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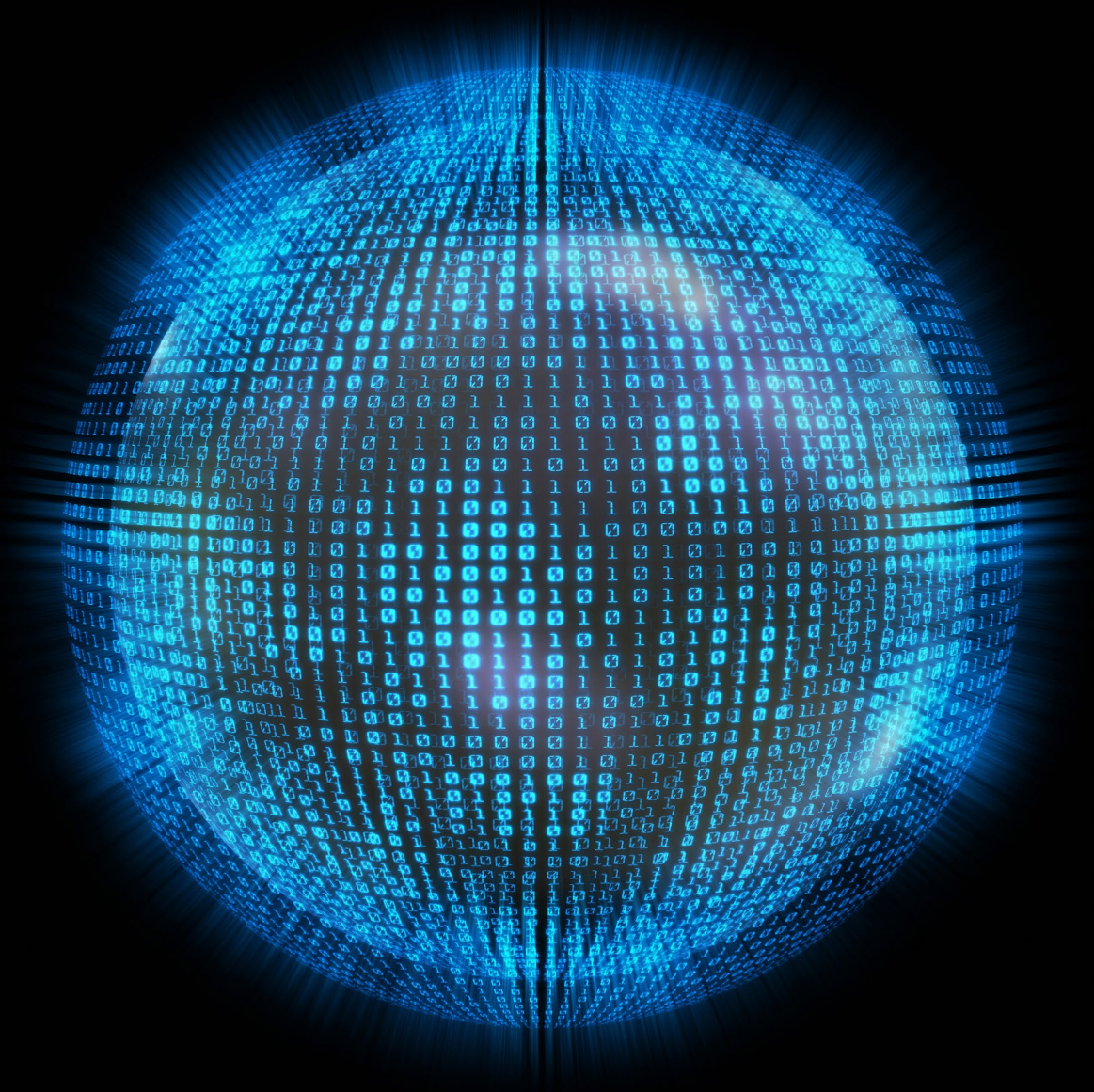
Are Central Bank Digital Currencies (CBDCs) the money of tomorrow?

Content



Executive summary

Central bank digital currencies (CBDCs) have undeniably stepped into the limelight and we believe they are here to stay. While the theoretical concept of CBDCs already emerged several years ago, an increasing number of countries and central banks are now assessing CBDCs in view of putting them into practice.

The surge in scrutiny is due to a combination of developments in the financial ecosystem, including the recent major shifts in the payment industry, the launch of cryptocurrencies and stablecoins, and the declining use of cash. Each country and jurisdiction is affected in varying degrees by these developments and is appearing to use CBDCs in line with its most pressing issues and policy objectives.

For instance, the Swedish Riksbank is focusing on issuing an electronic Krona to provide an alternative state-guaranteed means of payment and to ensure financial stability in case of private market failures. In contrast, the Monetary Authority of Singapore is focusing its efforts on providing faster and cheaper cross-border transactions and foreign currency exchange. These diverging objectives show that CBDCs can be used for different purposes by virtue of their highly versatile and customizable nature.

No wonder central banks now want to seize the opportunities of this digital innovation to power the economy of tomorrow.

This paper aims to not only present the key principles of CBDCs, but also demonstrate potential CBDC models and how they are currently being assessed by central banks. We will also highlight the key challenges inherent to CBDCs and express how we see the future of CBDCs. The paper is structured in the following way:

- Before addressing the concept of CBDCs, it is important to define the purpose of money and the role of the central bank in the current financial ecosystem. Indeed, the central banks' role in regulating the flow of money in the economy and how their interaction with commercial banks is of the utmost importance, similar to how a heart regulates blood pressure. We address this in chapter 1.
- Chapters 2 and 3 aim to not only clarify the concept and role of CBDCs but also shed detailed light on the different CBDC models, including several forms of retail and wholesale CBDCs. In addition, we provide a high-level overview of the current regulatory, monetary and technological implications of each model.
- Chapter 4 is an overview of the various CBDC projects initiated by central banks. We explain the root causes behind these initiatives and the different models chosen by central banks to address them. Despite the diverging approaches, we will explore a trend shared by all central banks.
- In chapter 5, we present the key CBDC challenges ranging from technological to legal and regulatory considerations.
- Chapter 6 concludes with Deloitte's point of view on CBDCs and the future.

We would like to extend our special thanks to Nasir Zubairi, CEO of the LHofT, for sharing his perspective with us and enriching the paper with his valuable insights.

1. In the beginning, there was money

Money is so deeply entrenched in our economic landscape that it is usually seen as the lifeblood of the economy. The nature of money has constantly evolved over the years from bartering, commodity money, coins, paper money and, most recently, to e-money through dematerialization and digitalization. However, defining money remains a conundrum for monetary theorists; as such, it is more helpful to define the key roles that money plays in society.

Money usually serves as:

1. A **store of value**, acting as an asset that sustains value over time
2. A **medium of exchange** to purchase and sell goods and services
3. A **unit of account** used to price a particular good or service as well as to denominate a certain debt

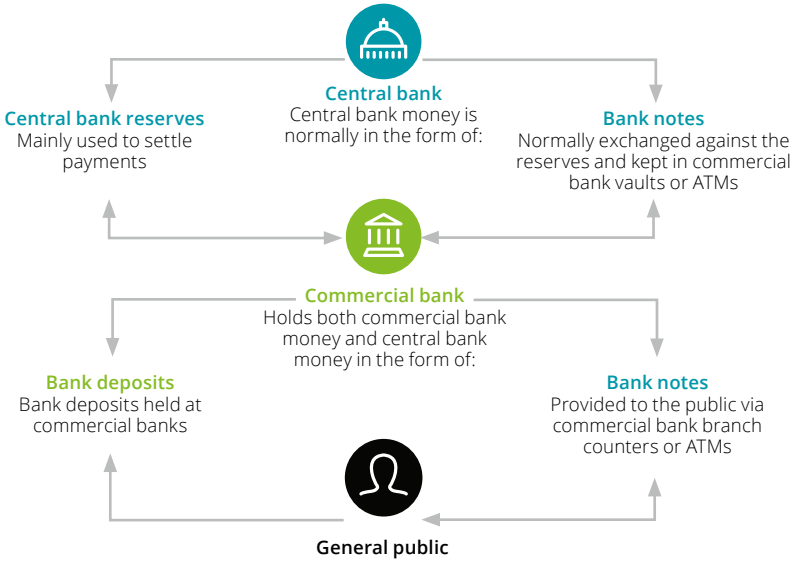
Money is a special kind of "*I owe you*" that is universally trusted. It can take the form of currency printed by a central bank or deposits that people hold in their commercial bank. In addition, for commercial banks themselves, reserves held in a central bank represent another form of money.

Today, most money is in the form of bills, coins and its electronic equivalent, **fiat currency**. There is a slight difference between the types of fiat money, such as central bank money and commercial bank money[1]. A common misconception is that central banks create most money. In fact, in a modern economy, money is created by commercial banks making loans and so-called commercial bank money. Central banks can only indirectly affect the amount of money lent to individuals and businesses.

Due to the latest developments in the retail payment landscape, the declining use of cash in some countries, and the announcement of Facebook's Libra in 2019, many countries were led to consider CBDC issuance. And, due to a shift in payment habits to contactless payments instead of cash during the current COVID-19 crisis, CBDCs could stimulate the supply of new payment services and offer another way to supply money to society. On top of this, CBDCs would complement the current offering of cash and wholesale central bank deposits.

Functions of a central bank

- Monetary stability functions (monetary policy and exchange rate policy)
- Financial stability and regulatory functions
- Provider of financial infrastructures (payment and settlement systems)
- Policy operations functions (FX reserves, FX reserves and liquidity interventions)
- Banker to the government
- Lender of last resort
- Asset and debt management
- Research analysis and statistics



Functions of a commercial bank

- Accepts deposits and lends funds to customers
- Credit creation
- Finances foreign trade
- Overdraft facilities
- Trades/issues financial instruments
- Private banking
- Cash and treasury management
- Processing payments
- Collects and clears checks

Key:
Commercial bank money
Central bank money

1. Commercial bank money is also called M1, M2 and M3 according to the type and size of the account in which the instrument is kept. It also reflects the different degrees of liquidity that each category of money has as it circulates in the economy.

2. The rise of money digitalization

In the current age of ongoing digitalization, the use of cash is slowly declining internationally and the concept of "cryptocurrencies" has emerged globally

As of now, there are two forms of digital money:

- Fiat money held on central bank accounts
- The crypto version of fiat money

The latter form, which is better known as cryptocurrency, is a digital asset or crypto-asset created as a digital medium of exchange where coin ownership records are stored in a robust cryptography to protect transaction records. There are three main subcategories of crypto-assets: exchange tokens, security tokens and utility tokens. In the current digital approach, cryptocurrencies are a means of payment that enables swift and straightforward transactions, wiring funds via bank accounts and cryptomoney without the use of fiat money.

There has been impressive growth in the number and value of cryptocurrencies that are challenging the current central bank's monopoly in money issuance. To date, 6,726 cryptocurrencies have been issued. The capitalization of crypto-assets over the years has skyrocketed from around US$10 billion at the end of 2013 to US$370 billion in August 2020. This trend has been accompanied by price bubbles and the extreme volatility of some cryptocurrencies. Disproportionate misuse, huge unpredictability and the decentralized control of cryptocurrencies have led many regulators worldwide to issue warnings for or even ban some cryptocurrencies. Under these circumstances, many private market actors perceived these currencies as an inadequate means of payment for future transactions.

To tackle this high volatility, new digital currency models called stablecoins have been developed. Stablecoins, which include JP Morgan's JPM Coin, aim to deliver price stability by pegging their value to another asset that is less prone to high fluctuations.

With the development of cryptocurrencies, stablecoins, private initiatives like Facebook/Libra and the clear digitalization of the global payment system, central banks must react and position themselves in this changing landscape. And, as the main authority in charge of money, central banks must also assess and investigate the potential opportunities and risks of emerging digital currencies regarding the financial economy.

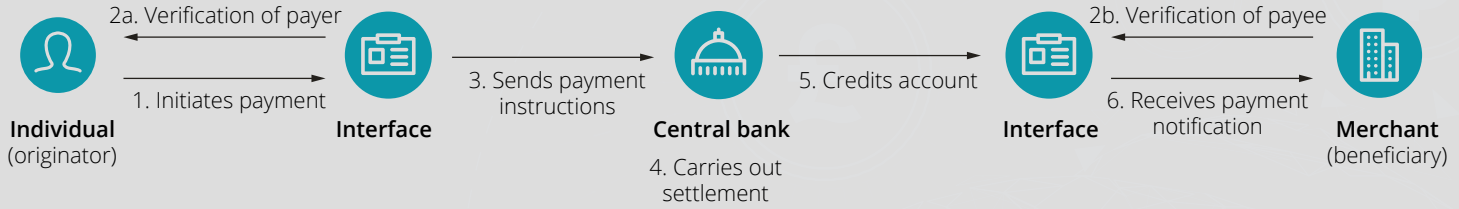
Yet, an exact definition of a CBDC is still lacking. As the Bank for International Settlements (BIS) puts it, "CBDC is not a well-defined term", but it is envisioned by most to be a new form of digital money with a central bank liability, denominated in an existing unit of account, which serves both as a medium of exchange and a store of value.

> "CBDC's promise faster, cheaper, and more efficient payments, both domestically and cross-border. Arguably, CBDCs also offer greater security and lower risk of fraud using blockchain technology"
>
> Nasir Zubairi, CEO, LHoFT

Difference between account-based CBDCs and token-based CBDCs

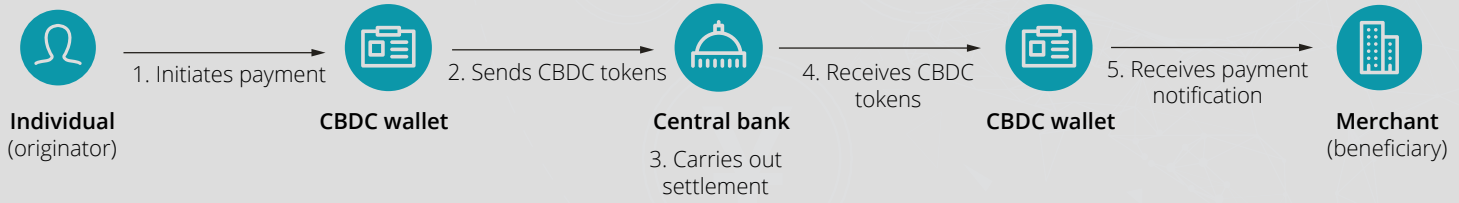
Account-based CBDCs versus...

An account-based CBDC model ensures that a transaction is approved by the originator and beneficiary based on the verification of the users' identities. All transactions can be attributed to their identity-based accounts. In issuing an account-based CBDC, the central bank would need to set up an account for every user and ensure the existence of a digital identity system.



... Token-based CBDCs

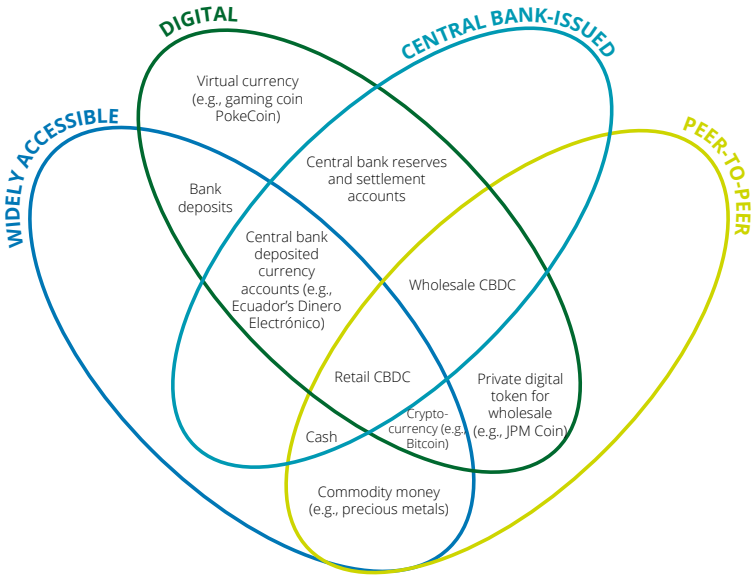
A token-based CBDC ensures that the transaction is approved by the originator and beneficiary based on public-private key pairs and digital signatures. Such a system does not require access to a user's identity, allowing for high levels of privacy but also more difficulties in tracing money laundering and fraudulent transactions. In addition, users need to remember their private key or they could lose access to their funds. As such, a token-based CBDC could be seen as similar to cash.



3. What are the scope and purpose of CBDCs?

A CBDC is an electronic form of money that can be held both by the public and financial institutions depending on the adopted model. At present, two CBDC models are in discussion: a retail CBDC and a wholesale CBDC.

In this section, we focus on how these two different models are reshaping the payment landscape of tomorrow.



3.1 Retail CBDC model

Retail payments typically consist of payments between individuals and businesses. They tend to be low in value but large in volume and are carried out through different payment instruments. While cash is still commonly used, many retail payments are executed via cards and online transfers. Electronic payments have sharply risen recently, increasing by about 101 percent from 2010 to 2018 in the Eurozone.

The structure of electronic retail payment systems around the world is relatively similar, usually consisting of three main processes that are part of a single system: the transaction process, the clearing process and the settlement process.

1. The transaction process ensures the dispatch and delivery of payment instructions from the originator to the relevant parties, depending on the payment instrument. It also verifies and authenticates the originator and beneficiary as well as validating the payment instructions.
2. The clearing process involves matching and processing payment data. However, its most important function is calculating settlement claims and obligations as well as ensuring the proper transmission of payment data to the settlement agent.
3. Finally, the settlement process is responsible for the proper transfer of funds between the relevant parties after all the necessary verifications regarding fund availability are duly completed. Once the settlement process is carried out, a confirmation of debit or credit is transferred to the relevant parties.

Many different parties are involved in the electronic retail payment process. Card payments have acquirers, online payments can have wallet providers, cross-border transactions require currency exchanges, and even central banks often take the role of settling electronic payments. The tangled involvement of these different parties means that the applicable fees are often far from clear.

3. What are the scope and purpose of CBDCs?

Similar inefficiencies have been noted regarding cross-border payments. Instant cross-border/cross-currency payment has still not been fully realized, while the transaction cost of executing these payment types is still considered expensive. The European Central Bank's (ECB) instant payment platform may help untangle these issues from June 2022 onward, but likely for only a subset of countries or currency pairs.

Retail CBDCs could be offered to the public in two different forms through:

- Deposit accounts in a central bank
- Digitally issued tokens

In the case of deposit accounts, individuals and businesses will be able to open accounts at their central bank and benefit from the same services provided by commercial banks. Through these accounts, they could typically initiate and receive payments as well as view their account balance.

In comparison, digitally-issued CBDC tokens would represent an electronic alternative to banknotes and coins. These tokens would only be issued by a central bank for distribution by commercial banks.

A key difference between both types is the verification needed upon usage. While CBDC tokens would need their authenticity checked, as well as whether they have not already been spent, CBDC deposit accounts would require verification at the account-holder level. As such, "know-your-customer" (KYC) procedures would need to be performed.

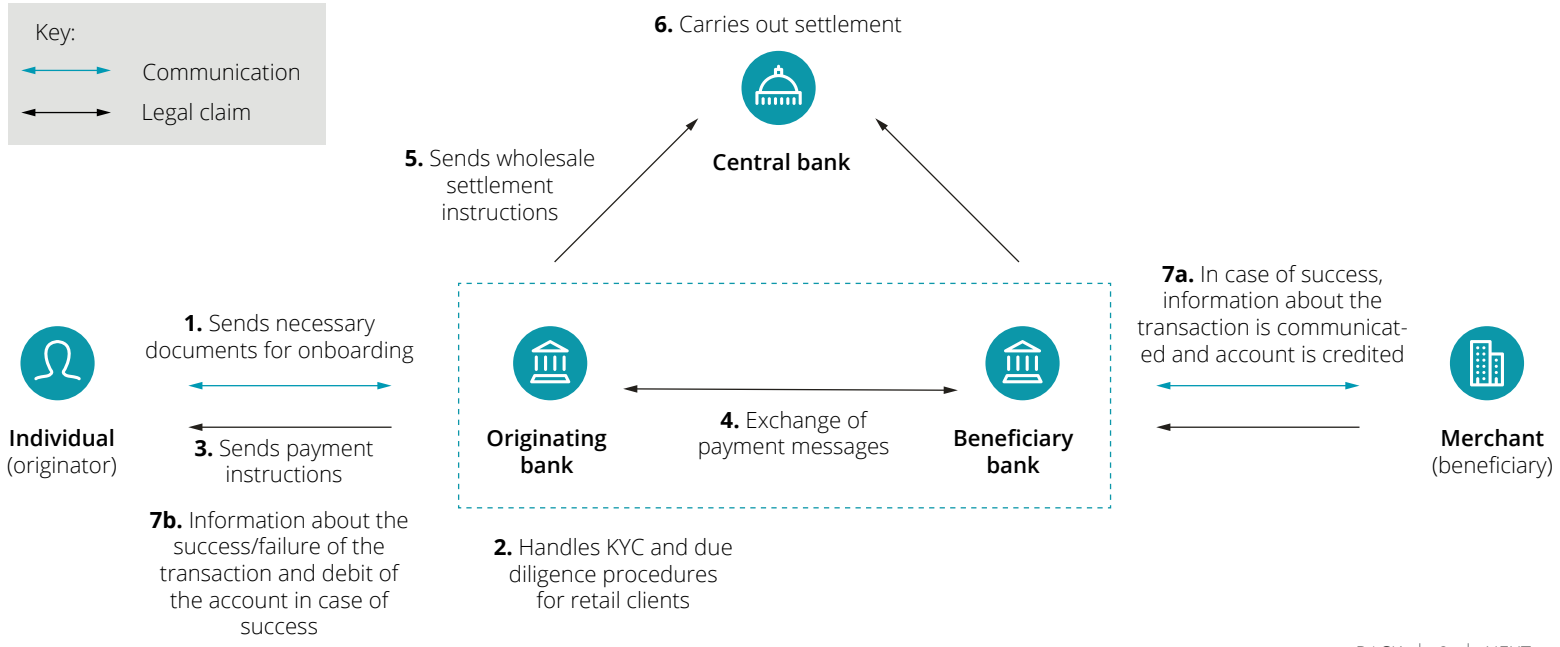
Here are a few potential scenarios of retail CBDCs. In each scenario, the CBDC is issued by the central bank only but differs in terms of who is ultimately liable.

In the first scenario, the issuing is done indirectly through financial intermediaries who are responsible for backing the money issued to individuals and businesses. In the other two scenarios, the financial intermediaries have a direct claim on the central bank.

Scenario 1 shares many parallels with the current retail payment process, as the set-up also includes an intermediary layer of financial institutions. These institutions are in charge of onboarding and communicating with individuals and businesses, sending payment messages to other financial institutions, and ultimately transmitting payment instructions to the central bank for settlement.

The key difference is that the intermediaries must back each outstanding CBDC issuance via CBDC deposits at the central bank. Here, a crucial consideration is that the central bank will not hold any records of the ultimate CBDC holders. Therefore, if there are any disputes, the central bank will need to rely on the intermediaries to provide the required information, putting a strain on both the central and intermediary banks.

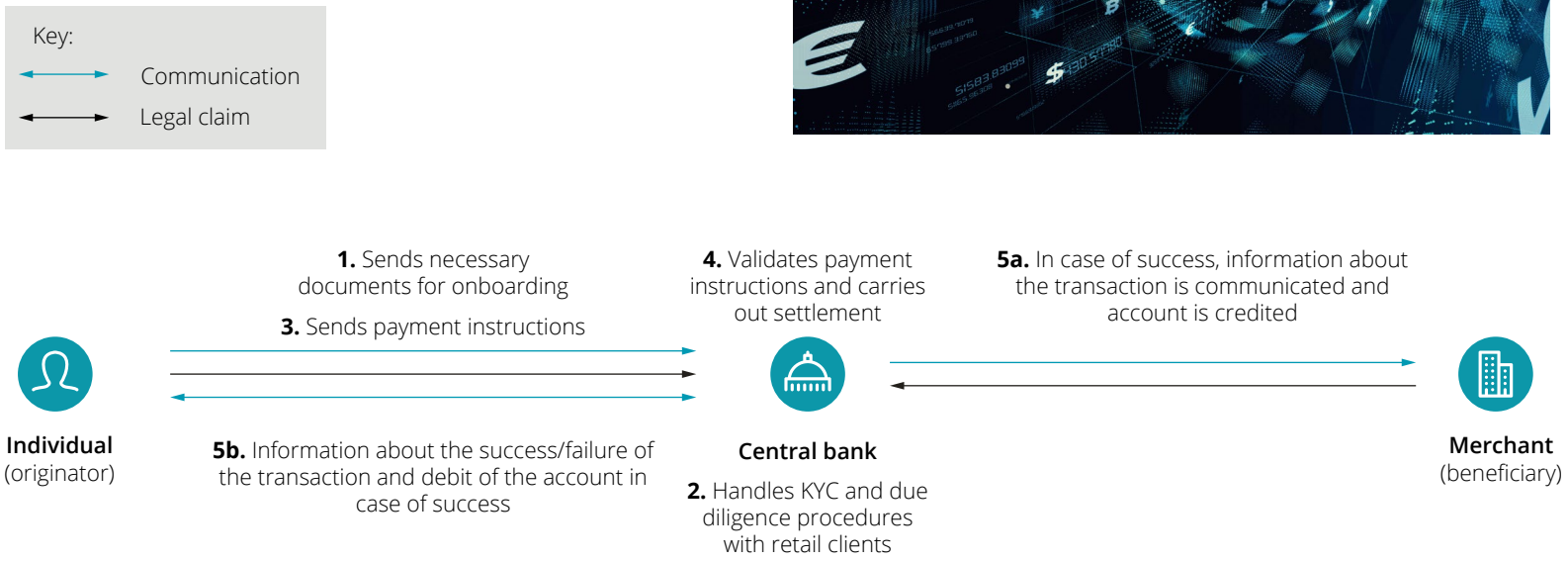
Scenario 1: Indirect retail CBDC



3. What are the scope and purpose of CBDCs?

Scenario 2 involves individuals and businesses holding CBDCs through private accounts at a central bank. Intermediaries are no longer necessary, as the central bank takes over the role of onboarding and handling all payment services. This scenario is likely to materially affect the structure of the current financial system and substantially increase the roles and responsibilities of central banks. However, we understand from the different studies and proofs of concept of central banks that this scenario is not their preferred option, so the CBDC model of the future will most likely involve intermediaries between central banks and users.

Scenario 2: Direct retail CBDC



Two ways that CBDCs could be useful during a pandemic

1. The real-time settlement functionality of a CBDC could have been a better digital payment alternative to quickly distribute "helicopter money" around the world. This is mainly because the COVID-19 pandemic revealed some major weaknesses in the current retail payment system. One recent example is the case where almost US$1.4 billion of the US Treasury's pandemic rescue funds were paid to more than a million deceased individuals in form of stimulus checks. Furthermore, a significant portion of vulnerable unbanked households could not cash in their stimulus funds for months. Due to these inefficiencies, the House Financial Services Committee (FSC) Task Force on Financial Technology in the US is now contemplating digital tools that would help the government distribute stimulus payments to Americans suffering from these types of economic crises.
2. In parallel, more and more questions are being raised about the risk of contracting diseases through handling cash, PIN pads or ATMs to perform payments and withdrawals. The risk is especially relevant to unbanked and older populations who are more reliant on these payment instruments. One way to counter this risk is to foster contactless payments through an accessible, fast and resilient CBDC that is based on contact-free technical interfaces. Compared to current contactless payment cards, the CBDC could also benefit from legal tender status; just like cash, the central bank would back the CBDC.

3. What are the scope and purpose of CBDCs?

Scenario 3 is a blended version of the previous two scenarios. While there is an intermediary layer of financial institutions, individuals and businesses still have a direct claim of a CBDC at the central bank. A key implication of this scenario is that intermediaries could keep the CBDC segregated from their balance sheet and that individuals and businesses could benefit from increased portability. For example, if a client's financial institution becomes insolvent, financial institutions acting as intermediaries can rely on the central bank to honor the claim and potentially transfer their funds to another financial institution.

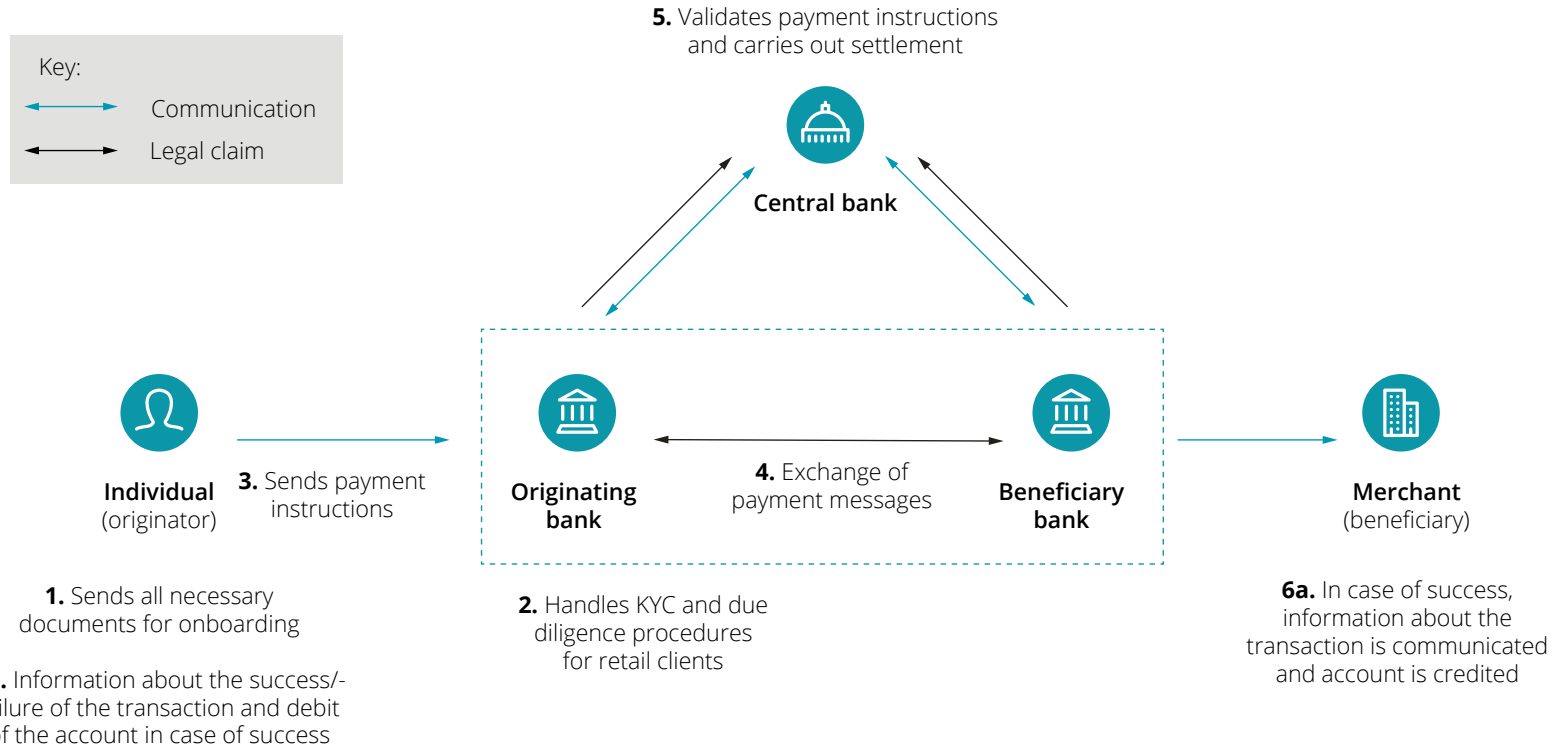
These three scenarios aim to increase the effectiveness of monetary policy tools. While money creation by commercial banks is currently limited and controlled by the central bank through regulation, a retail CBDC can allow central banks to distribute and control the digital money supply.

A retail CBDC could also drive the adoption of cashless transactions. If a CBDC qualifies as legal tender, it would provide a credible and trustworthy alternative to current cash transactions.

Faster settlement is also a key advantage of a CBDC-based payment system. Its direct links to central banks and the reduction of both domestic and cross-border intermediaries could significantly improve the efficiency of retail payments. Ideally, these time and cost savings would then be passed onto individuals and businesses, who would benefit from lower transaction costs as a result.

To achieve these objectives, the new central bank payment platform and CBDCs will need to integrate state-of-the-art cybersecurity tools as well as monitor customer due diligence, potential money laundering operations, and fraud.

Scenario 3: Hybrid retail CBDC



3. What are the scope and purpose of CBDCs?

3.2 Wholesale CBDC model

A wholesale CBDC model would enable the payment and settlement of transactions between financial institutions. This would not be a novelty as banks already have direct access to electronic central bank money. However, this model could improve the efficiency and risk management of the settlement process, potentially intensifying those benefits by extending the availability of a wholesale CBDC to financial market participants currently not allowed to hold accounts at a central bank.
Taking it a step further, a wholesale CBDC does not only apply to pure money transfers but could also be used in asset transfers involving securities. If two parties are trading an asset, such as a security for cash, a wholesale CBDC could allow the payment and delivery of the asset to occur instantaneously.

The implementation of a wholesale CBDC could also be considered for cross-border transactions. While nowadays a cross-border transaction involves several intermediaries, a high level of complexity and significant cost, a wholesale CBDC could simplify the process and add a degree of automation.

The following CBDC wholesale models are currently being assessed by central banks:

Wholesale CBDCs for domestic payments

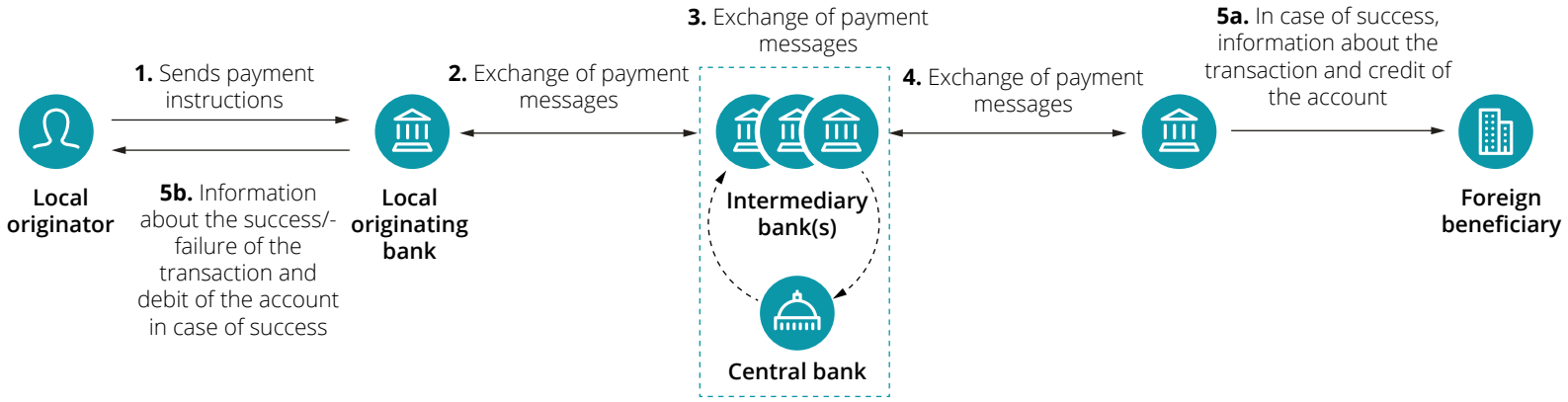
Today's wholesale transactions are characterized by large value, institutional counterparties and short settlement timeframes. Due to their systemic importance, they are generally routed through central banks, which operate so-called real-time gross settlement (RTGS) systems that execute these payments. In Europe, large-value payments are served by two systems: TARGET2, which is owned and operated by the Eurosystem, and EURO1, which is operated privately under strict supervision by the ECB. We will focus on TARGET2 for illustrative purposes.

In TARGET2, a typical domestic payment is executed in the following way. Once the originating bank issues instructions to pay the beneficiary bank, the system reconciles, confirms, and ultimately completes the transaction through a transfer of funds between the banks' accounts at the ECB. As such, the payment is executed in real-time and with immediate finality.

A domestic wholesale CBDC would typically operate in a similar way. In the European example, using a wholesale CBDC may not deliver enough advantages to counterbalance the required investment to build a new CBDC-based system. Due to the near-real-time execution of large-value payments through TARGET2, using a CBDC-based alternative would not offer a material increase in efficiency and effectiveness. Instead, the use case is more relevant for regions struggling to provide quick, reliable and secure high-value domestic payments.

Wholesale CBDCs for cross-border payments

While there is a perception that most central banks are currently focusing on implementing a domestic CBDC, the case for implementing a CBDC-based cross-border model may be more convincing. Currently, cross-border transactions involve several intermediaries and jurisdictions in a single payment.



3. What are the scope and purpose of CBDCs?

This current process means that payments are routed through different countries with different regulations, following different operational standards and with their own technical infrastructures. Both commercial and central banks struggle with this complexity in different ways.

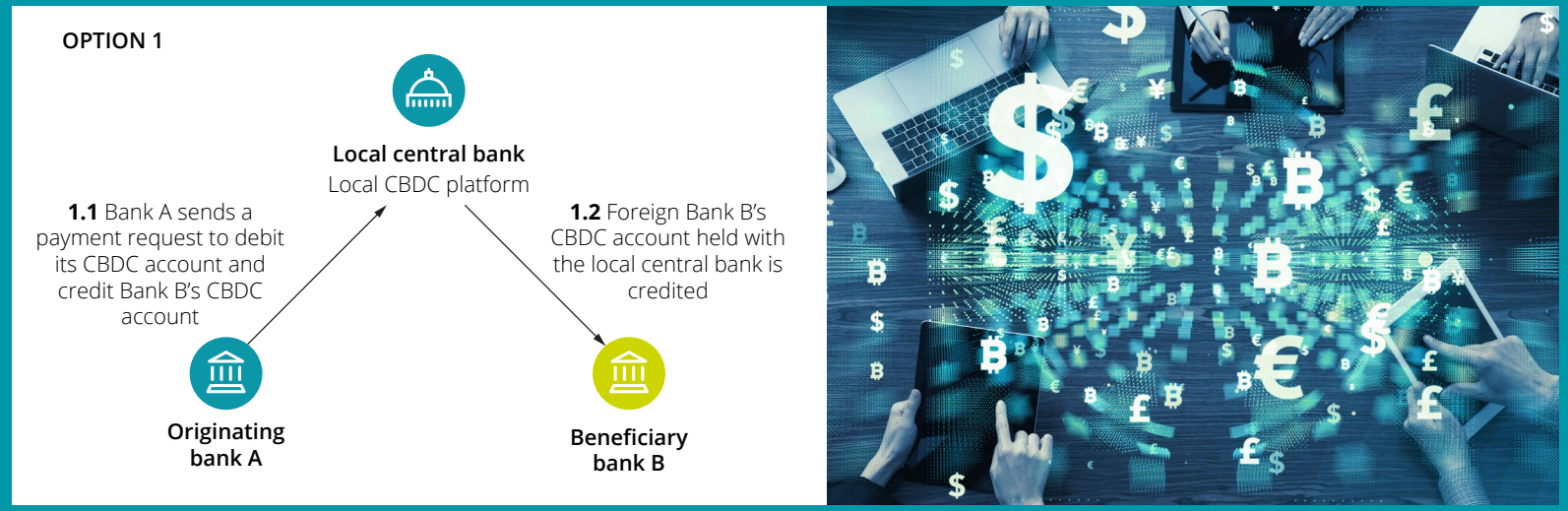
- **Commercial banks** are particularly affected by different cut-off times between jurisdictions. A limited service-time overlap can tie up a bank's liquidity while still requiring the bank to ensure sufficient liquidity to meet its obligations within the service time. This leads to the ineffective deployment of bank liquidity and its associated costs. Another significant issue is the lack of standardization of operating models and technical systems, which leads to a host of manual interventions during payment processing (e.g., sanction screenings and reconciliations) as well as payment tracking. Legacy systems do not help either, as they impede innovation and improvement of the payment infrastructure while making it vulnerable to cyberthreats and larger system failures.
- **For central banks**, these cross-border complexities can ultimately result in systemic impacts that threaten the stability of the financial sector and the efficiency of economic activity. When a bank's liquidity is tied up, it cannot be deployed efficiently, causing an economic slowdown. Regarding its day-to-day operations, this means that central banks must minimize settlement risk between banks to prevent it from accumulating in the payment system.

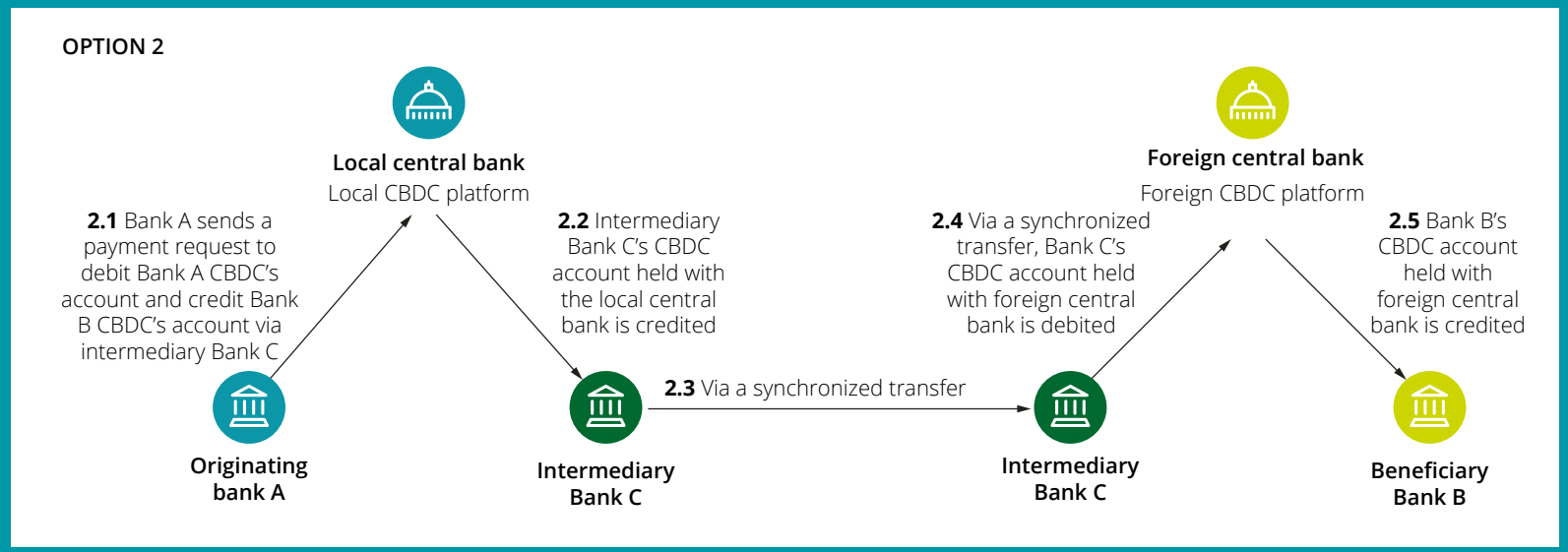
Scenario 1 (local CBDC)—Options 1 and 2

CBDCs can provide solutions to counter the challenges of cross-border transactions. There are typically three different scenarios involving CBDCs:

Scenario 1: Local wholesale CBDC
Scenario 1 involves a currency-specific CBDC that is only transferable within the local jurisdiction and not across borders. Each central bank provides an account denominated in its own CBDC to commercial banks that intend to operate in this jurisdiction and currency.
In practice, this means that central banks could issue their CBDC to commercial and intermediary banks in their jurisdiction. The process would look like a tokenized version of the current correspondent-banking model but without its opacity and complexity.

Originating Bank A transfers a CBDC amount from its local central bank's CBDC account to beneficiary Bank B's central bank account in the same jurisdiction. If Bank B does not have a CBDC account in Bank A's jurisdiction, it can use intermediary Bank C. As such, Bank A would transfer the CBDC locally to Bank C's central bank account, while simultaneously Bank C's central bank account in the foreign jurisdiction would make a foreign CBDC-denominated transfer to Bank B's account in the same jurisdiction.



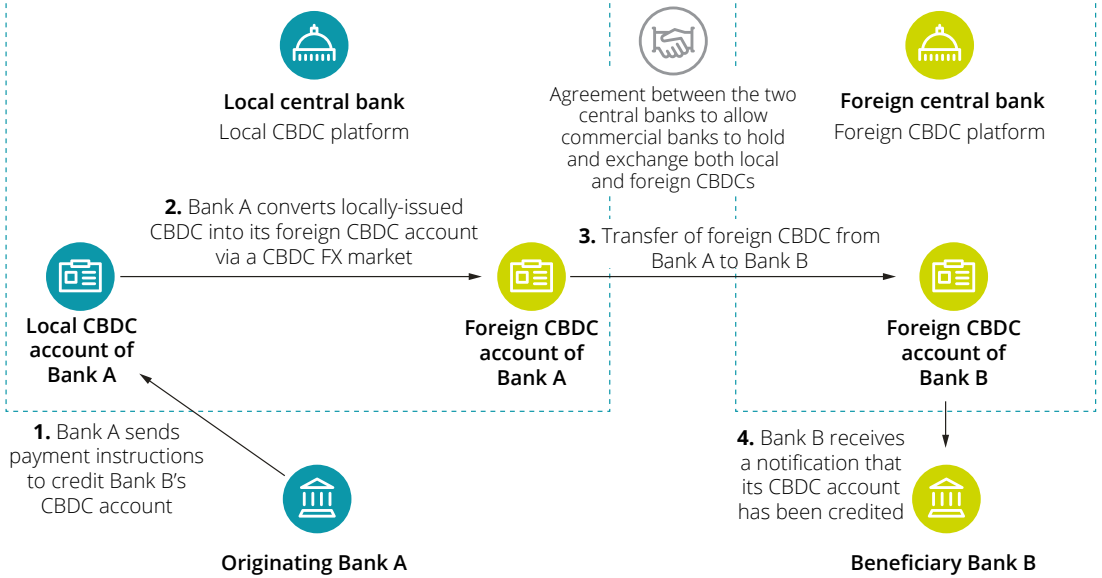


Scenario 2 (local transferable CBDC)—Options 1 and 2

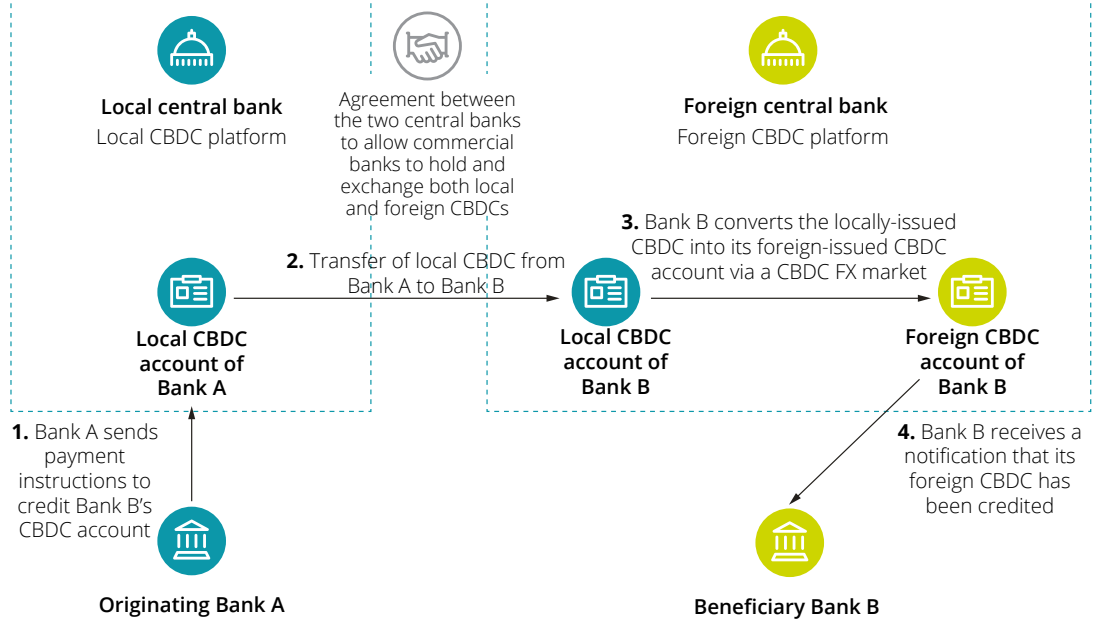
Scenario 2: Local transferable wholesale CBDC
While scenario 2 consists of the same currency-specific CBDC as in scenario 1, the difference is the ability to use a local CBDC across borders in other jurisdictions. In this case, collaborating central banks can offer participating banks a CBDC account denominated in their respective currencies, meaning they could hold both local and foreign CBDC-enabled accounts. Therefore, participating banks can initiate and receive payments of local and foreign CBDCs through their local central bank.

The payment process is the following. Originating Bank A converts an amount of local CBDC into foreign CBDC at its local central bank. The foreign CBDC is then transferred to beneficiary Bank B's account at its central bank. Bank A can also send its local CBDC to Bank B's account denominated in that same CBDC. Bank B then converts the local CBDC into its foreign CBDC.

OPTION 1



OPTION 2



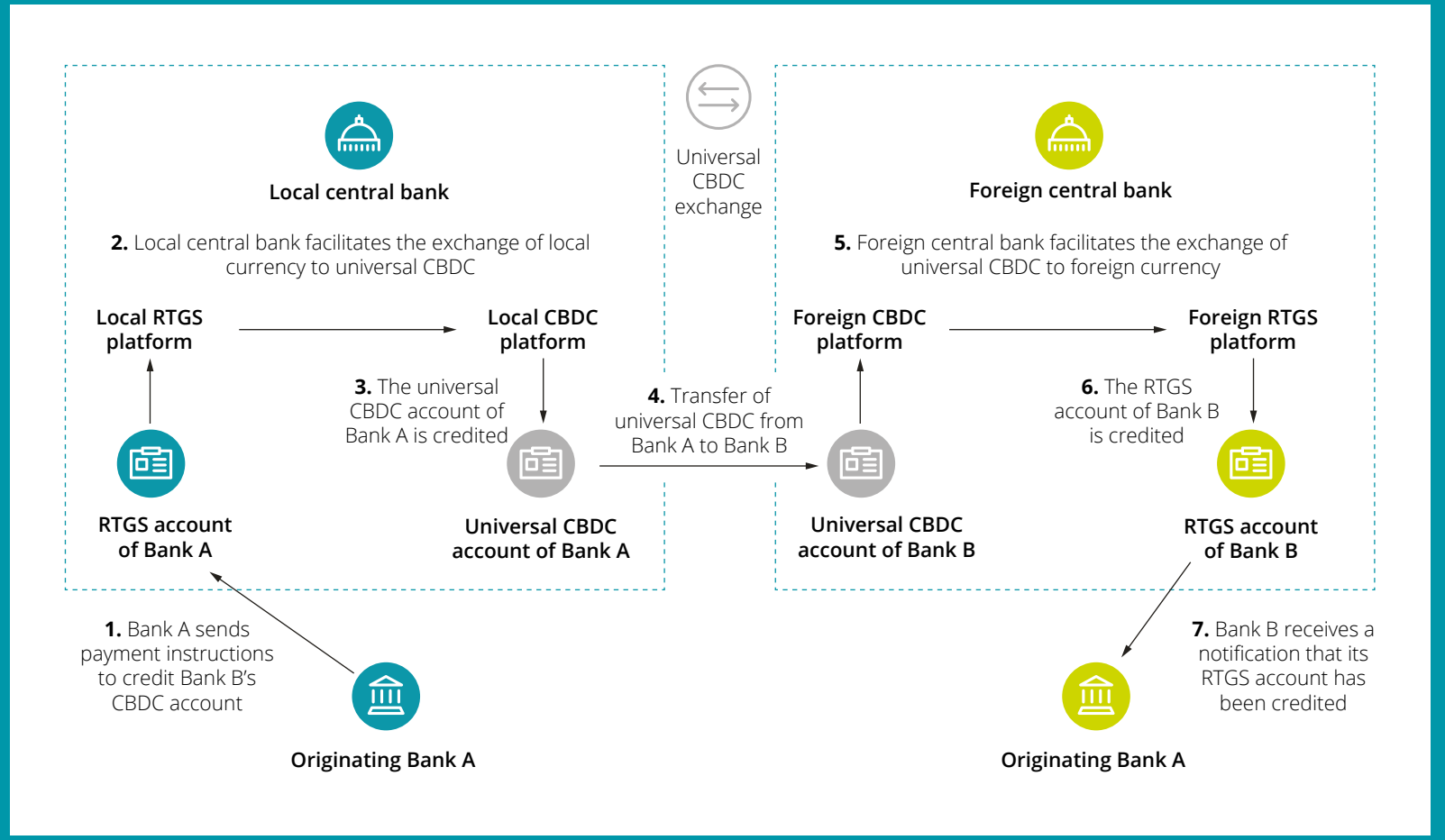
Scenario 3 (universal CBDC)

Scenario 3: Universal wholesale CBDC
Scenario 3 involves a collective CBDC accepted by several jurisdictions and backed by a basket of currencies. This is similar to the stablecoin concept mentioned earlier in this paper, allowing commercial banks to transact using a single CBDC across borders, jurisdictions and central banks while retaining control of their local RTGS systems (e.g., TARGET2 in Europe).

In theory, this process involves the originating Bank A initiating a payment in its local currency through the local central bank. The central bank then facilitates the exchange into a universal CBDC at the given exchange rate. Bank A then finalizes the transaction to beneficiary Bank B by transferring the amount in the universal CBDC. Bank B then exchanges the CBDC against its currency at its own central bank.
All three scenarios offer significant benefits:

- Real-time dimension: cross-border wholesale payments would no longer take several days to process. The 24/7 availability of a CBDC-based infrastructure could eliminate cut-off times and differences between jurisdictions.
- Settlement finality: this would significantly reduce liquidity and settlement risk, as the funds are no longer tied up in the banking network, and provides confidence to transaction participants that the payment will be reliably executed.
- Payment tracking: payments can be tracked along the lifecycle, providing an additional level of efficiency and allowing decision-making based on accurate and instantly tracked information. A CBDC-based infrastructure also implies standardized operating models and payment systems.

Both commercial and central banks would also benefit from fewer manual interventions and enhanced security and resilience. Ultimately, these efficiency gains could result in considerable cost and time savings for central banks, commercial banks, and end-users.



3. What are the scope and purpose of CBDCs?

Wholesale CBDCs for security transactions

The digitalization and tokenization of the security value chain is an ongoing project of most of the main financial market infrastructures. This digital transformation affects each step of the value chain, starting from the primary markets (issuance, register, and notary functions), trade, post-trade (clearing/settlement) and custody services[2].

A central securities depository (CSD) provides securities accounts, central safekeeping services and asset services (which may include the administration of corporate actions and redemptions) and plays an important role in helping to ensure the integrity of securities issues. In many instances, a CSD also serves as a securities settlement system (SSS) that enables securities ownership to be transferred and settled by book entry.

The sale of securities involves two transfers (legs):

- One leg transfers ownership of the securities from the seller to the buyer: the delivery leg
- The other leg transfers the corresponding cash from the buyer to the seller: the payment leg

When settling securities trades, several risks are involved between the trade date (T) and the settlement on the trade date plus two days (T+2):

- The risk of defaulting a counterparty
- The risk that one counterparty will lose the full value of a transaction, for example, the risk that a seller of securities will irrevocably deliver them but not receive payment
- The risk of a counterparty not being able to deliver the security by T+2

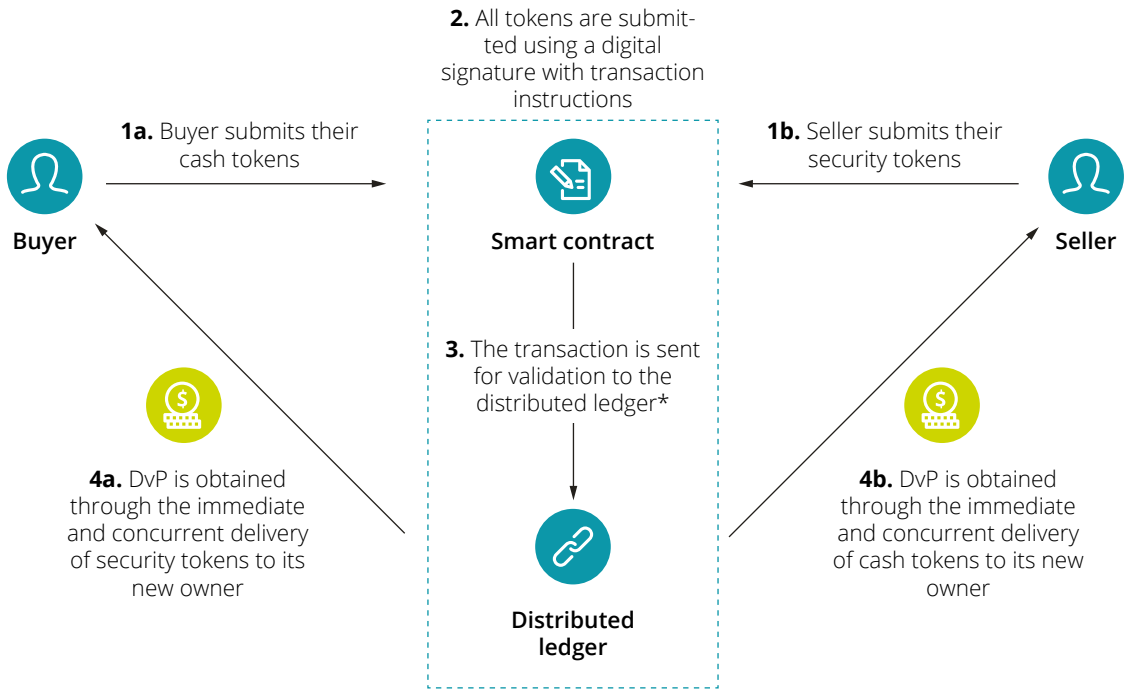
2. We have detailed the security token's transformation of securities in our document "Are token assets the securities of tomorrow?" and, more particularly, its impact in terms of securities settlement.

The CSD Regulation and the settlement discipline regime aim to address these risks and reduce the number of settlement failures.

One way to mitigate these is by reducing the settlement lifecycle and linking the delivery and payment legs so that the securities move only if the corresponding cash transfer occurs. This is known as delivery versus payment (DvP).

A security transaction that is settled via security tokens and related DvPs organized in CBDCs could help reduce counterparty credit and liquidity risks in the financial system. It could also help central banks monitor financial activity.

The Banque de France (BdF) and Societe Generale have successfully settled securities using a prototype wholesale CBDC using BdF's "digital euro" prototype.



*If this transaction is not approved, all tokens continue to remain with their initial owner

3. What are the scope and purpose of CBDCs?

3.3 What are the consequences of these new models?

These CBDC scenarios and their envisaged development would affect both central and commercial banks' business models and, ultimately, the banking ecosystem.

From the point of view of central banks, wholesale CBDCs could help them achieve their objective of maintaining financial stability by being a better transmission channel to money and lending markets, helping preserve the monetary sovereignty of central banks. Along the same lines, the idea of introducing interest-bearing CBDCs would also allow monetary policy to break below the effective lower bound (ELB). If widely used, this innovation could be an interesting monetary policy tool for central banks, especially when individuals prefer to hold cash due to prevailing negative interest rates.

CBDCs could also shrink the balance sheet of commercial banks due to the conversion of bank deposits into CBDCs. The degree of disintermediation of the banking system due to CBDCs being largely adopted instead of bank deposits will undoubtedly affect commercial bank lending, the supply of liquid assets and, consequently, market rates. At the same time, it is equally important to delineate the importance of efficiency and stability. Some central banks have already expressed their concerns regarding retail CBDC implementation and how it could have a destabilizing effect on the financial system. These apprehensions could be linked to a potential change in the composition and cost of bank funding.

At this point, we do not have a clear-cut view of what a successful future CBDC model may be. Regarding a future CBDC platform, there are both common outcomes and important differences between the various scenarios of central banks:

- The envisaged technology and IT infrastructures supporting CBDCs are either based fully on distributed ledger technology (DLT) or consisting of a balance between new DLT solutions and legacy database platforms
- Platform access is a critical question that central banks are investigating. How can platform users remain anonymous without increasing the risk of money laundering? One option is that users could use the platform anonymously with counterparts in daily transactions, but that "operators" between users and the central bank must submit transaction data to the central bank in a timely manner and perform the necessary AML/KYC duties
- This would require the foreseen platform to have a layered structure that separates the central bank, the commercial banks/fintechs, and the end-users. Commercial banks and fintechs will provide all necessary customer-facing payment services and others such as KYC, fraud management, and anti-money laundering checks. At the top layer, the central bank will provide a minimum level of functionality (payment finality) for CBDC payments
- Regarding interconnectivity, at this stage the focus seems to be mainly on domestic market solutions; however, some initiatives driven by BIS are addressing the cross-border dimension of CBDCs. The latter approach is essential for the future of CBDCs, as it will ensure that money can seamlessly cross country borders

It is crucial to ensure that the introduction of CBDCs does not affect the stability of the overall financial system in any way. Central banks must carefully assess the potential impact of CBDCs on disintermediation and how CBDCs would perform in periods of financial uncertainty.

A primer on security tokenization

Security tokens are a digital representation of existing securities such as equities, funds and debt instruments. They encapsulate a right of ownership and entitlement to a share of future profits or cash flow. A unique feature of security tokens is the possibility to enable fractional ownership. In addition, security tokens can include smart contracts where the terms, conditions and rights are embedded into the security itself and can be automatically executed if certain conditions are fulfilled. At the regulatory level, security tokens may qualify as transferable securities or financial instruments under the EU's Markets in Financial Instruments Directive (MiFID II).

4. Where do we stand on CBDC deployment so far?

A huge volume of literature, studies and proofs of concept have emerged around CBDCs. Currently, more than 60 central banks are striving to understand and assess how CBDCs could affect the role of traditional forms of money through proofs of concept. And, 36 central banks are exploring both retail and wholesale CBDCs, while 18 banks are focusing solely on retail CBDCs.

The main motivations driving the retail use case are to improve payment safety, increase domestic payment efficiency and ensure financial stability and inclusion.

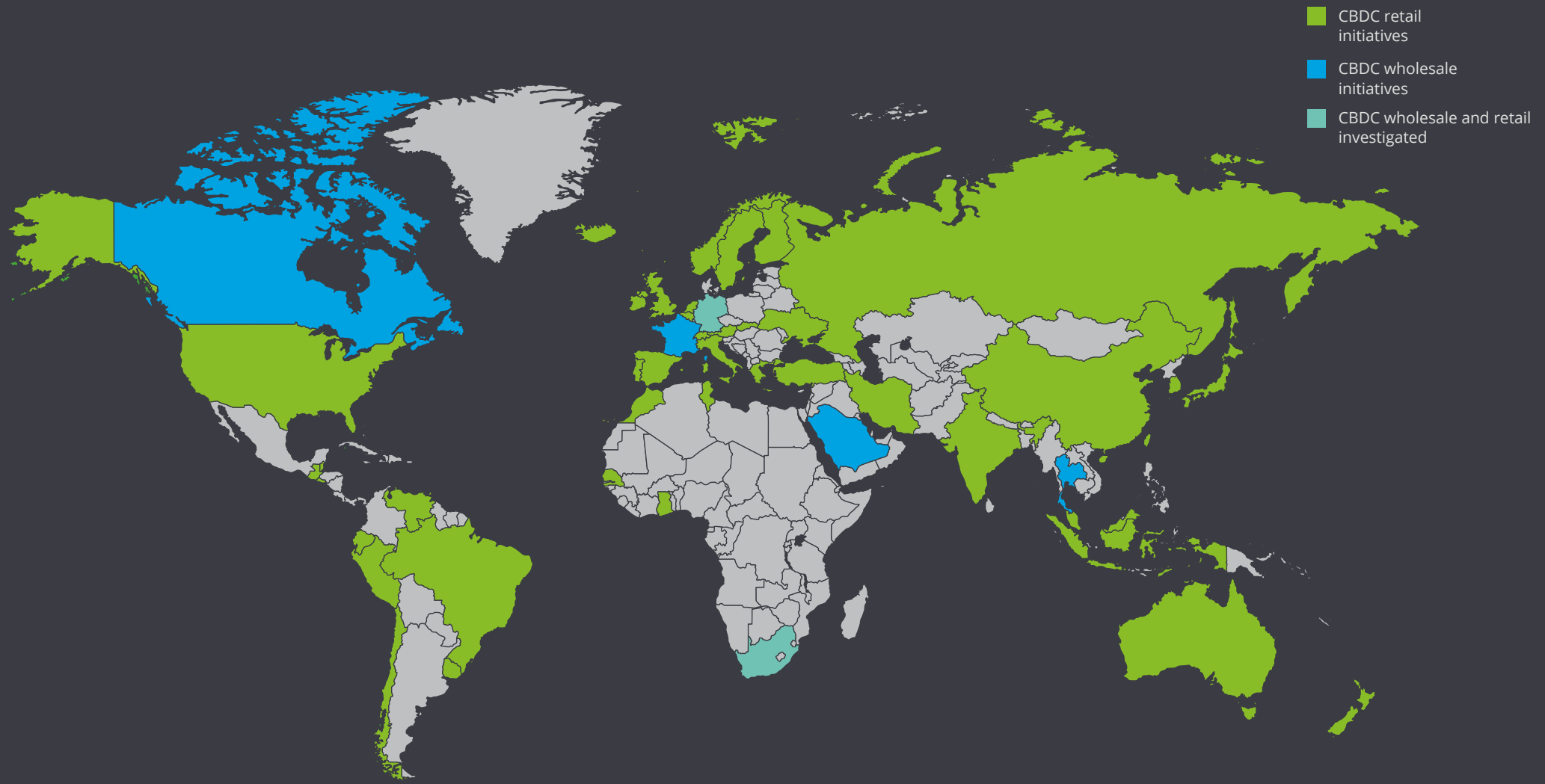
In Sweden, the Riksbank is currently exploring the concept of E-Krona. As the use of cash is in sharp decline, this concept aims to provide an alternative state-guaranteed means of payment. Also, the Riksbank is concerned with the payment systems' reliance on private actors, which would leave little room for the Riksbank to ensure financial stability in case of private market failures.

On the wholesale side, the Monetary Authority of Singapore's "Project Ubin", which focuses on wholesale CBDCs, has been ongoing since 2016. The project explores use cases around faster and cheaper cross-border transactions including foreign currency exchange, amongst others. The central bank recently announced the successful completion of a multi-currency payment network prototype in collaboration with 40 other financial and nonfinancial institutions.

China has emerged as a leader in CBDC development and may be the most advanced compared to other countries. In fact, introducing a CBDC in China would differ from other countries due to the duopoly of WeChat Pay and Alipay in terms of digital payment services. It should also be pointed out that the proposed "hybrid" CBDC model is intended to complement cash for online transactions. The possible issue of disintermediation would not arise as the Chinese central bank would only be responsible for providing the necessary infrastructures, while the public would need to liaise with commercial banks and payment service providers to use CBDCs.

Additionally, an increase in CBDC research activities has been noted in the US. In a recent speech, the Governor of the Federal Reserve Bank (FED) of San Francisco shed more light on the recent development. Intending to gain an in-depth understanding of the impact of CBDC issuance, the FED is collaborating with the Massachusetts Institute of Technology (MIT) to build and test a CBDC. The FED is also studying the implications of digital currencies on the payments ecosystem, monetary policy, financial stability, banking and finance, and consumer protection.

This map provides an overview of projects initiated by central banks.



This table highlights selected projects initiated by central banks (1/2)

Entity	Project description	CBDC type	Status	Date
Banque de France	The Banque de France is experimenting with CBDC interbank settlements and has announced candidates for its pilot project: Accenture, Euroclear, HSBC, Iznes, LiquidShare, ProsperUS, SEBA Bank and Société Générale. The bank will begin collaborating with these eight candidates to carry out the pilot projects over the coming months.	Wholesale	Pilot	2020 – present
Accenture and the Digital Dollar Foundation	This partnership between Accenture and the Digital Dollar Foundation aims to identify practical opportunities to test and evaluate key features of a US CBDC with its "digital dollar project". Nine distinct pilot programs have been designed.	Wholesale and retail	Multiple pilots	2020 – present
Central Bank of Sweden	The Central Bank of Sweden is aiming to test e-wallets, DLT and interoperability with commercial banks. The underlying technology is built on R3's Corda system and the central bank has enabled commercial banks to plug into it through application programming interfaces (APIs). A 24/7/365 e-wallet is also being designed to work with smart watches, apps, and credit cards.	Retail	Pilot	2020 – present
People's Bank of China	The People's Bank of China launched a project called Digital Currency Electronic Payment (DCEP) aiming to increase the efficiency of its payments system, replace cash, and make peer-to-peer transactions more secure. The system has already been piloted in several cities, and commercial banks have already run internal tests like cash-digital money conversion, account-balance checks, and payments.	Retail	Pilot	2014 – present
Monetary Authority of Singapore	The Monetary Authority of Singapore launched project Ubin, working together with the industry to explore the use of DLT for the clearing and settlement of payments and securities. To date, it has collaborated with over 40 financial and nonfinancial firms to explore any potential benefits. The multi-phase project focuses on tokenizing the local currency, reimagining real-time gross settlement (RTGS), exploring DvP and facilitating cross-border payments, and is currently in its last phase to enable a broad ecosystem collaboration.	Wholesale	Development	2016 – present
South African Reserve Bank	The South African Reserve Bank initiated project Khokha together with a consortium of South African settlement banks and nonfinancial institutions. The goal of the project is to build a proof-of-concept wholesale payment system for interbank settlement using a tokenized South African Rand on DLT.	Wholesale	Development	2018 – present
Bank of Canada	The Bank of Canada's project Jasper explored the capabilities for launching a retail CBDC as well as the benefits and risks of new technologies for wholesale payments. Contingency work on retail CBDCs is being conducted in case cash use suddenly declines.	4.0	38.4	41,467

This table highlights selected projects initiated by central banks (2/2)

Entity	Project description	CBDC type	Status	Date
Central Bank of the Federal Republic of Germany	The German Bundesbank evaluated CBDCs' potential benefits and downsides as well as their risks and opportunities. The German Finance Minister, Olaf Scholz, expressed support for introducing a European e-Euro and stressed the importance of achieving social consensus on how programmable digital money could be integrated into the existing financial system. Additionally, the European Central Bank's Governing Council decided to advance work on the possible issuance of a digital euro.	Wholesale	Research	2019
Consortium assessing potential cases for central bank digital currencies	The Bank of Canada, the Bank of England, the Bank of Japan, the ECB, the Sveriges Riksbank and the Swiss National Bank, together with BIS, have created a group to share their experiences in assessing the potential cases for CBDCs in their home jurisdictions. The group will assess CBDC use cases and economic, functional and technical design choices, including cross-border interoperability, and also share knowledge on emerging technologies. It will closely coordinate with relevant institutions and forums, in particular, the Financial Stability Board and the Committee on Payments and Market Infrastructure (CPMI).	Wholesale	Research	2016 – present

We can conclude that there are currently two key trends in the CBDC models being developed by central banks. Emerging countries are leaning towards the retail CBDC model due to a larger informal economy, while developed countries seem to be moving more towards the wholesale CBDC model.

While a wholesale CBDC, restricted to a limited group of financial counterparties, would largely provide efficiency gains with potential disintermediation, a retail CBDC, accessible to all, would be a game-changer and would require a solid legal basis. CBDCs should have the same legal tender status as banknotes and coins, with this status implying that a CBDC could be usable at any location and under any condition, possibly even offline.

5. CBDCs: Key challenges and regulatory implications

While it is widely recognized that retail and/or wholesale CBDCs will bring efficiency and benefits to the economy, CBDCs are still a new concept posing many open questions and risks. There are regulatory and legal considerations that need to be addressed before moving forward with the development of digital currencies.

We have summarized the different risks as follows.

Data privacy: private data could potentially be exposed to those holding the digital money, especially in the case of retail tokens. As such, storing a large amount of data in a centralized system is always questionable, and the transparency, traceability and privacy implications make CBDCs a double-edged sword. Many questions regarding data privacy remain unanswered. For instance, depending on the jurisdiction, would some central banks be allowed to share transactional data with other government agencies? And, would CBDCs be used as a tracking device to monitor the consumption habits of a segment of a population?

AML/KYC: the risk associated with the use of CBDCs regarding anti-money laundering and counter terrorist financing (AML/CTF) sanctions and regulations merits particular attention. Emerging financial innovations such as CBDCs will likely bring new financial risks, requiring necessary amendments to be implemented regarding sanction regulations or due diligence procedures. The impact of cross-border CBDC payments on AML/CTF requirements should also be carefully assessed.

Cybersecurity: given the growing prevalence of cyberattacks in the past few years, security must be a core component of a CBDC system. Although cyberthreats are already a part of the current payment, clearing and settlement system risks, the introduction of a retail CBDC would present a completely different cyber resilience challenge, especially as such a CBDC model is likely to be open to a very large number of participants. This could make the system more vulnerable as it provides multiple points of attack. Therefore, a robust risk mitigation framework would be a prerequisite for any central bank willing to issue a CBDC.

> "Yes, costs related to printing and managing cash in circulation will be reduced, but we must also consider the as yet un-scoped level of cost associated with introducing and managing a CBDC: Labour costs for development, deployment and maintenance of the infrastructure, the Infrastructure cost itself in relation to servers (cloud or private), software licensing costs, and critically, the unfathomably high costs of cyber-security of the network."
>
> Nasir Zubairi, CEO, LHoFT

5. CBDCs: Key challenges and regulatory implications

Legal and regulatory concerns must not be underestimated either. Two key concerns have been identified in this context:

- Is the central bank allowed to issue a CBDC? If so, what are the other legal implications of issuing such a type of currency? In the EU, the ECB currently relies on its price stability mandate to issue banknotes and coins. However, it could be argued that CBDC issuance would not be an inconsequential technological upgrade, as it could provide new tools to central banks in terms of negative interest rates or higher access to transactional data.
- The issuance of a retail CBDC could add new layers of legal complexities stemming from possible banking disintermediation. Indeed, if central banks would issue a CBDC to the public, the deposits at commercial banks would shrink, leading to a decrease in commercial loan issuance. The central bank would eventually centralize credit by granting the public access to its balance sheet. In this case, the legal implications are significant, especially in the EU, as this centralization would greatly contradict an open market economy with free competition; a key principle of the Treaty on the Functioning of the European Union that the ECB ought to abide by.

Finally, it is also understood that adapting current payment systems or building a new system from scratch will materially affect the current operational model. Even minor changes to what underpins the daily economic activity of banks and citizens can have major impacts on the reliability and availability of payment systems. The technological and operational challenge of a CBDC-based model should not be misjudged, as the goal should ultimately be to provide a real-time, highly reliable and continuously available payment system involving stakeholders across jurisdictions.

> "Whether CBDCs will be anonymous or permit traceability, is a key and contentious consideration being reflected on by central banks across the world."
>
> Nasir Zubairi, CEO, LHoFT

6. How we see the future of CBDCs

Over the past few years, we have been confronted with a multitude of fast-evolving payment methodologies and technologies, driven by people's ever-changing demands and needs for always-innovative technologies and real-time solutions.

While there are aspects that must still be analyzed and implemented, one thing is certain:

It is now just a matter of time. Given the ongoing pilots and the considerable attention and effort that central banks are dedicating to CBDCs, it is clear that they will become a reality soon. So, we must be ready to cope.

As it is now a given that we will see a growth of private and public "regulated" digital currency initiatives, we anticipate that CBDCs will be deployed in our economy within a horizon of two to three years.

We see the introduction of CBDCs as a game-changer, promoting payment efficiency and representing an additional alternative to the current money model from an operational and technological point of view.

There is currently no envisaged solution intending to replace the payment models in place. The implementation of a successful CBDC model should ideally be seamless and not disrupt the customer's experience.

It is undeniable that the introduction of a new CBDC may have major geopolitical implications, especially as a significant portion of cross-border trade is currently denominated in one currency, the US dollar. As such, we expect that many countries will grow keen to develop an alternative payment mechanism based on CBDCs to enhance quick and efficient payments across these countries. Along the same lines, we observe that central banks are doing their own research projects to preserve their domestic authority. However, the real challenge and actual need are regarding cross-border payments.

So, to finally answer the question of this paper: will CBDCs power the economy of tomorrow? The answer is yes, but the "when" question remains.

The answer as to "when" will rely on the foundations of a dedicated regulatory and legal framework to facilitate the issuance, distribution and transparency of digital currencies. Topics including legal status issues, policies, anonymity, and money laundering must be defined in the regulatory framework, as the issuance of CBDCs could have major consequences for the financial system and banks' current business models.

Some concrete steps in this direction have already been taken. The European Commission has recently issued the Financial Digital Package, which includes a proposal of the Markets in Crypto Assets (MiCA) regulation. This package aims to set a new ambitious regulatory framework to encourage responsible innovation within the single EU market to benefit consumers and businesses and to introduce key elements for a retail payment digital strategy.

This is a clear sign that regulators, together with central banks, will embrace the crypto and digital topic from now on with a harmonized approach.

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