less capital is tied up in multiple correspondent banking relationships.
- Because wCBDCs are CB liabilities, settlement risk is decreased significantly as CBs are far less likely to default on payment than private institutions.⁵¹ As CBDCs are representations of fiat currency, they are by nature more stable in terms of value and liquidity than private stablecoins, which must be backed by deposits and assets and monitored closely to avoid the risk of becoming unpegged from underlying assets.⁵² Additionally, because CBs can issue new wCBDC on demand,⁵³ there is minimal liquidity risk with the asset.

“It may also be possible to set up secondary markets for token-based interbank currencies that can operate outside central bank hours. This could enable the loaning/transfer of liquidity between bank and non-bank institutions to alleviate liquidity pressures built up in the system as well as reduce counterparty risk associated with long settlement times.”⁵⁴

- wCBDCs offer a “greenfield” opportunity to build a CB-issued asset and interoperable settlement mechanism that avoids the current shortcomings in international payments and supports rich data (i.e. ISO 20022-compliant messaging standards) and other functionality that could greatly improve payments processing while reducing risk and cost.

“Wholesale CBDCs are positively correlated with financial development, which could reflect the focus of such projects on increasing the efficiency of wholesale settlement. In the more parsimonious specification, there is a link with trade openness. As many wholesale projects focus on the cross-border dimension, this link is also intuitive.”⁵⁵

- Reduced correspondent routes and settlement in major currencies post-2008 have also driven the need for new avenues for low-risk and speedier cross-border settlements, particularly to smaller economies.⁵⁶

Objectives of rCBDCs

Retail CBDC goals and their associated design considerations differ across markets:

- BIS research has revealed key differences in policy objectives between advanced economies (AEs) and emerging markets and developing economies (EMDEs)⁵⁷
- For advanced economies (AEs), key policy objectives include:

⁴⁹ Ibid. P.11

⁵⁰ See CPML, FSB: [G20 Roadmap for enhancing cross-border payments: First consolidated progress report](#) (Oct 2021)

⁵¹ Ibid

⁵² Ibid

⁵³ Ibid

⁵⁴ Official Monetary and Financial Institutions Forum (OMFIF): [Central Bank Digital Currencies](#) (2018) p.10

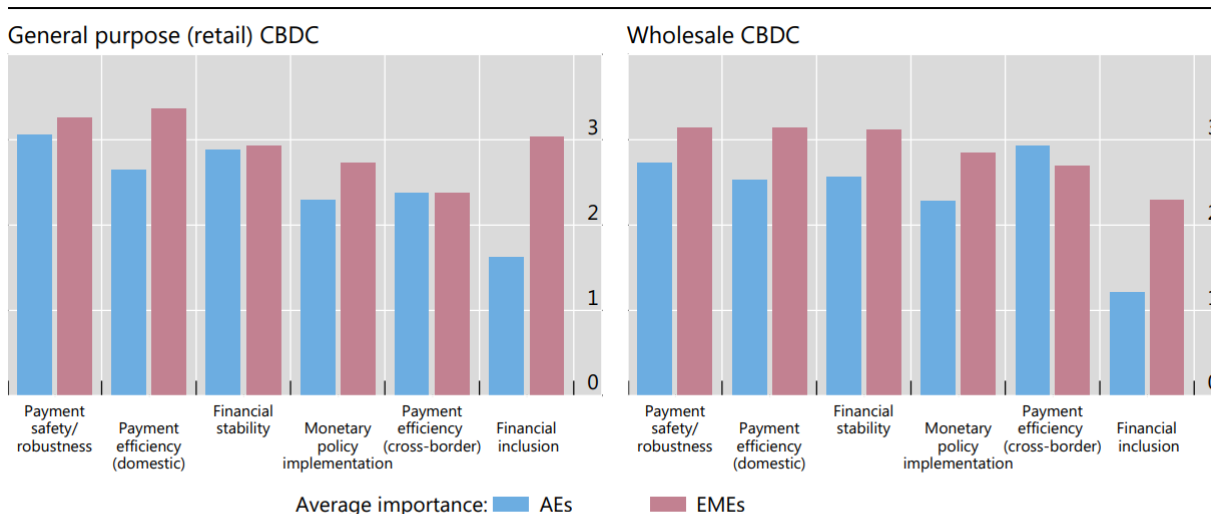
⁵⁵ BIS: [Rise of the central bank digital currencies: drivers, approaches and technologies](#) (Aug. 2020) p.16

⁵⁶ See e.g. BIS: [On the global retreat of correspondent banks](#) (Mar 2020)

⁵⁷ BIS: [Central bank digital currencies: motives, economic implications and the research frontier](#) (Nov. 2021)

- the maintenance of monetary sovereignty against cryptocurrencies, private stablecoins and foreign CBDCs;⁵⁸
- access to central bank money for individuals and businesses in the context of declining cash use;⁵⁹
- a platform to spur innovation and competitiveness in deposits, payments and lending;⁶⁰
- increased privacy for electronic payments, balanced by improved public safety monitoring;⁶¹ and
- eased fiscal transfers (e.g. emergency benefits).⁶²
- Other prominent policy drivers more closely associated with EMDEs include:
 - financial and social inclusion in economic activity;⁶³
 - reduction in illicit activities;⁶⁴
 - logistical solution for geographies where cash distribution is difficult;⁶⁵ and
 - eased cross-border retail payments and remittances.⁶⁶

Figure 5: Motivations for issuing a CBDC – retail vs. wholesale
Average importance



1 = not so important; 2 = somewhat important; 3 = important; and 4 = very important.

Sources: CPMI survey of central banks; Boar et al (2020).

System design

System design interoperability is a concern. The BIS has outlined different models for interoperability of wCBDCs⁶⁷ as described earlier in this report. It is also an important design objective of the G7 CBs.⁶⁸

⁵⁸ E.g. [Bank of Canada](#)

⁵⁹ E.g. [Riksbank \(Sweden\)](#)

⁶⁰ BIS et al. [Central bank digital currencies: foundational principles and core features](#) (June 2020)

⁶¹ E.g. BIS: [Central bank digital currencies: motives, economic implications and the research frontier](#) (Nov. 2021)

⁶² E.g. <https://www.bloomberg.com/news/articles/2021-09-17/digital-currency-clears-a-path-for-helicopter-money-says-prasad>

⁶³ Ibid.

⁶⁴ E.g. [Central Bank of the Bahamas](#)

⁶⁵ E.g. [Eastern Caribbean Central Bank \(ECCB\)](#)

⁶⁶ Ibid.

⁶⁷ See BIS: [Multi-CBDC arrangements and the future of cross-border payments](#) (Mar 2021)

⁶⁸ See BIS et al: [System design and interoperability](#) (Sep 2021)

Most CBs are considering technical motivation for cross-system PoCs like Project Jasper-Ubin, and the Dunbar/Inthanon-Lionrock demonstrates complete interoperability with a multi-currency system.

There is a crossover between rCBDC and wCBDC objectives, where wCBDCs could have the potential to promote greater financial inclusion by feeding more capital into institutional markets. However, given the efficiencies of digital central bank funds in the domestic wholesale space, most of the current focus of CBs is on the retail space, driven by the policy objectives outlined earlier.

- Wholesale settlement is seen to be served efficiently by RTGS and depository services and their associated risk controls. Therefore, domestic wCBDC has not shown much benefit beyond existing systems.⁶⁹ However there is a strong value proposition for institutions and corporations to use a wholesale cross-border CBDC to settle in CB money and overcome some of the frictions associated with correspondent channels.
- There is also an argument that SMEs could benefit from a wCBDC through better access to capital and existing financial markets within a jurisdiction as well as on a cross-border basis. Through enabling SMEs in this way, there is a theorized knock-on effect of being able to reach a wider individual community and increase financial inclusion among currently disadvantaged or otherwise unbanked individuals.

It should be noted that many of the advantages of a DLT could be extended to existing centralized account ledgers and escrow arrangements, particularly with regard to programmability/smart contracts/atomicity, application programming interfaces (APIs), resilience through redundancy, and expanded access and program/regulatory support for innovation and inclusion.

At the same time, authorities are developing and implementing solutions in the traditional cross-border space to address some of these problems, though progress is often slow and uneven. These efforts include:

- evolving prudential oversight of commercial bank operations and financial market infrastructures;⁷⁰
- [SWIFT gpi](#) tracking, recall, fee transparency etc. for participating banks;
- integration of SWIFT gpi instant routing and other initiatives (e.g. BIS Project Nexus⁷¹) with domestic fast payment settlement systems and low-value cross-border retail payments with SWIFT Go;⁷²
- harmonization of AML/CTF regimes and reporting requirements;⁷³
- increased use of richer data standards (ISO 20022) and better translation;⁷⁴ and
- extended high value system hours.⁷⁵

Under direction from the G20, the FSB and the CPMI have embarked on a 5-pillar roadmap to improve cost, speed, access and transparency of cross-border payments by coordinating global efforts, harmonizing regulation, improving infrastructure and arrangements, harmonizing use of data, and exploring new initiatives including CBDC.⁷⁶

⁶⁹ See e.g. Official Monetary and Financial Institutions Forum (OMFIF): [Central Bank Digital Currencies](#) (2018)

⁷⁰ E.g. [Principles for Financial Market Infrastructures \(PFMI\)](#)

⁷¹ <https://www.bis.org/press/p210728.htm>. Gpi may face scalability issues for full access of its members. See: Official Monetary and Financial Institutions Forum (OMFIF): [Central Bank Digital Currencies](#) (2018). P. 23

⁷² <https://www.swift.com/our-solutions/global-financial-messaging/payments/swiftgo>

⁷³ See CPMI, FSB: [G20 Roadmap for enhancing cross-border payments: First consolidated progress report](#) (Oct 2021)

⁷⁴ Ibid.

⁷⁵ See e.g. CPMI: [Extending and aligning payment system operating hours for cross-border payments](#) (Nov 2021)

⁷⁶ CPMI, FSB: [G20 Roadmap for enhancing cross-border payments: First consolidated progress report](#) (Oct 2021)

Beyond challenges associated specifically with a wCBDC DLT mechanism, discussed in this document, some existing problems remain unresolved by use of a DLT:

- Acquisition of a foreign CBDC would likely require expanded access to domestic systems or the use of exchange intermediaries.
- AML/CTF and KYC compliance would still apply for the affected jurisdictions (although fewer jurisdictions may be implicated with expanded and/or cross-border access).
- Only participating institutions would benefit. Payment beyond these arrangements would require other means (e.g. correspondent banking).

Furthermore, use of a DLT settlement mechanism may introduce additional challenges:

- Private, permissioned and partitioned DLTs require strict trust protocols, oversight and robust consensus mechanisms.
- Integration with other platforms and existing RTGS systems may be challenging in a production setting.
- Throughput on a DLT may be limited and not be able to meet expectations for scalability and speed.
- Partitioning/segregation may be required to maintain proprietary data which could undermine some of the purported resilience benefits of a distributed system.
- Recalls and reversals may be more problematic on an immutable DLT.
- Ubiquity - smaller economies may not have technological or financial resources to develop or participate in cross-border CBDC systems, leaving them out of potential improvements to current international payments problems (e.g. as mentioned in a World Bank report).⁷⁷

Implementation of a cross-border multilateral CBDC settlement mechanism based on DLT would be a novel development in the international payments landscape and bring a host of challenging issues to CBs and other participants, including:⁷⁸

- significant operational changes to manage participation in the system, security, liquidity, availability, among others;
- the need for regulatory change to allow greater access, create a legal basis for a new role in the economy, and assume legal and regulatory risk (e.g., court challenges);
- the need for monitoring and overseeing end user functions across jurisdictions (e.g. interface compliance, KYC compliance); and
- the need to develop an interoperability and governance model for a mechanism interlinking with other systems across borders.

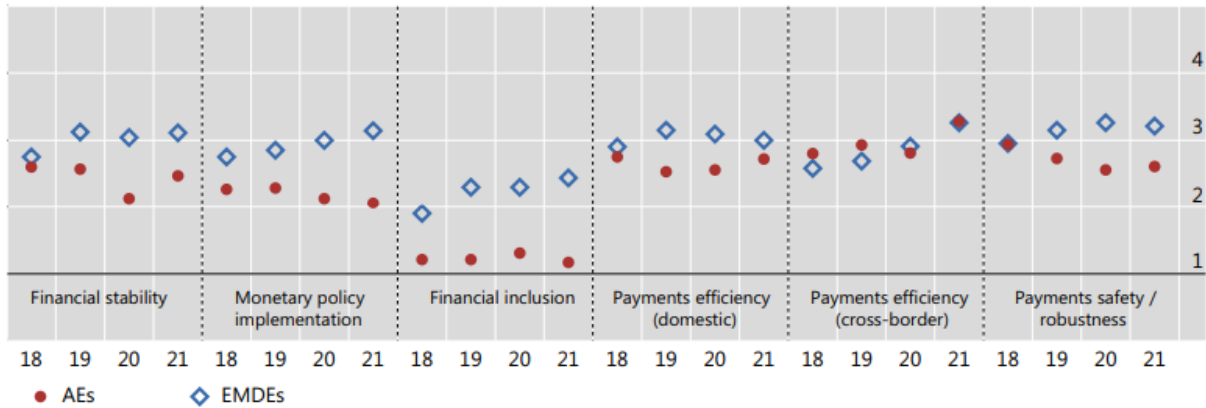
Current stated public sector objectives for wCBDC vary by jurisdiction and CBs generally. The World Bank Group in November presented a paper detailing many of the experiments and ideas in place as of November 2021.⁷⁹

Figure 6: Motivations for issuing a wholesale CBDC
Average importance

⁷⁷ See World Bank Group: [Central Bank Digital Currencies For Cross-Border Payments: A Review of Current Experiments and Ideas](#) (Nov 2021)

⁷⁸ See e.g. Official Monetary and Financial Institutions Forum (OMFIF): [Central Bank Digital Currencies](#) (2018) for a discussion of many of these issues

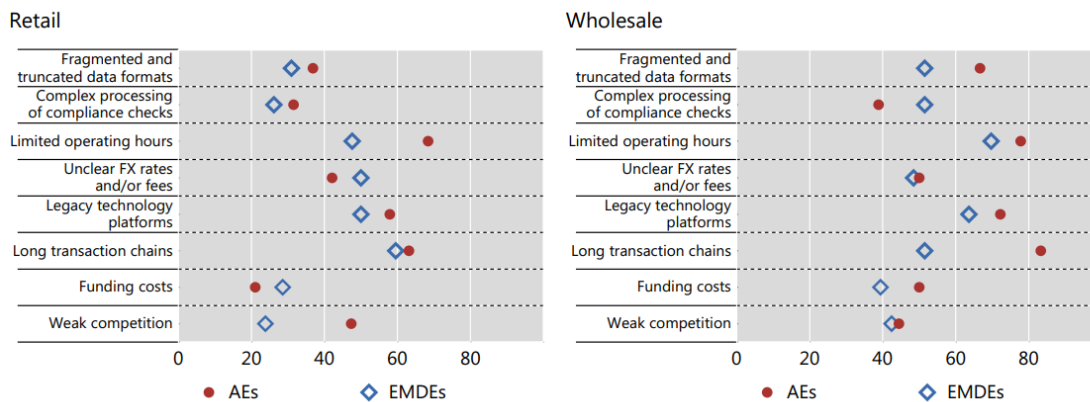
⁷⁹ See also e.g. BIS: [Central bank digital currencies: motives, economic implications and the research frontier](#) (Nov. 2021);



(1) = not so important; (2) = somewhat important; (3) = important; (4) = very important.

Source: 2021 BIS central bank survey on CBDCs and digital tokens.

Figure 7: Cross-border frictions that a CBDC could address
Share of respondents



¹ The sample includes jurisdictions that consider efficiency in cross-border payments as a somewhat important, important, and very important driver of their CBDC engagement.

Source: 2021 BIS central bank survey on CBDCs and digital tokens.

G7 CBs, in conjunction with the BIS Innovation Hub, have released a number of policy papers on the policy motivations, principles and design considerations for a CBDC in order for it to coexist with existing payment systems, do no economic harm and spur innovation. These efforts, however, are primarily aimed at the retail space.⁸⁰

Use case and design consideration for wCBDCs

Privacy vs inclusion

For institutional and corporate wCBDC participants, data privacy is critical.⁸¹ As such, different DLT architectures support privacy through cryptography and ledger visibility such as “multiple channel approach and the use of private data collection systems”.⁸² R3’s Corda, for example, allows participants

⁸⁰ See BIS: [Central bank digital currencies: foundational principles and core features](#) (June 2020); [Central bank digital currencies - executive summary](#) (Sept. 2021)

⁸¹ For example, to protect visibility into liquidity positions or portfolio strategy

⁸² Official Monetary and Financial Institutions Forum (OMFIF): [Central Bank Digital Currencies](#) (2018)

only to see bilateral transactions but not the whole ledger. Ledger integrity is assured through a notary node, operated by a central bank or other regulator.

“Constellations in platforms such as Quorum, Side-DB in Hyperledger Fabric and Corda all support this paradigm.”⁸³

End user financial inclusion is more closely associated with a retail CBDC. However, broader access to wholesale settlement mechanisms by smaller FIs, non-bank-FIs, corporates etc. is a key aspect of the wCBDC value proposition domestically and internationally.

Wholesale systems may also be used to settle aggregated retail payments, whether with public or privacy money. Broader access to such a mechanism by FIs, NBFIs, telcos and fintechs in emerging markets may facilitate innovation in inclusive end-user financial offerings. A wholesale CBDC may also facilitate user inclusion through a more efficient clearing and settlement mechanism for retail transactions such as cross-border remittances.

Basic issues for financial inclusion that may not need CBDC but CBDC projects may foster inclusion should be examined.

Potential competing goals across APEC exist based on different levels of maturity of the local economies, as well as level of international investment and cross border activity. Further, local aims in regards to inclusion, capital investment and combating illicit activities, among others, continue to drive divergence and diversity in stated goals.

Import/export

Incentives/scaling: Facilitating cross-border wholesale and retail trade was the key policy driver for the [mCBDC Bridge PoC](#)⁸⁴ carried out by the BIS Innovation Hub (Hong Kong, China), Hong Kong Monetary Authority, Bank of Thailand, Digital Currency Institute of the People's Bank of China and the Central Bank of the United Arab Emirates. While not exploring explicit incentives, the PoC demonstrated benefits to speed and cost while reducing settlement risk and regulatory frictions.

Capital markets

Several experiments, including [Project Helvetia](#)⁸⁵ (Switzerland) and [Project Jasper](#)⁸⁶ (Canada) on a domestic level and [Project Jura](#)⁸⁷ (France, Switzerland) in the cross-border space, explored potential DvP efficiencies that could be gained by linking tokenized securities and wholesale payments on the same DLT or linked ledgers via hash time-locked contracts (HTLC). These potential improvements, in conjunction with 24/7 wCBDC availability and wider access, could reduce risk and free up liquidity for capital markets.

“International capital markets are not frictionless: there are significant transaction costs and markets are segmented by informational asymmetries or familiarity effects. From an investor’s perspective, “plumbing” of market infrastructure may become more efficient because of digitalization of money and payments and the associated asset tokenization. As a result, transaction costs are lower and foreign financial markets could become more accessible”⁸⁸

⁸³ Ibid. p. 18

⁸⁴ https://www.bis.org/about/bisih/topics/cbdc/mcbdc_bridge.htm

⁸⁵ <https://www.bis.org/about/bisih/topics/cbdc/helvetia.htm>

⁸⁶ <https://www.payments.ca/industry-info/our-research/project-jasper>

⁸⁷ <https://www.bis.org/about/bisih/topics/cbdc/jura.htm>

⁸⁸ IMF: [Digital Money Across Borders: Macro-Financial Implications](#) (Oct 2020). P.25 (para 44)

“For reserve holders, increased adoption of a foreign CBDC or GSC [Global StableCoin] in trade and financial transactions, especially if paired with greater exposure of financial institutions to exchange rate volatility, may shift reserves into the unit of account of the CBDC or GSC. While the qualitative impact is akin to traditional currency substitution, a potentially faster roll-out of the CBDC or GSC might lower the inertia in reserve holdings observed so far.”⁸⁹

A greenfield wCBDC platform could also serve as a basis for innovation in cross-border capital markets.

“Innovation may reduce cross-border financial frictions and help deepen and integrate international capital markets. Along with payment efficiency, these new forms of digital money could enable digital and data-dependent technologies like asset tokenization and machine learning. Initial coin offerings, crowd funding and other innovations might boost the efficiency of financial services.”⁹⁰

Managing balance sheet of fiat currency vs CBDC

In theory, a domestic wholesale CBDC would be exchangeable with traditional central bank reserves and have limited impact on CB liabilities.⁹¹ An accompanying expansion of access to domestic wholesale mechanisms however could induce second-tier FIs and other regulated entities to migrate away from commercial bank deposits and expand the CB balance sheet.

The impact of cross-border use of a wCBDC depends upon the nature of the system design. If foreign entities are permitted to hold a domestic wCBDC, there could be large fluctuations in demand for the asset with an associated effect on the CB balance sheet.

Participation in cross-border CBDC models that tie up CB liquidity in an intermediate synthetic settlement asset⁹², could expand the participating CB’s balance sheet and contribute to monetary instability depending on market dynamics

“Swings in the external demand for the CBDC could drive large movements in capital flows...market liquidity could move significantly in response to global capital flows in some reserve currency issuers...a CBDC issuer could experience fluctuations in market liquidity and asset prices that mirror the global demand for its currency.”⁹³

Additionally, CBs are concerned about the potential for currency substitutions associated with a cross-border wCBDC that could undermine monetary policy and sovereignty as well as impinge responsiveness of monetary policy to business cycles. Substitution or foreign adoption of a CBDC could also affect seigniorage revenues for the issuing central bank.

Some of these considerations equally apply to existing fiat reserves and cross-border correspondent banking dynamics. However, impacts could be accelerated with an efficient and interoperable cross-border CBDC mechanism in place.

The CB balance sheet could also expand if institutions seek to hold liquidity in a cross-border wCBDC instead of correspondent commercial banks, resulting in a reduction in liquidity tied up in multiple

⁸⁹ IMF: [Digital Money Across Borders: Macro-Financial Implications](#) (Oct 2020) p. 27 (para 52)

⁹⁰ IMF: [Digital Money Across Borders: Macro-Financial Implications](#) (Oct 2020) p. 23 (Box 2)

⁹¹ Official Monetary and Financial Institutions Forum (OMFIF): [Central Bank Digital Currencies](#) (2018)

⁹² e.g. see [Project Jasper-Ubin](#) (sec. 3.2.2)

⁹³ See e.g. IMF: [Digital Money Across Borders: Macro-Financial Implications](#) (Oct 2020). P. 21 (para 34)

nostro accounts. This wholesale form of deposit substitution mirrors the concern associated with retail CBDCs and could have follow-on impacts on the credit market in the vostro account holders' market.

“The dangers of large central balance sheets for their independence from the fiscal authority are well known”⁹⁴

Interoperability considerations

Interoperability of settlement across CBDCs are discussed in the first section of this White Paper. Enabling other digital-related efforts such as security tokens (STs) and non-fungible tokens (NFTs) is also discussed in the description of cross-border wCBDC projects in previous sections that have investigated the use of DLT to improve domestic and cross-border DvP of tokenized securities. To date, the role of NFTs as a specific tokenized asset class has not figured significantly in current wCBDC discussions.

The intersection between CBDC and growth of the digital economy

With the advent of new technologies, interest in virtual assets, including not only crypto currencies but also STs and NFTs has been growing.

STs are applied to financing of governments and companies, and securitizing transactions of real assets to reach a wider investor base yet to be reached by traditional securities instruments. For example, there is a significant gap in the availability of raising capital for SMEs where use of STs could provide a mechanism for reducing barriers. Secondary trading marketplaces are being established in multiple economies to provide further liquidities and risk mitigation tools, beneficial to both investors and issuers.

NFT markets are rapidly growing in many economies, attracting non-traditional actors of financial services, including artists, celebrities, professional sports leagues and online-gaming communities. They enable more direct connection between creators and their supporters, with significant potential social benefits and impacts. Use of NFTs could broaden access and induce higher investment in these traditionally isolated communities.

Importance of intermediaries

Since it is still very early stages of market development, especially for NFTs, many investors need to secure safe custody of their assets on their own, using so-called “non-custodial wallets” installed in their devices to hold cryptographic keys. While this may enable rapid innovation in experimental stages, it is certainly not a safe and sound environment for mainstream investors when markets are still growing. In addition, peer-to-peer transactions are not monitored by authorities, preventing the implementation of policies for protecting investors from false schemes as well as detecting illicit financial transactions, such as money laundering.

In traditional financial markets, intermediaries (financial service institutions) perform important functions such as safe custody, secure settlements of transactions, and preventing and reporting suspicious activities to ensure safe and sound financial markets. Economies are encouraged to promote the development and use of professional custodial services to investors as a viable alternative to non-custodial wallets.

Whereas digital economies may not require traditional banking as a set of intermediary services, they require new forms of market services including digital custody, liquidity management, collateral taking,

⁹⁴ BIS: [Central bank digital currencies: motives, economic implications and the research frontier](#) (Nov. 2021) p. 20

market making, foreign exchange trading, execution, and reporting, for better functioning markets and mitigating risks.

Settlement risk as pain point

Where markets utilize these professional custodial and intermediary services, there may be apparent settlement risk in the “street-side” transactions. It certainly includes “Herstatt risk” if it uses traditional commercial bank deposit as a means of cash leg. Credit and liquidity risk of the issuing entity still exists, even if it utilized DLT on commercial bank money, or stablecoin, to address the above risk via “atomic-swap”. This risk has already been addressed in traditional financial markets, utilizing central bank money for most of the street-side settlements and dealer to custodian bank settlements.

Use of wCBDC in street-side settlement of digital assets

To mitigate the above mentioned risks in the street-side settlement of digital assets, it is worth undertaking experiments and discussions concerning the design and use of wholesale CBDC in economies where policymakers look to promote digital innovation and/or mitigate systemic risk that can arise from the growing digital markets. Discussion points could include:

- liquidity management, collateral and if it would pay interest;
- regulations, policies and business practices around use cases such as programmable/conditional payments (tokenized money is not necessarily always connected to banking systems for new flexibility e.g., in 24/7 clearing and settlement of funds);
- FX trading, execution and reporting;
- token-based versus account balance based;
- managed anonymity versus transaction privacy: roles within the environment (existing payment infrastructure across fiat currency and CBDC, cross-border incentives); and
- preconditions for CBDC.

Overcoming interoperability and fragmentation challenges in the development of CBDCs and digital assets – the Regulated Liability Network⁹⁵

One challenge with the proliferation in new forms of money is the risk of fragmentation as competing and parallel systems are considered or developed across digital assets and jurisdictions. Financial sector participants have begun to develop various solutions as proof of concepts to help address some of the challenges in this space. One example is the Regulated Liability Network.

Existing digital forms of sovereign currencies are liabilities of institutions such as central banks, commercial banks and regulated non-bank e-money issuers. Cryptocurrencies in contrast are non-liabilities, as they do not represent a promise to pay the domestic currency from an institution to a known user. The “Regulated Liability Network” (RLN) initiative would “tokenize” (make digital representations of) “regulated liabilities” on a common platform, providing 24/7, programmable, final settlement in sovereign currencies. Tokenization is “the process of converting any rights or assets into a digital token that can then be used, owned and transferred by the holder through a blockchain.” Its benefits include the following:

- 24/7: DLTs are ‘always on’ in contrast to account-based banking systems;
- Programmability: “Smart contracts” can deliver new forms of automation;
- Atomic settlement: Token exchange represents instant settlement, which reduces counterparty risks;
- Multi-asset: Any asset can be ‘tokenized’ on the blockchain.

⁹⁵<https://www.citibank.com/ts/insights/articles/article191.html>

Features of the RLN - changing the technology, not the instrument

The legal instrument does not change in the RLN, only the technology that records the instrument, in this case the ledger. RLN operates a shared ledger to record, transfer and settle “regulated liabilities” of central, commercial and regulated non-banks. This could include other issuers within the regulatory perimeter, such as stablecoins. These liabilities would be exchangeable with traditional account-based forms of money as they are in effect the same legal instrument. The RLN changes where liabilities are recorded, not the nature of the liabilities. As such, bank-grade KYC/AML/sanctions processes would remain in place.

Operationalizing via partitions

The shared ledger would comprise of a number of “partitions” where an RLN institution would determine access and uphold its obligations. A CB participant would represent a CBDC and would determine access to private RLN institutions (wCBDC) or allow access to individuals (rCBDC). It would also determine whether that access was direct or via a distribution agent (“two-tier” CBDC). Commercial bank partitions would operate in a similar way, where the RLN liabilities represent customer balances. Similar partitions would be established for e-money providers as well as for stablecoin issuers (subject to clear regulation being in place).

Benefits

The RLN would provide a global settlement service supporting domestic and international use cases that would equate to a global RTGS system. RLN would also be interoperable with existing networks such as SWIFT and correspondent banking. It would therefore avoid fragmentation by bringing together the regulated sector on a common platform, with the advantages of shared ledger technology as previously mentioned. The RLN would incorporate a wide array of use cases, from internal book transfers to P2P, B2B, B2C, C2G, and G2C transactions. It could also tokenize other regulated assets such as bonds, equities and trade instruments, leading to a less siloed financial system.

4. Recommendations

Common principles on CBDC development

The APFF FMI Network recommends that APEC Finance Ministers encourage relevant stakeholders to collaborate in drafting common principles to guide member economies intending to develop CBDCs, noting that many APEC member economies are participating in various cross-border wCBDC experimentation⁹⁶ and efforts to develop principles have been started.⁹⁷ Common principles on CBDCs for adoption by APEC economies could address a number of important challenges in their development. They could guide and inform APEC economies in their own exploration of CBDCs, without seeking to pre-judge how and whether individual economies should take forward their respective CBDC work. This includes setting out some important markers and considerations in the conversation on CBDC, for example:

- acknowledging diversity (recognizing that the drivers of and justification for wholesale CBDCs will differ among economies – from inclusion to SME access to global capital, to improving cross-border payments – and each will have their own approach which may be different but should not be conflicting;
- providing clarity on terminology, including definitions of digital assets, including crypto assets among others;
- clarity on differing considerations around and applications for both retail and wholesale CBDCs;

⁹⁶ These include:

- Australia ([Project Dunbar*](#))
- Canada ([Project Jasper-Ubin](#))
- China ([Project Multiple CBDC Bridge*](#))
- Hong Kong, China ([Project Inthanon-LionRock](#); [Project Multiple CBDC Bridge*](#))
- Japan ([Project Stella*](#))
- Malaysia ([Project Dunbar*](#))
- Singapore ([Project Dunbar*](#); [Project Jasper-Ubin](#); [Multi-currency Corridor Network*](#))
- Thailand ([Project Inthanon-LionRock](#); [Project Multiple CBDC Bridge*](#))

**Includes partnerships with central banks and monetary authorities outside of APEC membership (see list of cross-border wCBDC projects at the beginning of this White Paper)*

Many members have also explored domestic wholesale CBDC solutions. Links are provided for projects not already covered earlier:

- Australia ([Project Atom](#))
- Canada ([Project Jasper](#))
- Hong Kong, China ([Project LionRock](#))
- Indonesia ([Rupiah Digital](#))
- Japan ([Project Stella](#))
- New Zealand ([Future of Money CBDC](#))
- Peru ([Digital Sol](#))
- Singapore ([Project Ubin](#))
- Chinese Taipei ([Digital NT Dollar](#))
- Thailand ([Project Inthanon](#))

China is also at an advanced piloting stage with the [e-CNY](#) retail CBDC

⁹⁷ These include the following:

- CPMI, FSB: [G20 Roadmap for enhancing cross-border payments: First consolidated progress report](#) (Oct 2021);
- CPMI, BIS, World Bank, IMF: [Central bank digital currencies for cross-border payments](#) (July 2021)

- the importance of interoperability and alignment of systems to ensure that the system for CBDCs in one APEC economy should be designed to be able to work together with an equivalent system from another APEC economy;
- the importance of including the private sector in the development thinking;
- the need for high privacy and security standards and to ensure compliance with AML/CFT and sanctions requirements;
- enablement and inclusiveness in access to any CBDC, which necessarily includes how to ensure SMEs are not disenfranchised and that the necessary infrastructure is in place to enable access, from multiple perspectives (e.g. technology access, power grids);
- using CBDCs as a way to increase competition, recognizing that wholesale CBDC development will be about co-existence and not replacement of existing payment methods; and
- recognizing potential concern around impacting the role of private credit creation, the growth in central bank balance sheets (through a transfer of liabilities via wholesale CBDCs) and of the possibility of currency substitution.

In all, such an exercise will enable the region's public sector to better articulate and understand the goals being sought. A further evaluation can then be made on how CBDC may provide a path to those goals, or if existing infrastructure and processes can be enhanced to attain them with less disruption, costs or risks.

Capacity building

There will remain a challenge in collecting the resources, specifically in expertise, over what will undoubtedly be a long period of time. Much expertise exists in the private sector, yet it remains scarce overall. While many larger firms may be able to dedicate resources to enhance and support public sector needs, this still comes at a cost. Additionally, a portion of the expertise resides in smaller enterprises that may not have the ability to dedicate staff, even in short term engagements.

Regardless, a first step of establishing a conference of public sector interested parties in crafting the recommended common principles would naturally be a foundation to include appropriate private sector experts in a next stage. The composition should include financial market infrastructure players, but also other entities that connect to and would support any wCBDC implementation effort.

An industry survey crafted around the recommended common principles could act as an initial catalyst in attracting interest and identifying keys issues that need to be addressed. Established policy initiatives under the Finance Ministers' Process that already provide a platform for ongoing public-private partnership, such as the Asia-Pacific Financial Forum, particularly its Financial Market Infrastructure Network, could be leveraged.

This could involve conducting a survey on technological features and specifications of current CBDCs including the projects under planning to identify possible differences and secure necessary interoperability of CBDCs. It could build on the work of relevant international organizations such as the BIS, CPMI, IMF, the Official Monetary and Financial Institutions Forum (OMFIF) and the World Bank Group.⁹⁸

⁹⁸ These include the following:

From a practical point of view, a volunteer secretariat team could organize an online meeting by members (central banks) on CBDCs in APEC. Each member will try to explain technological features and specifications of each CBDC by using some material including PPT slides and online databases that can be documented and catalogued. Second, the secretariat can consolidate the information and make a summary report after analyzing the wCBDCs in APEC. Third, this public-private partnership will discuss the results and public reports at each stage. This kind of cooperation among APEC members will enhance interoperability and standardization of wCBDCs in APEC, which will enhance cross-border economic and financial activities in APEC. Hopefully, a future APEC digital common currency and other alternative methods may also be eventually considered as a result of the discussions.

This should be followed by formalized cross-project working groups, as well as a public-private steering group.

Laying a foundation for interoperability

To ensure future interoperability, a proper foundation should include the necessary enabling requirements. Working with potential service providers and issuers, service models should ensure to be open, in regards to having methodologies to cross technical boundaries and account for differences in those service models and potential legal differences by jurisdiction.

In regards to this last point, conceptual agreements regarding cross-jurisdictional enforcement, as well as leveraging established rules regarding traditional fiat currency should be considered. Any framework will necessarily need to consider co-existence with other digital currencies that are not CBDC (e.g. private and stablecoins, etc).

Timeline considerations

Realistic timelines should be established, but initial planning should hopefully target a mid- to 3rd quarter 2023 for any initial joint meeting to discuss proposals in this paper, and evaluate suggestions for moving forward. Timelines for immediate next steps can then be considered.

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- BIS: [Gaining momentum – Results of the 2021 BIS survey on central bank digital currencies](#) (May 2022); [spreadsheet maintained by BIS](#) (updated Jan 2022) for list of recent wholesale CBDC projects
 - CPMI, BIS, World Bank, IMF: [Central bank digital currencies for cross-border payments](#) (July 2021)
 - World Bank Group: [Central Bank Digital Currencies For Cross-Border Payments: A Review of Current Experiments and Ideas](#) (Nov 2021)
 - BIS: [Central bank digital currencies: motives, economic implications and the research frontier](#) (Nov. 2021)
 - OMFIF: [Central Bank Digital Currencies](#) (2018)