



Between hype and hope:

CBDC, the FX game changer?

Discussions around central bank digital currencies (CBDCs) intensified almost a decade ago. Initially focusing on wholesale payments, the conversation soon shifted to retail CBDCs. More recently, wholesale CBDCs are stepping into the spotlight again. What caused this shift in focus, what is the business case for wholesale CBDCs and how could they impact the FX market and CLS specifically?

The advent of CBDC

CBDCs are considered an advanced form of central bank money. CBDCs are different from cash and from balances in traditional accounts with a central bank,¹ though all are a direct liability of the central bank.² The extent to which a CBDC differs from existing forms of central bank money depends on the specific CBDC purpose and design.

Public discussion around CBDCs gained impetus around 2017,³ when the global market capitalization of crypto assets started to soar⁴ and the industry and central bank community intensified research and experimentation on distributed ledger technologies (DLT). CBDCs gained further attention with the advent of global stablecoins in 2019.⁵

While many herald CBDCs as an innovation that could potentially transform payments, detractors dismiss it as a recycled idea. CBDC's critics note the underlying concept has been discussed amongst experts for decades without much public attention,⁶ and the basic idea traces back to the traditional view that currency is a public good under government control.⁷

The CBDC dichotomy

The CBDC taxonomy has evolved over the years. Initially, emphasis was placed on concepts like token/value-based and account-based CBDCs,⁸ while more recently the discussion shifted to two separate designs: retail (also known as general purpose)⁹ CBDCs and wholesale CBDCs.

- In very simple terms, **retail CBDCs** (rCBDCs) are essentially digital banknotes. rCBDCs would be issued to the general public, e.g., as a response to the declining use of cash in an increasingly digital world. Individuals and businesses would use rCBDCs to make payments for everyday transactions.

Just over 30 years ago, the Bank of Finland launched the Avant payment card with a chip that stored central bank-backed money.¹⁰ This initiative, which was eventually shelved in 2003, could be considered the world's first rCBDC. More recently, four rCBDCs were issued in Africa and the Caribbean between 2020 and 2022.¹¹ No larger economy has implemented an rCBDC yet.

- In contrast to broadly accessible rCBDCs, **wholesale CBDCs** (wCBDCs) are intended for use exclusively by regulated financial institutions, e.g., to settle financial transactions. They are therefore very similar to existing central bank reserves held on central bank accounts to facilitate payments between financial intermediaries. Deposits held in real-time gross settlement (RTGS) systems like Fedwire in the US, TARGET2 in the EU and CHAPS in the UK are not too different from wCBDCs.¹² According to commentators, a DLT-based RTGS system would effectively turn central bank reserves into wCBDC. There is not yet a large-scale DLT application in any RTGS system, and wCBDCs do not yet exist.



¹ See CPMI – Markets Committee (2018) Central bank digital currencies.

² See Group of Central Banks (2020) Central bank digital currencies: foundational principles and core features.

³ See Bank of England (2015) One Bank Research Agenda (page 7: "...might central banks issue digital currencies and what would be the impact on existing payment and settlement systems?") or CPMI (2015) Digital Currencies (page 17: "This raises the question of how central banks could respond to an increasing use of distributed ledger technology to settle transactions. One option is to consider using the technology itself to issue digital currencies.")

⁴ The market capitalization of crypto assets increased from USD15 billion in January 2017 to over USD600 billion at the end of 2017; see Coindesk (2017) The year crypto became a new asset class.

⁵ See G7 Working Group on Stablecoins (2019) Investigating the impact of global stablecoins.

⁶ See Tobin, J. (1985) Financial innovation and deregulation in perspective.

⁷ See Friedman, M., Schwartz, A. (1986). Has government any role in money?; Journal of Monetary Economics.

⁸ See Mersch, Y. (2017) Digital Base Money: an assessment from the ECB's perspective.

⁹ See CPMI – Markets Committee (2018) Central bank digital currencies.

¹⁰ See Grym, A. (2020) Lessons learned from the world's first CBDC; Bank of Finland Economics Review No. 8/2020.

¹¹ Central Bank of the Bahamas (Sand Dollar), Eastern Caribbean Central Bank (DCash pilot), Bank of Nigeria (eNaira), and Bank of Jamaica (Jam-Dex).

¹² Panetta, F. (2022) Demystifying wholesale central bank digital currency.

The swinging CBDC pendulum

The public discussion around CBDCs took off in 2017 amidst the DLT hype boom. Though the term was not explicitly used at the time, several central banks were exploring DLT use cases that can be broadly associated with wCBDCs such as Project Ubin (Monetary Authority of Singapore), Project Jasper (Bank of Canada) and Project Stella (Bank of Japan and the European Central Bank).

Then, more central banks started exploring CBDCs, and the focus shifted from wholesale to retail use cases. By 2022, nine of every ten central banks were engaged in some form of CBDC project, with rCBDCs projects progressing further than wCBDCs.¹³

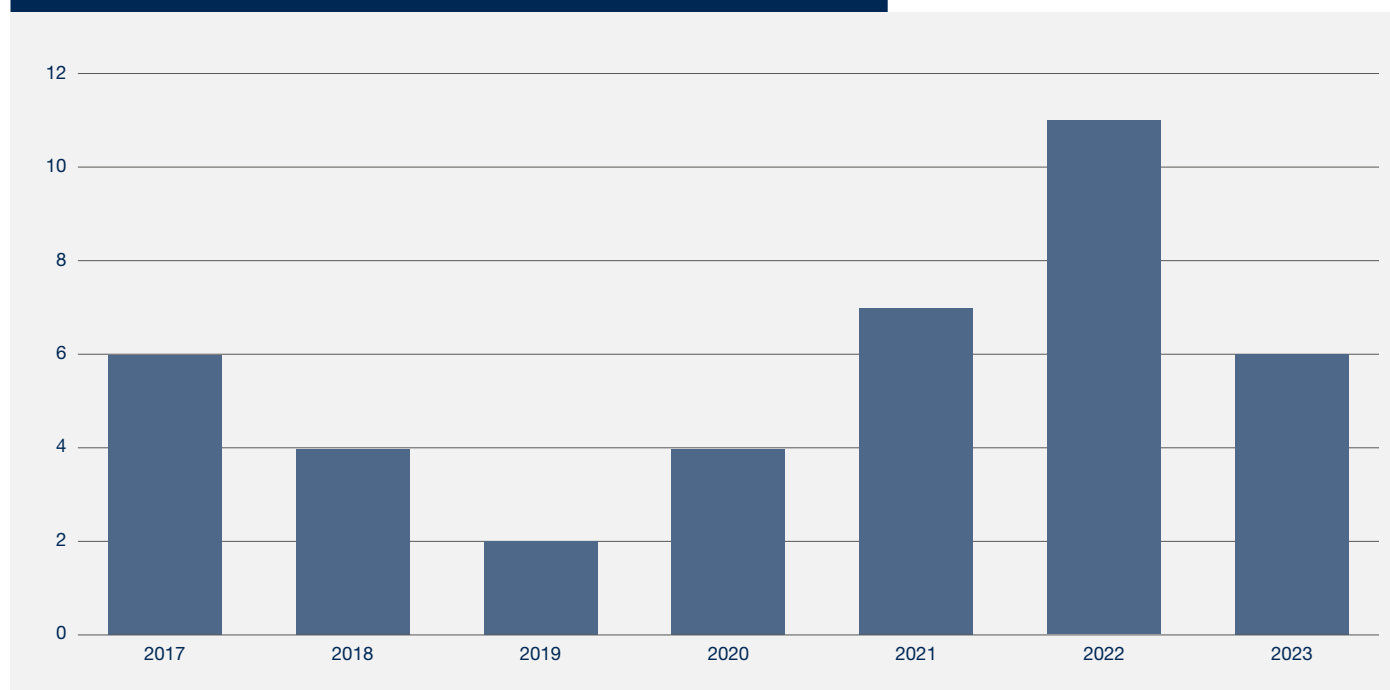
Now the pendulum is swinging back towards wCBDCs. While rCBDC work is complicated by a wide range of issues in law, policy, technology and ecosystem impact,¹⁴ wCBDCs are to a large extent 'just' about running financial market infrastructures with new technologies, such as DLT. Today, the implementation of wCBDCs appears to be less challenging than that of rCBDCs.¹⁵

The whole(sale) picture

Between 2017 and 2023, at least 40 wCBDC project reports were published, largely focusing on the technical feasibility of a particular design in a controlled test environment. It is noteworthy that after the early research and experimentation work in 2017, the years 2018 to 2020 saw a dip in wCBDC report publications and public attention, followed by a substantial increase (figure 1 and annex 1).

The G20 cross-border roadmap established in 2020 to help overcome long-standing challenges in cross-border payments contributed to the increase in 2021 and subsequent years.¹⁶ Building block 19 of the roadmap focuses on 'factoring an international dimension into CBDC design'. This global initiative dovetails with the shift in wCBDC projects to increasingly explore cross-border use cases, including those with FX payment-versus-payment (PvP)¹⁷ solutions (figure 2 and annex 2).

Figure 1: Global publication of wCBDC project reports (annex 1 for details)



¹³ See Kosse, A., Mattei, I. (2023). Making headway – results of the 2022 BIS survey on central bank digital currencies and crypto; BIS paper No. 136.

¹⁴ If not adequately designed, retail CBDCs could adversely affect financial stability as they could compete with banks and ultimately disintermediate them; see Infante, S. et al (2023) Retail central bank digital currencies: implications for banking and financial stability; Federal Reserve Board Finance and Economics discussion series.

¹⁵ See Carstens, A. (2023) The future monetary system: from vision to reality.

¹⁶ See CLS (2023) The cross-border roadmap: Navigating the FX lane; Shaping FX // 01 FX policy.

¹⁷ Payment-versus-payment (PvP): Settlement mechanism that ensures that the final transfer of a payment in one currency occurs if and only if the final transfer of a payment in another currency or currencies takes place. CLS Settlement offers the world's largest multicurrency settlement system, and it mitigates FX settlement risk through PvP. See CLS (2023) FX settlement risk; To PvP or not to PvP; Shaping FX // 02 The ecosystem.

Figure 2: The scope of wCBDC experiments (annex 2 for details)

Year	Domestic use cases		Cross-border use cases	
	Payment	DvP	Payment/PvP	DvP ¹⁸
2017	●●●●●●			
2018	●	●●●		
2019			●●	
2020	●●	●●	●●	
2021		●	●●●●	●
2022	●●●	●●●●●	●●●	●
2023	●	●	●●●●●	

● = reports published involving relevant use cases

Project Mariana

“A 24 hours-a-day, seven days-a-week wCBDC ecosystem.”

Project mBridge

“Settled transactions instantly.”

Project Jura

“Executed automatically, instantaneously and atomically.”

Project Cedar II x Ubin +

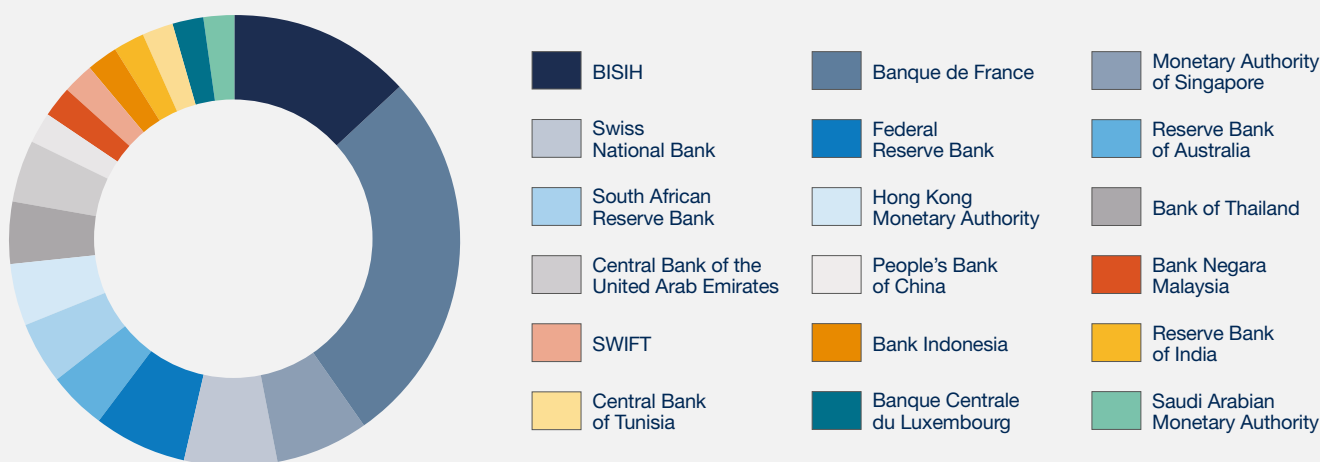
“Assumption that all currency ledgers operate on a 24/7 basis.”

Several key players drove the recent wCBDC uptick (figure 3). For example, the Banque de France launched a wCBDC experimentation program using DLT in 2020, which so far comprises 12 experiments in total.¹⁹ Work by the Bank for International Settlements Innovation Hub (BISIH) directly supports the efforts around the G20 cross-border roadmap.²⁰

The wCBDC experiments vary in technical approach, but most aim to provide ‘instant’ settlement on a ‘24/7’ basis (see box to the left). Recent wCBDC experiment reports emphasize these features in their assumptions, solution designs and success metrics (figure 4).

A more detailed overview of the wCBDC projects conducted between 2017 and 2023 can be found in the CBDC deep dive at the end of this opinion piece.

Figure 3: Key contributors to recent wCBDC projects 2021–2023

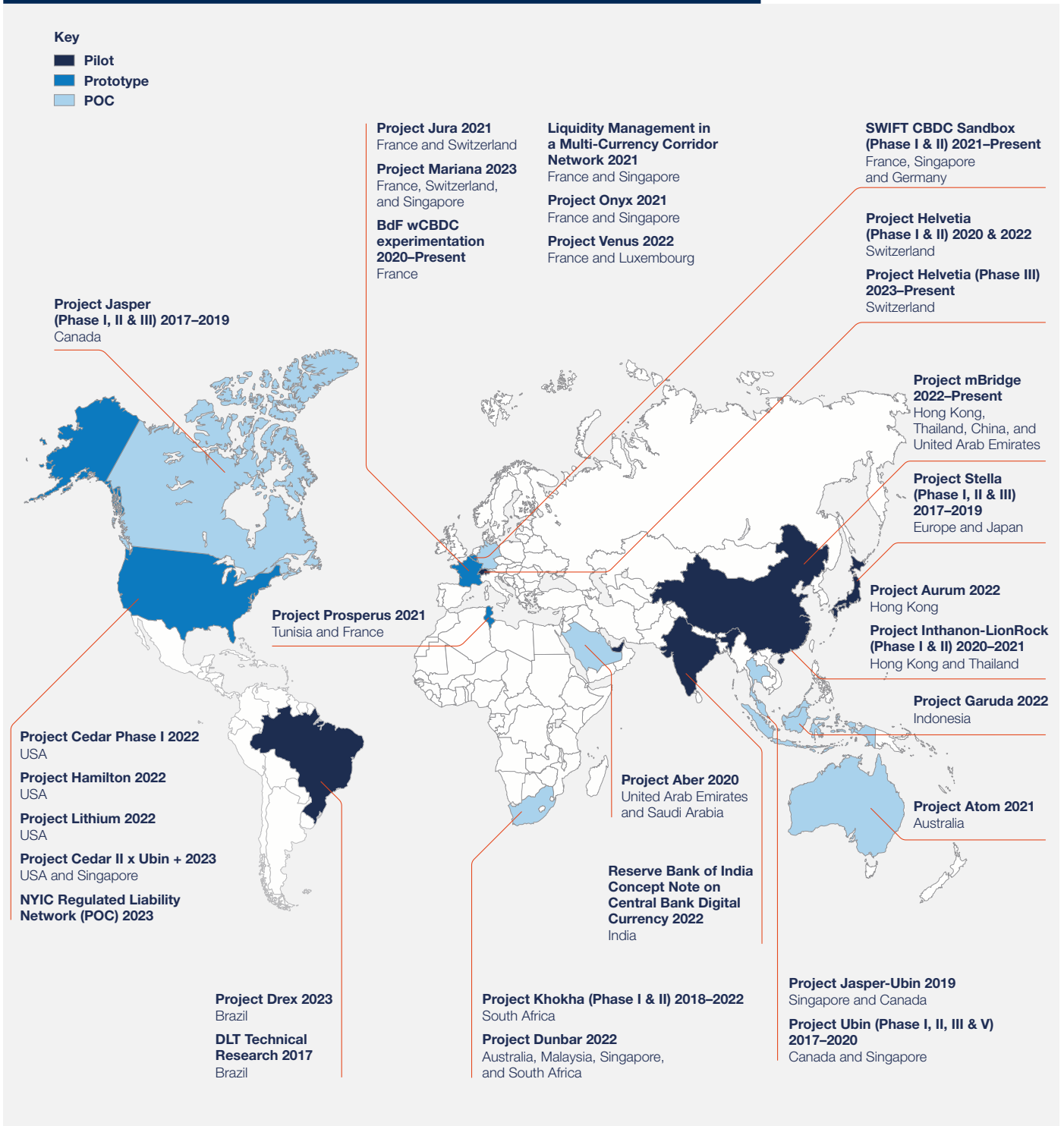


¹⁸ Delivery-versus-payment (DvP): Mechanism used in the settlement of securities transactions which links the delivery (securities) and payment (cash) obligations in such a way as to ensure that the delivery of the securities occurs if, and only if, the corresponding payment occurs.

¹⁹ Banque de France has published its findings across two reports, in 2021 (Banque de France wCBDC Report 2021) and 2023 (Banque de France wCBDC Report 2023).

²⁰ See bisih.org

Figure 4: wCBDC projects globally (proof of concepts (POCs), prototypes and pilots)



CBDC and PvP, beyond tech

Over the past three years, wCBDC experiments have increasingly explored creative and thought-provoking designs for cross-border and cross-currency payments, including PvP solutions, mainly from the vantage point of technological feasibility. However, the greatest challenges to PvP settlement are not technological.

Onboarding of currencies

PvP, as provided by CLSSettlement, synchronizes the settlement of payment instructions for the two currency legs of an FX trade. PvP has become the *de facto* market standard for tackling FX settlement risk. Today, however, around USD2.2 trillion of daily FX turnover – predominantly in emerging market currencies – still cannot benefit from the risk mitigation that PvP provides.²¹

Adding new currencies to a PvP mechanism like CLSSettlement is a complex endeavour. Solutions must be found and agreements reached between a multitude of players on a host of issues ranging from operational and legal to regulatory and political. Based on the most recent CBDC reports, it is not clear whether onboarding a wCBDC would be easier than onboarding a traditional currency. This issue requires further analysis.

Providing liquidity optimization

The FX market is the world's largest financial market, with a daily turnover of approximately USD7.5 trillion.²² Given the enormous amounts at play, FX market participants demand liquidity-efficient settlement solutions. CLSSettlement, for example, offers multilateral netting and additional liquidity-optimization features, which together translate into liquidity savings of up to 99%.²³

Operating wCBDC on an 'instant' settlement basis (i.e., atomic, gross and trade by trade), as premised in several wCBDC experiments, would not permit netting and thus would require significant liquidity. There could be merit in exploring near-instant settlement designs that allow at least some time for liquidity optimization through netting (i.e., "molecular" instead of "atomic" settlement).²⁴

At least in the wholesale FX ecosystem, instant or near-instant settlement solutions are likely to remain a niche market for the foreseeable future due to the time lag inherent in many business processes.²⁵ Discussions around shortening settlement cycles to T+1²⁶ revealed limited appetite to explore instant settlement absent a compelling business need, as it would require a fundamental overhaul of the post-trade ecosystem and its underlying processes.²⁷



²¹ See Glowka, M., Nilsson, T. (2022) FX settlement risk: an unsettled issue; BIS Quarterly Review.

²² See BIS Triennial central bank survey of foreign exchange and over-the-counter derivatives markets in 2022.

²³ See CLS (2023) Liquidity benefits: Do (not) settle for less; Shaping FX // 03 The FX ecosystem.

²⁴ See Leon, C. et al (2023) Molecular Settlement: Making atomic settlement work in a positive interest rate environment; FNA blog.

²⁵ See GFMA's Global FX Division (2023) Accelerated FX settlement – Moving to T0 and continuous settlement.

²⁶ Settlement cycles are currently contracting in the securities market. In January 2023, India completed its transition to T+1. The US and Canada will move to T+1 for most securities trades starting in May 2024. The UK government created the 'Accelerated Settlement Taskforce', and in the European Union, the European Securities and Markets Authority (ESMA) launched a public consultation.

²⁷ See AFME (2022) T+1 Settlement in Europe: Potential benefits and challenges.

Offering sound governance

Given its cross-jurisdictional nature, and depending on its scope and size, a wCBDC PvP settlement arrangement could be systemically important on a regional or even global level. If so, it would need a clear and sound legal basis²⁸ including a well-established governance framework, as stipulated in the Principles for Financial Market Infrastructures (PFMI).²⁹

Existing wCBDC experimentation follows two broad approaches: interoperating wCBDCs and single platform solutions that house multiple wCBDCs. Further work could explore potential governance arrangements for each:

- In the case of interoperable wCBDCs, PvP could be achieved through so-called smart contracts, which are self-executing programs that ensure simultaneous exchanges of wCBDCs on an all-or-nothing basis.³⁰ However, smart contracts raise issues about how the wCBDCs would be legally owned and governed.
- In single platform solutions, the issuing central banks (possibly together with other players, if tokenized deposits and other assets were also available on a 'unified ledger'³¹ platform) would need to reach consensus on the precise legal set-up and the underlying governance arrangements. The experience gained through establishing CLS as a public-private partnership on a global scale has demonstrated the importance of clear and strong legal, regulatory and governance frameworks.

Searching for a PvP use case

Analysis around wCBDCs has increasingly come into the spotlight. Technical experimentation has intensified in recent years, while analysis of legal, regulatory, governance and other non-technical aspects remains to be deepened.

The jury is still out on which role wCBDCs could play in cross-border payments, wholesale PvP settlement and the FX ecosystem generally. Initiatives to renew existing RTGS systems are already considering questions around extending operating hours, broadening participation to foreign entities and improving interoperability – issues that are also relevant to cross-border payment processing.³² RTGS system renewal may bring further innovations that could undermine the business case for wCBDCs.

The answer may be found in the securities ecosystem, where there is growing interest in tokenization of securities using DLT³³ and forthcoming experimentation involving central banks.³⁴ The issuance of securities tokens – and the need for their efficient and safe settlement in central bank money (i.e., DvP) – may eventually spur the business case for wCBDCs.³⁵ If wCBDCs became available for DvP, usage in PvP arrangements may logically follow. Synchronizing DvP and PvP could enable seamless exchange of local into foreign currency for purchasing bonds abroad.

Even if no obvious FX use case springs to mind today, new ones may arise as the industry evolves. In 1985, when computers were expensive and difficult to use, Apple Inc. founder Steve Jobs predicted that computers would eventually be used in every home.³⁶ The ubiquity of desktops and laptops proved his skeptics wrong decades ago, and the rapid pace of innovation continues to surprise with new use cases as we enter an age of AI chatbots and unprecedented digital connectivity.

²⁸ Including settlement finality, which is a legal concept, not a technological one.

²⁹ See CPSS-IOSCO (2012) Principles for financial market infrastructures; Principle 1 (legal basis): "An FMI [financial market infrastructure] 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."

³⁰ Several wCBDC experiments rely on hash time lock contracts (HTLCs), which create conditionality between assets. In order to receive the respective asset/currency/wCBDC, the beneficiary must enter a cryptographic passphrase (hash lock) and act within a predetermined timeframe (time lock).

³¹ See BIS (2023) Blueprint for the future monetary system: improving the old, enabling the new; BIS Annual Economic Report.

³² Cleland, V. (2024) The Real Time Gross Settlement service: an open platform to drive innovation; "An RTGS service open longer, with more and different types of participants, and which offers synchronisation to a wide range of ledgers, could achieve many of the benefits often associated with wholesale CBDCs."

³³ See UK Finance (2023) Unlocking the power of securities tokenisation.

³⁴ See ECB press release, Eurosystem to explore new technologies for wholesale central bank money, 28 April 2023; Swiss National Bank press release, SNB launches pilot project with central bank digital currency for financial institutions, 2 November 2023.

³⁵ DvP could be designed in various ways, and not all involve wCBDC. For example: (1) the cash leg could be provided based on current technology interoperable with a DLT-based securities leg; (2) a DLT-based cash leg could be interoperable with a DLT-based securities leg; or (3) an integrated DLT-based infrastructure could settle both the cash leg and the securities leg; see Neuhaus, H., Plooi, M. (2023) Central bank money settlement of wholesale transactions in the face of technological innovation; ECB Economic Bulletin, Issue 8/2023.

³⁶ cnbc.com/2018/05/24/apple-co-founder-steve-jobs-accurate-predictions-about-future-of-tech.html

CBDC deep dive

Annex 1: CBDC reports published (corresponding to figure 1)

2017	2018	2019	2020	2021	2022	2023
Project Stella Phase 1 report European Central Bank and Bank of Japan	Project Stella Phase 2 report European Central Bank and Bank of Japan	Project Stella Phase 3 report European Central Bank and Bank of Japan	Project Ubin Phase 5 report Monetary Authority of Singapore	Project Inthanon-Lionrock Phase 2 report Hong Kong Monetary Authority and Bank of Thailand	Project mBridge Report BISIH, Hong Kong Monetary Authority, Bank of Thailand, People's Bank of China, and Central Bank of the United Arab Emirates	Project Mariana Report BISIH, Banque de France, Swiss National Bank and Monetary Authority of Singapore
Project Ubin Phase 1 and 2 reports Monetary Authority of Singapore	Project Ubin Phase 3 report Monetary Authority of Singapore	Project Jasper-Ubin Report Monetary Authority of Singapore and Bank of Canada	Project Helvetia Phase 1 report BISIH and Swiss National Bank	Project Jura Report BISIH, Banque de France and Swiss National Bank	Project Dunbar Report BISIH, Reserve Bank of Australia, Bank Negara Malaysia, Monetary Authority of Singapore, and South African Reserve Bank	Project Cedar II x Ubin + Phase 2 report New York Innovation Centre (Federal Reserve Bank) and Monetary Authority of Singapore
Project Jasper Phase 1 and 2 reports Bank of Canada	Project Jasper Phase 3 report Bank of Canada		Project Inthanon-Lionrock Phase 1 report Hong Kong Monetary Authority and Bank of Thailand	Liquidity Management in a Multi-Currency Corridor Network Report Banque de France and Monetary Authority of Singapore	Project Helvetia Phase 2 report BISIH and Swiss National Bank	SWIFT CBDC Sandbox Phase 2
DLT Technical Research in Central Bank of Brazil Positioning report Banco Centrale do Brasil	Project Khokha Phase 1 report South African Reserve Bank		Project Aber Report Central Bank of United Arab Emirates and Saudi Arabian Monetary Authority	SWIFT CBDC Sandbox Experiment Phase 1 report Banque de France, Monetary Authority of Singapore and Deutsche Bundesbank	Project Cedar Phase 1 report New York Innovation Centre (Federal Reserve Bank)	Regulated Liability Network (US) Report New York Innovation Centre (Federal Reserve Bank)
				Project Atom Report Reserve Bank of Australia	Project Khokha Phase 2 report South African Reserve Bank	Project mBridge Update report 2023 BISIH, Hong Kong Monetary Authority, Bank of Thailand, People's Bank of China, and Central Bank of the United Arab Emirates
				Project Prosperus Report Central Bank of Tunisia and Banque de France	Project Garuda Phase 1 report Bank Indonesia	Project Drex Report Banco Central do Brasil
				Project Onyx Report Banque de France and Monetary Authority of Singapore	Reserve Bank of India Concept Note on Central Bank Digital Currency Report Reserve Bank of India	
					Project Aurum Report Hong Kong Monetary Authority	
					Project Lithium Report N/A (driven by private sector, Depository Trust and Clearing Corporation)	
					Project Hamilton Report Boston Federal Reserve Bank	
					Project Venus Report Banque de France and Banque Central du Luxembourg	

Annex 2: Development of the scope of wCBDC experiments (corresponding to figure 2)

Year	Domestic use cases		Cross-border use cases	
	Payment	DvP	Payment/PvP	DvP
2017	<p>Project Stella Phase 1 report European Central Bank and Bank of Japan</p> <p>Project Ubin Phase 1 and 2 reports Monetary Authority of Singapore</p> <p>Project Jasper Phase 1 and 2 reports Bank of Canada</p> <p>DLT Technical Research in Central Bank of Brazil Positioning report Banco Centrale do Brasil</p>			
2018	<p>Project Khokha Phase 1 report South African Reserve Bank</p>	<p>Project Stella Phase 2 report European Central Bank and Bank of Japan</p> <p>Project Ubin Phase 3 report Monetary Authority of Singapore</p> <p>Project Jasper Phase 3 report Bank of Canada</p>		
2019			<p>Project Stella Phase 3 report European Central Bank and Bank of Japan</p> <p>Project Jasper-Ubin Report Monetary Authority of Singapore and Bank of Canada</p>	
2020	<p>Project Helvetia Phase 1 report BISIH and Swiss National Bank</p> <p>Project Aber Report Central Bank of United Arab Emirates and Saudi Arabian Monetary Authority</p>	<p>Project Helvetia Phase 1 report BISIH and Swiss National Bank</p> <p>Project Ubin Phase 5 report Monetary Authority of Singapore</p>	<p>Project Inthanon-Lionrock Phase 1 report Hong Kong Monetary Authority and Bank of Thailand</p> <p>Project Aber Report Central Bank of United Arab Emirates and Saudi Arabian Monetary Authority</p>	
2021		<p>Project Atom Report Reserve Bank of Australia</p>	<p>Project Inthanon-Lionrock Phase 2 report Hong Kong Monetary Authority and Bank of Thailand</p> <p>Project Jura Report BISIH, Banque de France and Swiss National Bank</p> <p>Project Prosperus Report Central Bank of Tunisia and Banque de France</p> <p>Liquidity Management in a Multi-Currency Corridor Network Report Banque de France and Monetary Authority of Singapore</p>	<p>Project Jura Report BISIH, Banque de France and Swiss National Bank</p>

Table continued on the next page.

Annex 2: Development of the scope of wCBDC experiments (corresponding to figure 2) cont.

Year	Domestic use cases		Cross-border use cases	
	Payment	DvP	Payment/PvP	DvP
2022	<p>Project Garuda Phase 1 report Bank Indonesia</p> <p>Project Aurum Report Hong Kong Monetary Authority</p> <p>Project Hamilton Report Boston Federal Reserve Bank</p>	<p>Project Helvetia Phase 2 report BISIH and Swiss National Bank</p> <p>Project Khokha Phase 2 report South African Reserve Bank</p> <p>Project Garuda Phase 1 report Bank Indonesia</p> <p>Reserve Bank of India Concept Note on Central Bank Digital Currency Report Reserve Bank of India</p> <p>Project Lithium Report N/A (driven by private sector, Depository Trust and Clearing Corporation)</p>	<p>Project mBridge Report BISIH, Hong Kong Monetary Authority, Bank of Thailand, People's Bank of China, and Central Bank of the United Arab Emirates</p> <p>Project Dunbar Report BISIH, Reserve Bank of Australia, Bank Negara Malaysia, Monetary Authority of Singapore, and South African Reserve Bank</p> <p>Project Cedar Phase 1 report New York Innovation Centre (Federal Reserve Bank)</p>	<p>Project Venus Report Banque de France and Banque Central du Luxembourg</p>
2023	<p>NYIC Regulated Liability Network Report New York Innovation Centre (Federal Reserve Bank)</p>	<p>Project Drex Banco Central do Brasil</p>	<p>Project Mariana Report BISIH, Banque de France, Swiss National Bank and Monetary Authority of Singapore</p> <p>Project Cedar II x Ubin + Phase 2 report New York Innovation Centre (Federal Reserve Bank) and Monetary Authority of Singapore</p> <p>SWIFT CBDC Sandbox Experiment Report Banque de France, Monetary Authority of Singapore and Deutsche Bundesbank</p> <p>Project mBridge Update report BISIH, Hong Kong Monetary Authority, Bank of Thailand, People's Bank of China, and Central Bank of the United Arab Emirates</p> <p>NYIC Regulated Liability Network Report New York Innovation Centre (Federal Reserve Bank)</p>	

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