



Regulatory Brief

The Evolution of Money: Why Financial Institutions Should Start Paying Attention to CBDCs

As the world has increasingly become more digital, so too has our money — as evidenced by the rise of digital banking and mobile payments. According to a 2018 study, approximately one-third of American adults generally did not use cash to make payments while one in ten millennials made payments only using digital apps.¹ This trend has accelerated during the global pandemic as customers have favored digital and contactless transactions over physical cash, with one study showing that cash use declined by 40%. Further, 90% of respondents indicated that they will reduce their use of cash going forward.²

The private sector has responded with the rise of mobile payment platforms, larger companies creating their own digital currencies, and the growth of “stablecoins” (i.e., fiat-pegged digital currencies). Central banks have also started to take notice by developing their own “central bank digital currencies” (CBDCs), which are digital forms of fiat currency.

According to PwC’s CBDC Global Index, more than 60 central banks are at different stages of research and development of CBDCs. Some countries such as the US and UK are conducting research but have not announced an intention to begin CBDC development, while others - including China and Sweden - have launched live pilot programs.³ Motivations cited by central banks for pursuing CBDCs include maintaining control over monetary policy, financial inclusion,⁴ traceability of transactions for anti-money laundering (AML) and tax purposes, and improved cross-border payments.⁵ Critics have been quick to note that CBDCs could pose data security and privacy concerns as well as reduce deposits at banks, which could reduce liquidity in the financial system.⁶

While it will likely take years to launch a digital dollar if the US decides to pursue its development, there are steps that financial institutions can take now to prepare themselves for potential domestic and global shifts toward CBDCs. This **Regulatory brief** provides our perspective on how CBDCs could impact the business models of financial institutions as well as how existing custody, blockchain, cybersecurity and other functions can be adapted to support CBDCs.

¹ See Pew Research Center’s [More Americans are making no weekly purchases with cash](#) (December 2018).

² See the European Central Bank’s [Study on the payment attitudes of consumers in the euro area](#) (December 2020).

³ For more information, see PwC’s [CBDC Global Index](#) (April 2021).

⁴ Certain central banks pursuing CBDC projects including the Bahamas and Cambodia have cited that digital currencies could improve access to the financial system for many citizens that do not have access to bank accounts but use mobile phones. Further, countries with high rural populations or other limitations that reduce access to physical bank branches or ATMs could see financial inclusion benefits from CBDCs.

⁵ For more information, see the Bank of International Settlements’ [Central bank digital currencies: foundational principles and core features](#) (October 2020).

⁶ For more information, see the Bank Policy Institute’s [Central Bank Digital Currencies: Costs, Benefits and Major Implications for the U.S. Economic System](#) (April 2021).

Background

What are CBDCs?

Unlike bitcoin and other decentralized cryptocurrencies, CBDCs are digital forms of central bank-issued money in which the central bank carries all liabilities. Most CBDCs are being developed using distributed ledger technology (DLT), a shared database where multiple participants maintain a copy of the data whereby all copies of such data remain consistent through computerized consensus mechanisms⁷ rather than through a third party.

CBDCs have been developed in two primary distinct forms: (1) retail CBDCs that can be directly held by individuals and entities as a form of digital cash, and (2) wholesale CBDCs intended to be used by financial institutions that have central bank accounts to conduct interbank transactions and financial settlement. For retail CBDCs, users store their funds in a “digital wallet,” software that allows users to store funds, initiate transactions and track payment activities with digital devices such as mobile phones and computers. Depending on their design, digital wallets could be provided by the central bank or by authorized financial institutions. Retail CBDCs generally share the following attributes:

- **Available.** CBDCs will need to be available to send and receive regardless of whether a network connection can be established. The ability to operate offline serves to ensure inclusivity for populations living in remote areas in addition to durability during temporary network blackouts⁸.
- **Secure.** As most CBDCs currently in development incorporate DLT, the distributed nature of the network reduces the risk of a central point of failure resulting in a potential cybersecurity incident. For example, if one node of the distributed ledger becomes compromised, the other nodes will be able to verify legitimate transactions.⁹
- **Transparent.** The transaction history for CBDCs is fully traceable, which could aid in AML compliance procedures and investigations but also raises concerns around privacy.

⁷ With consensus mechanisms, for each transaction that results in a change to the shared database, a majority share of participants must agree to the change (i.e., reach a consensus that the change is valid).

⁸ For more information on offline payments see Visa's [Towards a Two-Tier Hierarchical Infrastructure: An Offline Payment System for Central Bank Digital Currencies](#)

⁹ For more information, see the Bank for International Settlements' [Distributed ledger technology in payment, clearing and settlement](#) (February 2017).

- **Programmable.** Many CBDCs will be able to implement “smart contracts,” which are programs stored on a blockchain that run when predetermined conditions are met, allowing for automation. Instead of financial institutions automating their internal back end processes, CBDCs that allow for smart contracts can self-execute when agreed conditions are met. For example, the People's Bank of China has experimented with attaching expiration dates to stimulus funds to incentivize spending.
- **Interoperable.** CBDCs allow for a more seamless exchange of digital money among different technology networks and mediums of exchange, allowing real-time cross-border transactions.

Some central banks such as those of the UK and Hong Kong are pursuing CBDCs that are reserved for wholesale payments, which are large-value transactions settled between financial institutions that have accounts at the central bank. Currently, wholesale payments can take days to settle in some markets, especially with regard to international transactions, and wholesale CBDCs could present a vehicle for instant settlement. They also could expand upon instant settlement of currency transactions to provide for real-time settlement of “tokenized securities.”¹⁰ Further use cases for wholesale CBDCs involve facilitating business-to-business transfers and providing for more efficient cross-border transactions.

Central banks have also differed in their plans for issuance of CBDCs, ranging from direct issuance models where central banks issue CBDCs to digital wallets held by individuals or entities, indirect models where central banks use intermediaries such as banks to onboard users, and hybrid models. At present in the US, we do not see a direct issuance model to be likely, particularly given comments from Federal Reserve (Fed) Chair Jerome Powell that he does not want to disturb the two-tier banking model.¹¹

The chart below outlines key differences among various forms of money, including CBDC:

¹⁰ [Tokenized securities](#) are digital tokens based on blockchain technology that are similar in nature to traditional securities. They can provide an economic stake in a legal entity: sometimes a right to receive cash or another financial asset, which might be discretionary or mandatory; sometimes the ability to vote in company decisions and/or a residual interest in the entity. For more information, see PwC and SIFMA's joint whitepaper [Security Tokens: Current Regulatory and Operational Considerations for Broker-Dealers](#) (November 2020).

¹¹ See Fed Chair Powell's [remarks](#) at a Bank for International Settlements event titled "How Can Central Banks Innovate in the Digital Age?."

	Conventional Forms of Money			New Forms of Money		
	Cash	Bank Deposits	Master Account Balances	Cryptocurrency	Privately Issued Currency or Stablecoin	Central Bank Digital Currency
Digital	X	✓	✓	✓	✓	✓
Central Bank Issued	✓	X	✓	X	X	✓
Widely Accessible(*)	✓	✓	X	✓	✓	✓
Universally Accessible(**)	✓	X	X	✓	X	✓
Anonymity	✓	X	X	X	X	X

✓ = existing or likely feature, X = not typical or possible feature

Adapted from the Bank of International Settlements

(*) “Widely Accessible” means available to a wide range of people with minor restraints.

(**) “Universally Accessible” means available to all regardless of access to the banking system.

Where are various central banks in their CBDC development?

Central banks are currently at very different stages of CBDC development, with most still in the research phase. The Central Bank of the Bahamas became the first to issue a live retail CBDC in October 2020. A number of other central banks have live pilot programs, with the People’s Bank of China notably launching several pilot programs for its retail CBDC last year and having more than two billion digital RMB currently in circulation. Other central banks with retail CBDC pilot programs include Sweden’s Riksbank, which has reported that less than 10% of transactions in Sweden are now made using cash. It is currently reviewing the feasibility of the proposed E-Krona, which is expected to be completed by November 2022.¹² On the wholesale CBDC side, the Hong Kong Monetary Authority and Bank of Thailand have reported progress conducting a joint pilot program to test wholesale and cross-border payments.

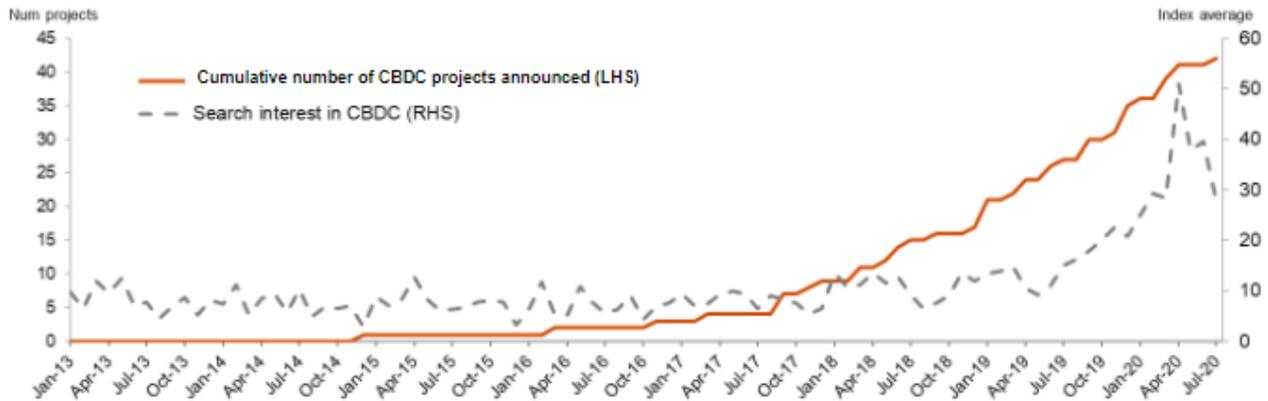
Earlier this month, the Bank of England and HM Treasury announced the creation of a joint CBDC Taskforce to explore opportunities and risks related to the development of a digital currency and to recommend design features. The European Central Bank has been progressing in its research since January 2020, and after conducting a public consultation, it recently reported that its primary testing objectives include scalability, interoperability, payment blockchains, and hardware devices that can facilitate transactions without a network connection.¹³ In the US, Fed Chair Powell has described research into the digital dollar as a “high-priority project,¹⁴” and Treasury Secretary Janet Yellen has highlighted the potential benefits of a US CBDC in recent speeches. However, Chair Powell also stated that he does not believe the US needs to be among the first countries to implement a CBDC. For now, the Fed and other US regulatory authorities are studying the impacts of other CBDC projects, conducting public outreach and studies, and working to address concerns such as the need to promote the highest levels of security to safeguard against potential fraud and cybersecurity attacks. Powell recently announced that the Fed will release a paper on its research this summer. See **Appendix A** for the PwC CBDC Global Index’s Top 10 Retail and Wholesale CBDC projects.

¹² See Riksbank’s [Payments in Sweden 2020](#).

¹³ <https://www.ecb.europa.eu/press/key/date/2020/html/ecb.sp201127~a781c4e0fc.en.html>

¹⁴ See Fed Chair Powell’s [testimony before the Senate Banking Committee](#).

A growing interest for CBDC



Central Bank project announcements accelerated in early 2019, shortly followed by global public interest.

¹Source: BIS. Please note that project dates are based on the first publication date of the related report, as provided by BIS. When there is an ongoing or completed pilot, a is marked on the right side of the country flag by a star. Flags without stars indicate that Central Banks are on the stage of research studies. More information concerning the determination of pilot could be found in 'Rise of the central bank digital currencies: drivers, approaches and technologies', BIS working paper, No 880, August by Auer, R, G Cornelli and J Frost (2020).

What guidance have governments and regulators provided?

Interest in a US CBDC has picked up among regulators and policymakers, but Chair Powell has indicated that the Fed will await Congressional approval before doing so. The Fed's authority to issue a retail CBDC is currently in a legal gray area because there is no specific statutory authority enabling it to do so. There are currently three bills in Congress that call upon the Fed to issue a CBDC. While details vary among the bills, they all appear to authorize the issuance of digital currency that can be accessed via consumer-facing digital wallets provided by the Fed. Considering that these bills currently lack Republican co-sponsors, coupled with the generally controversial nature of CBDCs, the likelihood that they eventually become law remains unclear.

Meanwhile, the Office of the Comptroller of the Currency (OCC) published an interpretive letter confirming the ability of federally-chartered banks to participate in Independent Node Verification Networks,¹⁵ which means that these banks have

¹⁵ Independent node verification networks are a form of decentralized technology that validates and records financial transactions. Participants in these networks are known as nodes, which validate transactions and broadcasts the history to the network.

explicit regulatory permission to use blockchain technology to validate financial transactions in real-time.¹⁶ While this interpretive letter applies broadly to a wide range of digital assets, it serves to establish the necessary infrastructure to facilitate collaboration between private banks and the public sector with regards to a CBDC. International organizations have also weighed in on developing CBDCs in line with policy objectives. For example, the Bank for International Settlements released a paper in October 2020 outlining principles for CBDC development.¹⁷ The paper explains that CBDCs should be interoperable across borders, not interfere with central banks' mandates for monetary and fiscal stability and focus on preventing consumer harm.

As the regulatory environment to enable a potential future transition to CBDCs continues to take shape, central banks will likely need to work with the private sector and public sectors to make further progress. For example, EU countries have organized a Taskforce to collaborate on the development of a

¹⁶ While the OCC's interpretation impacts federally-chartered entities, state-chartered banks have the ability to invoke state parity laws to gain the same authorizations from the regulators - this includes not only smaller community and regional banks, but many of the G-SIBs operating under state charters.

¹⁷ See the Bank for International Settlements' [Central bank digital currencies: Foundational principles and core features](#) (October 2020).

digital euro and engage with citizens, financial institutions, regulatory authorities and academics on design considerations and potential impacts. In April of this year the Bank of England announced a Taskforce between HM Treasury and the Bank of England to explore the potential need for CBDC.¹⁸ We can see a similar pathway for the US, especially considering that Fed Chair Powell recently emphasized the need for a public consultation regarding potential CBDC development.

What is the potential impact of a cashless society?

Just as CDBCs have the potential to change the way individuals and businesses store money and facilitate transaction processing, they also could alter the way customers interact with financial institutions. This will likely disrupt traditional business models for financial institutions and create new business opportunities. For example, depending on their design, digital wallets could be provided by the central bank or by authorized financial institutions. Below, we highlight considerations for the following traditional banking services: a) deposit and loans, b) payments, and c) ATMs & physical branches.

Deposit and Loans

At the core of a bank's business model is establishing a base of deposits from customers and generating revenue by redistributing such funds to customers via different lending products such as mortgages, auto loans and student loans. If a retail CBDC with a digital wallet is introduced that is capable of being hosted with a non-bank financial institution, banking deposit accounts will face new competition. The potential lower deposit balances pose an asset liability management risk should reserves fall below requirements needed for lending activities. Additionally, some users may elect to store CBDCs in digital wallets offered by competitors if they could save on fees or if it is more convenient to do so. In this case, banks may face pressure to consider offering higher interest rates on deposits and adjusting their fees when competing for CBDC deposits. Since deposit accounts at banks are FDIC insured, this may continue to be a differentiating factor between "digital cash" and a deposit account.

Payments

The ability to conduct payments instantly and electronically via digital wallets could pose a threat to financial institutions' ability to collect fees from wire transfers, check issuances, and other payment services. If the CBDC is designed to allow for central

bank-issued digital wallets, financial institutions may face competition from potentially lower fees. In situations where users store their CBDC on third party digital wallets, traditional financial institutions will likely face competition from technology companies. For example, Chinese tech companies are already building digital wallets into smartphones. CBDCs would also reduce the need for most smaller banks and non-bank financial institutions to process their payments through larger banks.

Anonymity & Privacy

The anonymity feature of cash is unlikely to be replicated with CBDC, although we expect that there will be strict rules regarding confidentiality and data protection. Since transactions are recorded on a digital ledger, digital wallet managers presumably will be able to view transactional data that are linked to an individual's identification. Some Central Banks have researched implementing anonymity vouchers, which are vouchers that would allow low value transactions to be executed without passing AML regulatory legal requirements.¹⁹

ATMs & Branches

CBDCs will heavily influence the already-changing banking infrastructure, reducing the need for ATMs and branches (and therefore commercial real estate) that will no longer serve as essential sources of access to paper money. Branch and ATM usage have gradually decreased over the past several years, with last year seeing drops in usage of approximately 50% and 60%, respectively. The potential introduction of CBDCs would likely further accelerate the impact of this transition, resulting in cost savings in real estate and marketing. However, a reduced real estate footprint for some financial institutions may result in significantly less market presence in metropolitan areas with dense foot traffic.

What can financial institutions be doing now?

Financial institutions should recognize the possibility of a future where: (1) a significant amount of global economic activity is conducted with CBDCs, (2) cash usage has dramatically declined, and (3) business models have changed drastically. The good news is that it is not too late to avoid being left behind. While most central banks are still in the research phase regarding digital currency, financial institutions can begin taking steps now to prepare. Doing so will provide them with the opportunity to identify new products and services to better serve their

¹⁸ See [Bank of England Statement on Central Bank Digital Currency](#).

¹⁹ See the European Central Bank's [Exploring anonymity in central bank digital currencies](#) (December 2019).

customers - and allow them to emerge as industry leaders in the digital asset space.

Design a digital asset strategy

Some financial institutions have begun adapting to innovation in the digital asset space by, for example, (1) offering US dollar-denominated digital coins (stablecoins) and tokens; (2) providing institutional custody services; (3) introducing digital asset investment products; and (4) building out digital asset payment rails. Firms that have taken these initial steps may find themselves at a competitive advantage. The relatively long runway for potential CBDC issuance by many central banks means that it is not too late for firms to begin developing their digital asset strategies, but with major economies such as China reportedly preparing for widespread CBDC use as early as next year,²⁰ they should consider taking action sooner rather than later.

Financial institutions can begin by first understanding how their core capabilities intersect with the necessary capabilities needed to support CBDCs, for example, by examining whether their programs are equipped to handle the expansion of traditional custody services to include digital assets. This includes considering whether existing programs can be leveraged to support physical CBDC custody (i.e., safeguarding digital assets stored on physical devices), adopting cybersecurity practices to protect against hacking, and using cryptography to support the use of public and private “keys” (i.e., encrypted strings of information used to transfer and withdraw digital assets).²¹ Further, when building capabilities for digital wallets and related transaction processing services, financial institutions should consider how they can take advantage of their existing infrastructure for third-party payment platforms and deposit accounts.

Because CBDCs will need to interact with the existing financial services ecosystem, financial institutions should also consider how their existing systems may potentially need to be updated, integrated or retired based on CBDC design and implementation decisions. For example, payment rails for CBDCs should be able to coexist with the current payment infrastructure that includes debit cards, credit cards, bank transfers and third-party payments apps; customer CBDC wallets should provide a similar experience to what is offered today. Financial institutions should also consider whether their systems and processes are dynamic enough to adjust and react to various CBDC design outcomes

²⁰ See the [publication cited in note 3](#).

²¹ A public key consists of a string of random numbers and can be used to encrypt a message, which can be deciphered with a specific private key that decodes the message.

(e.g., retail vs. wholesale, and direct vs. indirect issuance) so that teams can hit the ground running.

If a firm decides to build out its existing internal architecture to prepare for CBDCs, it will need to assess internal strengths and weaknesses to determine whether to make such changes internally or acquire companies with existing technological capabilities. Firms can prioritize their efforts based on their geographic presence using the PwC CBDC Global Index, which tracks the development of both retail and wholesale CBDCs globally.²² With this approach, they will be better able to prioritize activities, and apply lessons learned to jurisdictions that are less mature in terms of CBDC development.

Develop the appropriate skillset

With over 60 central banks in the process of researching and/or developing CBDCs, final design decisions, pilot programs and releases will likely roll in over the next several years. To avoid being caught off guard, financial institutions will need qualified and knowledgeable staff who will be ready to adapt and begin implementation processes quickly regardless of the final design decisions. Having the right resources will be a key success factor, yet 74% of CEOs surveyed in PwC’s 23rd Annual Global CEO survey expressed concern that their organization lacks the right skills to keep up with evolving technological demands.²³ For some organizations, hiring or acquiring technical resources may be a priority to meet the demand for appropriately skilled staff, while others may opt to re-train existing resources. Firms should consider the following questions:

- **Who will build your technology?** Based on the PwC Global CBDC Maturity Index, 7 out of the 10 most advanced central banks with regard to CBDC development are designing their currency using DLT, which means that banks should develop DLT learning programs to effectively upskill staff. This may also require hiring of technical staff members with strong fundamental backgrounds in DLT who are capable of developing a core CBDC infrastructure.
- **How will you develop the necessary security?** Financial institutions are already dedicating an increasing amount of resources to their cybersecurity programs. With CBDCs they will not only need to evaluate their cybersecurity risks to ensure resilience against cyber attacks but also security around public and private keys. Having a team of cybersecurity subject matter specialists that understand cryptography will be crucial because keeping information protected though

²² For more information, see the [publication cited in note 3](#).

²³ For more information, see PwC’s [Upskilling: Building confidence in an uncertain world](#).

encryption is as important as keeping it secure against cyber attacks.

- **How will you know your CBDC customers?.**

While final CBDC design decisions have yet to be taken around the world, a highly anticipated feature is interoperability. This component of CBDCs offers convenience for consumers traveling across borders and institutions transacting internationally, but digital asset AML and know your customer (KYC) standards and regulatory expectations are evolving. An institution supporting CBDCs will need to reflect this in its financial crime risk assessment and revise its program accordingly. As jurisdictions implement new AML and KYC requirements for digital assets, institutions will need to ensure their risk-based approach will meet these new compliance obligations.

- **What will be your liquidity management approach?** One thing a CBDC will likely not change is the requirement that a bank manage liquidity both internally among businesses and externally with counterparties. The enablement of liquidity provisioning and movement of money within the bank will be significantly impacted through the adoption of CBDCs and other cash settlement tools currently under development. For these reasons it is important to collaborate closely with finance and treasury to effectively capture, evaluate, and address the potential implications.

- **How will you turn the “threat” of CBDCs into new opportunities?** Given the transformative nature of digital assets, those on the front lines driving business strategies will be best suited to define the impact to the bank’s value proposition. For example, thoughtful consideration around potential threats from this technology can be pivoted into areas of opportunities across new products and services. Regardless of the future of a US CBDC, developing the infrastructure to support areas such as CBDC custody, payments and security will provide firms with the essential building blocks for the provision of other digital asset services (e.g., tokenized securities,²⁴ cryptocurrency, and stablecoins).

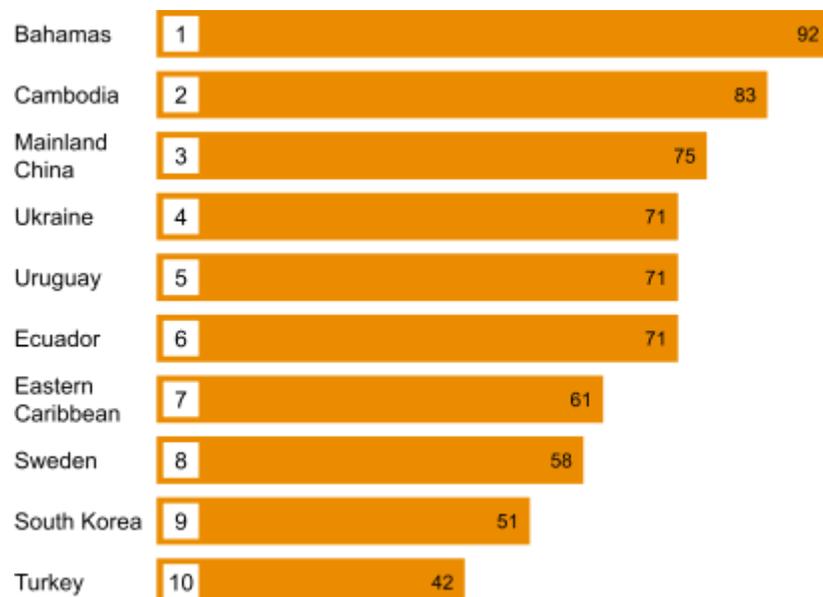
With the potential next phase of the evolution of money in sight, firms must ask themselves: will you be the next Tower Records or Blockbuster Video? Or will you take the decisions today that will position your institution for the future?

²⁴ For more information, see the [publication cited in note 10](#).

APPENDIX A:

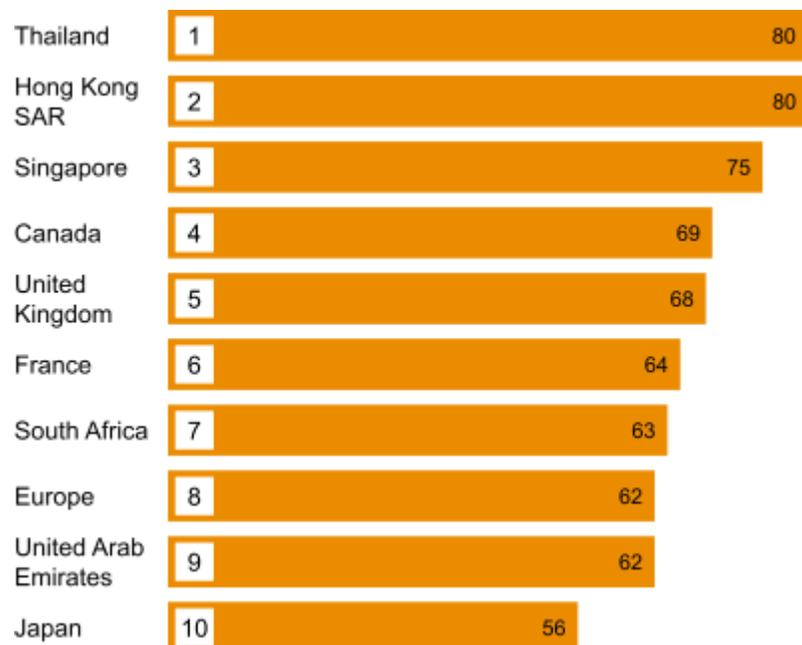
PwC CBDC Global Index's Top 10 Retail and Wholesale CBDC projects

Top 10 - Retail CBDC projects



Source: BIS Working paper No 880, December 2020 update and PwC analysis. Rebased against an index of 100. and is dependent on the availability of data.

Top 10 - Interbank or Wholesale CBDC projects



Source: BIS Working paper No 880, December 2020 update and PwC analysis. Rebased against an index of 100. and is dependent on the availability of data.

Additional information

For additional information about this Regulatory brief or PwC's Financial Services Regulatory Practice, and how we can help you, please contact:

Julien Courbe
Financial Services Leader
646 471 4771
julien.courbe@pwc.com
@juliencourbe

Adam Gilbert
Financial Services Advisory Regulatory Leader
646 471 5806
adam.gilbert@pwc.com

Dan Ryan
Banking and Capital Markets Partner
646 471 8488
daniel.ryan@pwc.com
@DanRyanWallSt

Roberto Rodriguez
Director of Regulatory Strategy
646 471 2604
roberto.j.rodriquez@pwc.com

Contributing authors: Paul Chew, Matthew Blumenfeld, Robert Donovan, Alexander Yip, Scott Toppi, Ali Ulasan, Patryk Czerwony and Michael Horn.