Central Bank Digital Currencies (CBDC): Cryptocurrencies issued by central banks

Why financial institutions should embrace crypto-payments

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Cypherium is a layer 1 blockchain protocol designed to offer financial inclusivity for users, while delivering operational efficiencies for its enterprise and institutional partners. Using a hybrid consensus mechanism, the Cypherium blockchain is designed to achieve commercial viability while preserving the characteristics of decentralization and DLT. Cypherium's approach to creating financial inclusivity between civilians, banks, government, and enterprise begins with our Digital Currency Interoperability Framework. The DCIF is Cypherium's proprietary architecture for allowing any asset, including CBDCs, stable coins and digital assets, to be received or distributed on-chain or cross-ledger.

Agenda

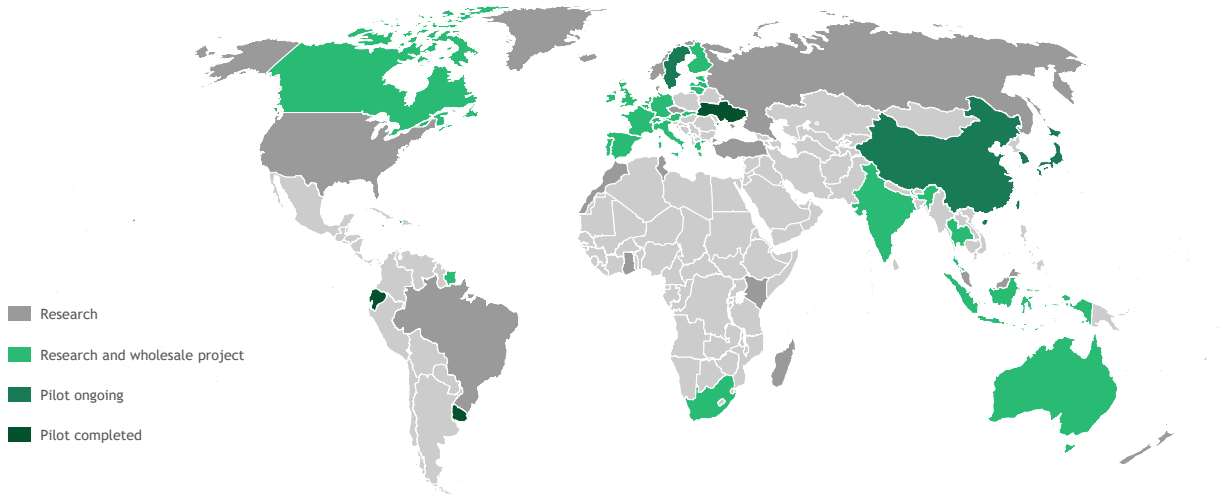
1 Why CBDCs Now?

The public and the financial sectors have historically seen cryptocurrencies as destined to remain on the fringes of the mainstream. However, amid increased regulatory attention in recent months, citizens and institutions have begun to see more long-term potential. Moreover, the underlying distributed ledger technology has been applied to an increasingly diverse range of activities, from financial industry operations to contract validation and personal identification.

Alongside these dynamics, the payments and transaction banking sectors that are most aligned with cryptocurrency use cases have seen significant innovation. The $1.5 trillion payments market has been disrupted by a global migration from cash to non-cash, alongside increased financial inclusion, and the expansion of e-commerce. Innovations such as real-time payments, mobile payments using QR codes, and virtual credit cards are attracting significant demand. In this environment, some big players in the payments space, such as Paypal, VISA, Mastercard, are starting to be willing to accept cryptocurrencies alongside conventional means of payment. In parallel, technology companies such as Amazon are reportedly getting ready to make cryptocurrency transactions available to consumers — instantly, and with minimal fees and direct verification.

These developments raise significant questions around the monetary sovereignty of central banks, which generally sit outside the crypto ambit. In response, several are assessing the possibility of creating their own Central Bank Digital Coins (CBDC) as the "digital cash of tomorrow" (Exhibit 1).

Status of central-bank digital currencies, retail projects[1], April 2021



1. Retail CBDCs are for the public; wholesale CBDCs for financial institutions

Exhibit 1: Status of CBDC introduction per country (April 2021)

Three Central Banks at the Vanguard:

Three central banks are ahead of the curve in terms of digital currency experimentation:

(1) The Chinese Central Bank is testing a **Digital Yuan** in a number of cities (Davoodalhosseini, 2018) and is working with the Bank of Thailand and Hong Kong Monetary Authority to simulate the use of the digital yuan for cross-border payments (Abdel-Quader, 2021).

(2) The Swedish Central bank is developing an **e-krona,** and plans to get commercial banks involved soon (Reuters, 2021).

(3) The ECB has set up a working group to examine the potential implementation of a **Digital Euro**, targeted for 2024/2025. The bank is likely to try using existing real-time clearing infrastructure.

What Are the Advantages of CBDCs for Central Banks and Economies?

- **Easier design of monetary policies:** It is currently time-consuming to monitor the macroeconomic and monetary situation across countries. Efficiency could be improved through real-time monitoring of digital spending (Anissimov, 2021).
- **Ease of access to financial services:** A possible benefit would be increased access to financial services (such as saving, lending, investing) for unbanked populations. In many countries, people still struggle to order international goods above US$100, send money quickly at a reasonable cost, and deposit money for free in a bank account.
- **Close to real-time payments:** With market participants confident of central bank stability, central banks could use CBDCs to offer a variety of global instant payments (Jiang, 2020; Davoodalhosseini, 2018).
- **Support digitalization:** Digital currencies could support the ongoing digitalization of economies (ECB, 2021). Worldwide payments and transactions could be executed digitally from anywhere, and better integrated into business and customer journeys.
- **Safe and trustworthy payments with no commercial interest:** Distributed ledger technology has the potential to make payments transparent and safe. In addition, central banks are trustworthy data custodians (Klein, 2021).
- **More hygiene and less space:** Unlike physical currencies, CDBCs definitively do not carry pathogens and require no physical storage space.
- **Balancing private-sector and central-banked digital currencies:** CBDCs avoid the risk of crowding out central bank money (as may occur with private sector cryptocurrencies), and can create a balance between private-sector and central-bank digital currencies.

2 Implementation Choices

The International Monetary Fund breaks down CBDC architecture into two main categories: token based and account based (IMF, 2019). Much like cash, the remittance of token-based CBDCs is a direct transfer of ownership and does not require a bank account – a simple digital wallet is all that is required. Conversely, account-based CBDCs function more like traditional bank accounts: The transfer of CBDC ownership is a change of balance between two accounts. Moreover, participants in this scenario must complete the KYC process. The architecture is arguably less game changing, because it still relies on intermediaries such as (legacy) banking systems.

CBDCs can also be divided into retail and wholesale (IMF, 2019). The former is widely open to the public, while the latter is restricted to financial institutions such as commercial banks and clearing houses. The two systems offer contrasting functionality. Retail CBDCs can play the role of a digital currency, replacing or supplementing the existing cash system. By reducing costs and automating processes, wholesale CBDCs could boost the efficiency of domestic and cross-border inter-bank payments. The Banque de France digital Euro pilot is one example of an experiment in action.

CBDCs can be implemented with traditional centralized server-client architecture or distributed ledger technology. China's e-CNY uses centralized architecture while Sweden's e-Krona is blockchain based.

The Most Likely Implementation of CBDCs in Europe and US

The European Central Bank has proposed both centralized and decentralized implementations for the digital Euro (ECB, 2020). To retain an element of bank intermediation, it seems likely the currency will indeed be built on a combination of centralized ledger and distributed ledger, using a system such as asymmetric cryptography. Both ledgers give the central bank power to supervise transactions.

At the time of writing, the US has not yet announced any technical roadmap regarding its CBDC project. However, it is likely that it will favor a centralized design, as China has done.

3 CBDC Challenges

The risks assessment around CBDCs is a significant challenge, amid uncertainties around data privacy, interoperability, cybersecurity, and offline payments. The ability of developer communities to address these shortcomings will determine if CBDCs see meaningful enterprise and retail adoption.

Data privacy: Cash is usually anonymous and untraceable. Digital payments, however, are fully visible to the processor. In designing CBDCs, regulators must find a balance between meeting regulatory requirements and protecting user privacy (ECB, 2021). Neither fully anonymous nor fully traceable ledgers are likely to be suitable. Like most complex systems, nothing is binary. China's e-CNY proposes the concept of controllable anonymity. Under this mechanism, transactions above a certain threshold are reported to the supervisory system but smaller transactions require less disclosure. Other solutions include isolation of transaction data and user information.

Interoperability: Due to regulatory and security requirements, CBDCs are likely to be designed as closed and centralized systems. This will create barriers to interoperability, including with other CBDC payment platforms and legacy banking and enterprise systems. A feasible solution would be a common communication data format, such as ISO 20022. Cross-border transactions could be conducted through a trusted third party or public blockchains such as Cypherium. The rise of decentralized finance is expanding use cases of integrated public blockchains and CBDCs.

Cybersecurity: As the world becomes increasingly data driven, identity theft and fraud continue to rise. Billions of dollars are stolen via social engineering, malware, and other hacking techniques. Cryptocurrency users normally do not have sophisticated knowledge about fraud prevention. Effective safeguarding mechanisms will therefore be crucial for CBDCs. Central banks must also establish repayment processes in case of theft.

Offline Payment: CBDC systems need to offer the same level of convenience to all, whether or not they have a Wi-Fi connection, so CBDC designs should support offline transactions. The e-CNY supports double offline payments (Boao Forum for Asia, 2020), allowing both sender and receiver to complete payment without being connected to the Internet. Some CBDC designs include specialized devices, such as RFID chips, for offline transactions.

Energy consumption: Some tokens (e.g., Bitcoin) are validated through the proof-of-work principle, in which miners compete to add blocks of transactions to the record and mint new currency. Each miner has a success probability proportional to computational effort expended. This approach relies on expending significant amounts of computational power. Indeed, if Bitcoin were a country, it would rank in the top 30 for energy use. Most newer cryptocurrencies, therefore, use an alternative approach that uses much less energy. So-called proof-of-stake allows transactions to be validated based on the number of coins held. Our working assumption is that most CBDCs will be based on the proof-of-stake principle.

4 Implications for the Financial Sector

The introduction of CBDCs and cryptocurrencies as payment solutions threaten banks on two counts:

(1) **Big techs**, such as Alipay, Amazon, and Facebook can take market share in the payment and transaction banking sector, with or without their own coins. They are well positioned for mass adoption, reflecting strong customer bases, widely-used devices, shops, apps, and technology knowledge.
(2) **Central banks** offer consumers a digital and central bank-backed alternative to cash, building on a direct relationship to consumers via new CBDC wallets. Banks could – in principle – become redundant as intermediaries. The impact will likely be greater in the unbanked world, which is not yet accustomed to cheap transfers of digital money.

The threat from big tech, in which 11% of revenues already stem from financial services, is well understood (BIS, 2021). However, the central bank threat to incumbent banking systems is less widely analyzed. The idea behind CBDCs is simple: to retain financial oversight rather than ceding it to private monopolies (The Economist, 2021). Instead of having a payment account at a bank, customers might only have a wallet at the central bank with app functionality that resembles that of Alipay or PayPal. This may prohibit further growth of new coins and payment solutions outside the monetary control of central banks, but would undermine banks' role as intermediaries and in the conversion of economic assets into investments.

A critical decision for central banks, will be the design of the CBDC (e.g. directly as a wallet of the central bank or via intermediaries). Furthermore, it will be important for central banks to integrate CBDCs into payments ecosystems, for example with merchant or acquiror services. This will foster acceptance of the CBDC as a credible means of payment. Finally, central banks should assess in advance the potential impact of CDBCs on their own operating models. They will need to take on a new role in contracting directly with currency users, rather than through banks, as is currently the case.

For the most part, it is likely banks will continue to act as distributors, maintaining some balance in the system. We have identified four potential models (Exhibit 2), of which a decentralized infrastructure with a hybrid bearer and account-based infrastructure seems to be most realistic, because it is not so far from the current infrastructure.

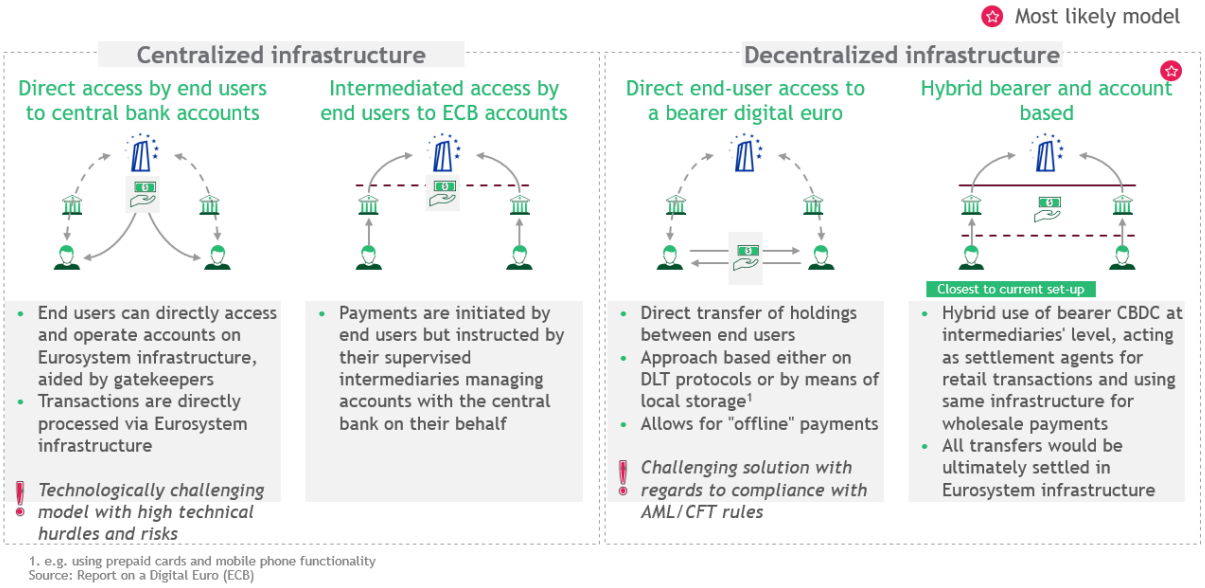


Exhibit 2: Four operating models for the digital Euro

What Financial Institutions Need to do Now

On the current trajectory, CBDCs will be a new payment rail at some point – probably sooner rather than later. Banks need to get ready via the following non-exhaustive steps:

- **Prepare to maintain and exchange cryptocurrencies/CBDCs:** The US OCC (Office of the Comptroller of the Currency, 2020) has empowered national banks to function as custodians for cryptocurrencies, but banks should in any event prepare to offer wallets to their clients. In some countries (e.g., Germany), a crypto custodian license is required.
- **Integrate new crypto front-to-back infrastructure:** Before final network implementation details are published, banks could start to evaluate the required IT, referencing countries that are already in the piloting phase.
- **Update anti-money laundering and chain verification:** New AML and compliance methods will be required to monitor the blockchain and the digital origin of coins. "Know your transaction (KYT)" will become as important as "Know your client (KYC)". Vendor solutions such as Coinfirm and Chainalysis can be easily plugged in.
- **Explore adjacent technologies and developments:** The cryptocurrency space is potentially far larger than payments or as an investment opportunity. Broadly, use cases in banking include tokenization of asset classes (capital market products, real estate), collateral management, decentralized finance, and smart contracts.

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Crypto payments have not yet become mainstream everywhere, and there remain significant uncertainties around how they will be regulated. However, we believe further digitalization on- or

off-chain has the potential to dramatically and speedily reshape the payment services industry. In response, banks and payment service providers must start planning now. They should think about CBDCs in the same way they would approach the introduction of any new payment rail offered by central banks. At a minimum, they must address the many misunderstandings associated with blockchain technology and ensure existing systems are future-proofed for the disruptive changes ahead.

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