



Central Bank Digital
Currencies:
Building Block of the
Future of Value Transfer

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Introduction



As a financial services innovation, Central Bank Digital Currencies (CBDCs) are likely to play a pivotal role in shaping the Future of Value Transfer. Most Central Banks worldwide are now in various stages of their evaluation of launching their national digital currencies.

Interest in CBDCs has grown exponentially in the last few years in response to innovation in payments and technology, alongside the disruption caused by Covid-19. This shift has also been triggered by the growing interest and influence of cryptocurrency as a medium of exchange and as an asset class. As a region, APAC has been the frontrunner in this space, with seven out of the top ten global CBDCs projects being conducted in the APAC region alone.

With increasing globalization and digitization of financial services, CBDCs have the potential to create a Future of Value Transfer platform that contributes to a more resilient, innovative, and competitive payment system for households, businesses and economies.

CBDCs are likely to drive efficiencies and effectiveness of a jurisdiction's payments system by ensuring that its users access safe digital money. CBDCs will provide users with a sovereign option as compared to other less safe digital instruments, which may lead to less reliable payments, relatively volatile store of value and potentially erode monetary and financial stability. It may be especially important in the future as the use of cash declines and new forms of "value transfer alternatives" become more widely used in the payment cycle.

Banks and financial services players need to prepare themselves for this inevitability and plan for the impact that it is likely to have on their profit pools, customer propositions, technology models and balance sheets.

In this paper, we seek to provide an analysis of the progress made across Asia Pacific and to explore some of the considerations and implications that are relevant in tracking your journey in the rapidly changing and increasingly digital financial world.



Central Bank Digital Currencies – An early state of play and an inevitability

Central Bank Digital Currencies (CBDCs) have the potential to be the most pervasive innovation in the digital and payments space that will fundamentally impact all participants in the global financial services industry. A Central Bank Digital Currency is an innovation in the form of money issued as well as the underlying infrastructure on transactions can happen.

A CBDC is a digital payment instrument denominated in the national unit of account that is a direct liability of the Central Bank (BIS 2020, 3). It is the legal tender issued by the Central Bank in a digital form as a medium of exchange, store of value and unit of account. It is a fiat currency issued in a digital form and has the same value as the fiat currency.

Currently, only commercial banks and certain permitted financial institutions can hold Central Bank money in the form of ‘reserves’ while the retail public can hold money issued by the Central Bank only in the form of physical banknotes. In their electronic form, CBDCs have the potential to be widely used by wholesale financial institutions, households and businesses to store value and make payments more securely.

With cash usage declining over most economies, CBDCs can play a role in maintaining and streamlining the Central Bank’s function of providing money, financial stability and ensuring continued access in a purely digital economy.

The following table provides an overview of the purpose of CBDCs and compares them to physical cash and alternate private currency.

Figure 1: Comparison of CBDCs with physical cash and alternate private currency

Aspect	CBDCs	Cash	Alternate private currency
Issuing Authority	Issued and backed by a central monetary authority	Issued and backed by a central monetary authority	Privately owned, governed by algorithms
Form	Electronic/Digital	Paper/Physical	Electronic/Digital
Guarantee	Issued by the Central Bank as their liability	Issued by the Central Bank as their liability	Privately issued
Payment acceptance	Legal Tender	Legal Tender	Limited acceptance
Know Your Customer (KYC)	Required in most cases	Transfer doesn't require KYC	May not be required Anonymity is high
Structure	Centralized or permissioned decentralization	Centralized issue	Decentralized
Risk	Very low market, counterparty, liquidity risk	Very low market, counterparty, liquidity risk	Relatively medium to very high market, counterparty, liquidity risk



Key drivers, economic impact and risks of CBDCs

Globally, the need for CBDCs is being driven by the push for faster payments, rapid digitization, better mitigation for clearing and settlement risk. There is also a demand for more efficient domestic and cross-border value transfers and financial inclusion.

These developments have resulted in many Central Banks and governments increasing efforts towards exploring a digital version of the fiat currency. A 2021 BIS survey of Central Banks found that 86% have been actively researching the potential for CBDCs, 60% have been experimenting with the technology, and 14% have been deploying pilot projects. (Source: paper no. 114, BIS)

Besides leveraging CBDCs to drive monetary and fiscal policies, we have identified four key drivers pushing Central Banks to evaluate CBDCs.

Driver 1: Need to bring Central Banks back to the centre of currency creation and trust

Central Banks are becoming cognizant of the advent of new forms of digital money and the utility of non-fiat cryptocurrency. They are also increasingly aware that they may individually need to play a central role in the system rather than remain an observer. There is a need to provide the public with digital currencies that

carry the legitimate benefits of alternate private currencies while avoiding economic consequences. While AML/CFT requirements are not core to the issuance of CBDCs, most Central Banks would design their platforms to conform to these requirements as well as requirements around data protection to create trust.

Driver 2: CBDCs have immense potential to bring efficiencies in the financial system

Payments using CBDCs are real-time, gross, and final. This reduces the settlement risk in the financial system; therefore, the need for interbank settlement and reconciliation disappears. CBDCs also potentially enable real-time and cost-effective globalization of payment systems. Time zone differences would no longer matter in currency settlements – there would be no ‘Herstatt’ risk. CBDCs can facilitate ‘programmable money’ in terms of smart contracts to enable ‘atomic’ transactions, where the transfer of CBDCs with another asset is contingent on the real-time transfer of the other asset. In a multi-currency CBDCs environment, this would enable a Payment versus Payment (PvP) for cross-currency transactions or, in the case of a domestic transaction, the other asset could be a physical or financial asset enabling Delivery versus Payment (DvP).

The cost of cash has been estimated to be between 0.5% of GDP (Gross Domestic Product) for countries such as Sweden to 1.7% of GDP for India. This cost, which does not include the ESG cost of printing money, is predominantly borne by four stakeholders – households, businesses, banks, and the Central Bank. Improving tax efficiencies, which in the case of India is expected to account for 3.2% of India’s GDP, is another area of consideration (Source: Accelerating the growth of digital payments in India, Visa).

CBDCs increase the efficiency of clearing and settlements and post-market activities. Currently, most security clearing and settlement processes have a multi-day lag. With the introduction of this form of digital money, there would be a significant increase in efficiencies and a reduction in associated reconciliation costs.

Driver 3: Improving financial access and financial inclusion

Many Central Banks look to CBDCs to provide last mile financial reach by eliminating all intermediaries and physical boundaries and democratizing financial access. However, the low-income groups' preference for cash, the technological challenges and costs associated with a truly digital currency may act as a barrier in achieving the CBDC vision. A recent study by ADB (source: Central Bank Digital Currencies, Asian Development Bank) suggests that

CBDCs may offer a highly efficacious solution to the problem of high remittance costs and the broader financial inclusion challenges. Leveraging a two-tier CBDCs model (explained later) will also help in allowing Participating Institutions to leverage Open Banking frameworks to innovate more relevant customer value propositions.

Driver 4: Enhancing monetary and fiscal policy

The introduction of CBDCs could serve as an impetus to improve the monetary policies for Central Banks. Its architecture and structure could allow for the seamless and transparent distribution of government benefits to individuals, improving control over transactions.

CBDCs would improve and enhance financial stability by managing liquidity squeezes and providing the public with alternatives to cryptocurrencies.

CBDCs potentially reduce identity theft risk, as the digital trail would ensure traceability and enhanced security. CBDCs could enable Central Banks to protect purchasing power to maintain the real

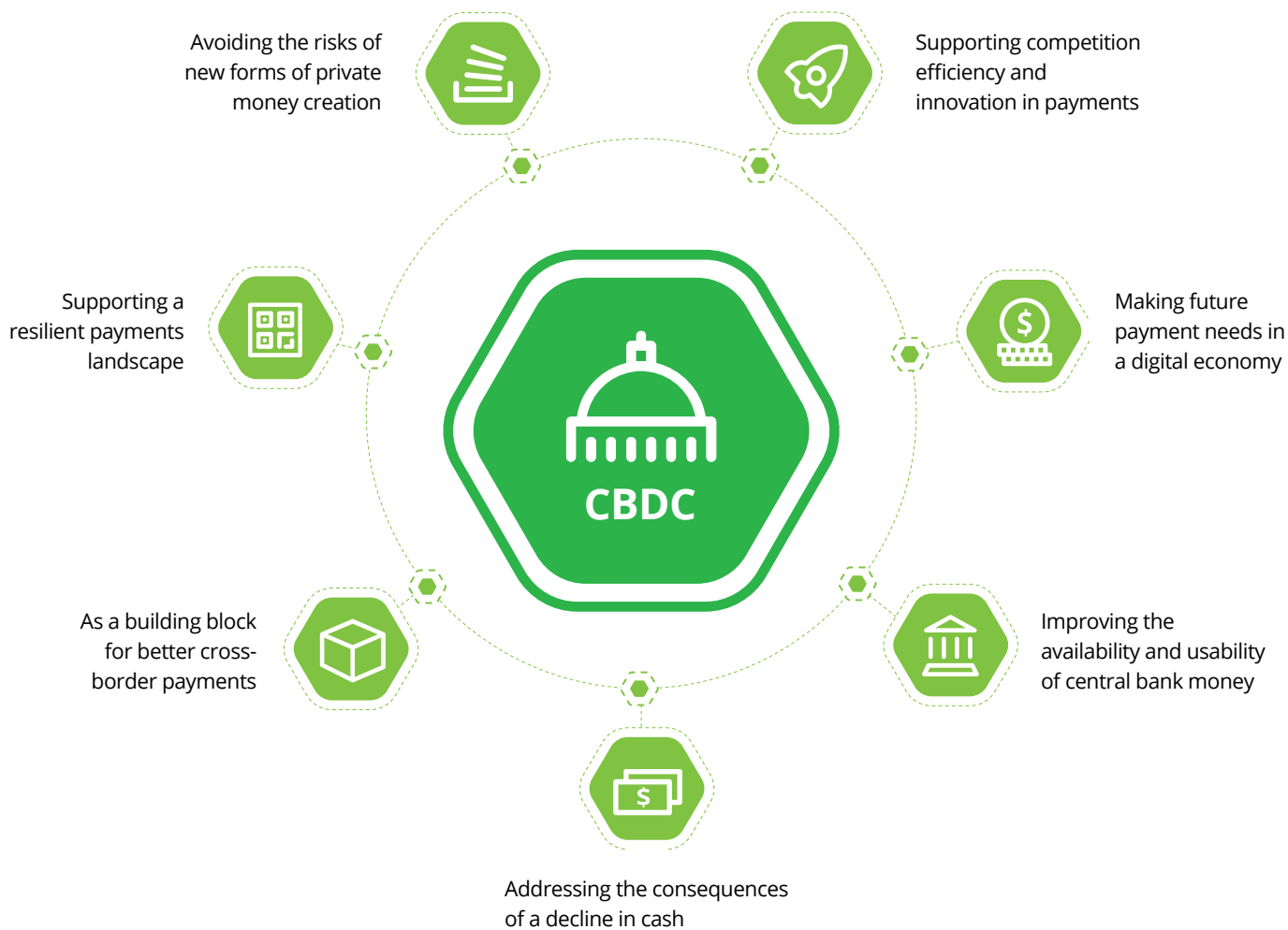
value of money in the economy. For example, under an indexation scheme, the nominal value of an individual's CBDCs holdings may be incentivized during periods of higher-than-expected inflation. (Source: Future of Payments, Deutsche Bank, January 2020)

The digital nature of CBDCs will allow Central Banks to tap into more granular payment flow data across an economy which in turn would enhance macroeconomic data integrity and analytics. CBDCs are not expected to replace cash completely but to provide users with a new digital form of money and a way of making payments.



The opportunities for Central Banks to leverage CBDCs are provided in the exhibit below.

Figure 2: Opportunities for CBDCs to support Monetary and Financial Policies



Source: Central Bank Digital Currency: opportunities, challenges and design, Bank of England

While the next section details the current stage of development of CBDCs in various geographies; commercial adoption by one large economy in the region or a trade bloc may also act as a catalyst in faster adoption and provide an impetus for a large-scale roll-out of CBDC frameworks across jurisdictions and pave the way for a multi-currency CBDC platform.

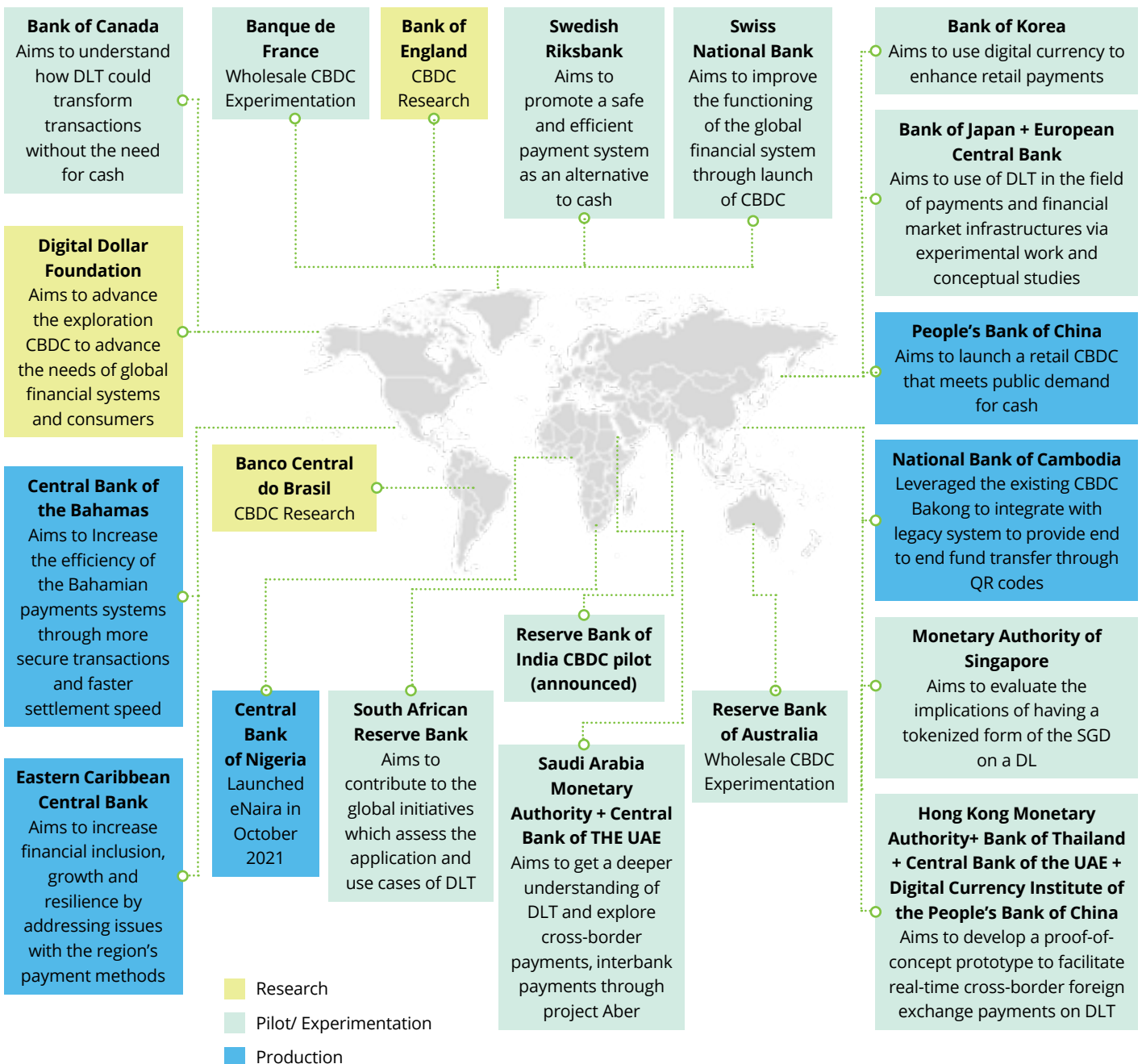
Regulatory considerations



Global benchmarking and developments in Asia Pacific markets

Most regulators globally have taken initiatives towards embarking on their CBDCs journey by either connecting with industry experts to research different models or are in a testing phase. Some countries like Cambodia and the Bahamas have already launched CBDCs. The below diagram depicts some of the ongoing projects globally (Source: Are Central Bank Digital Currencies the money of tomorrow? - Deloitte, Deloitte Analysis):





















Figure 3: Global snapshot of CBDCs journey



Five countries have implemented CBDCs across the globe. A comparison between the implementation strategy of these 'live' CBDCs and results have been summarized in the below table.

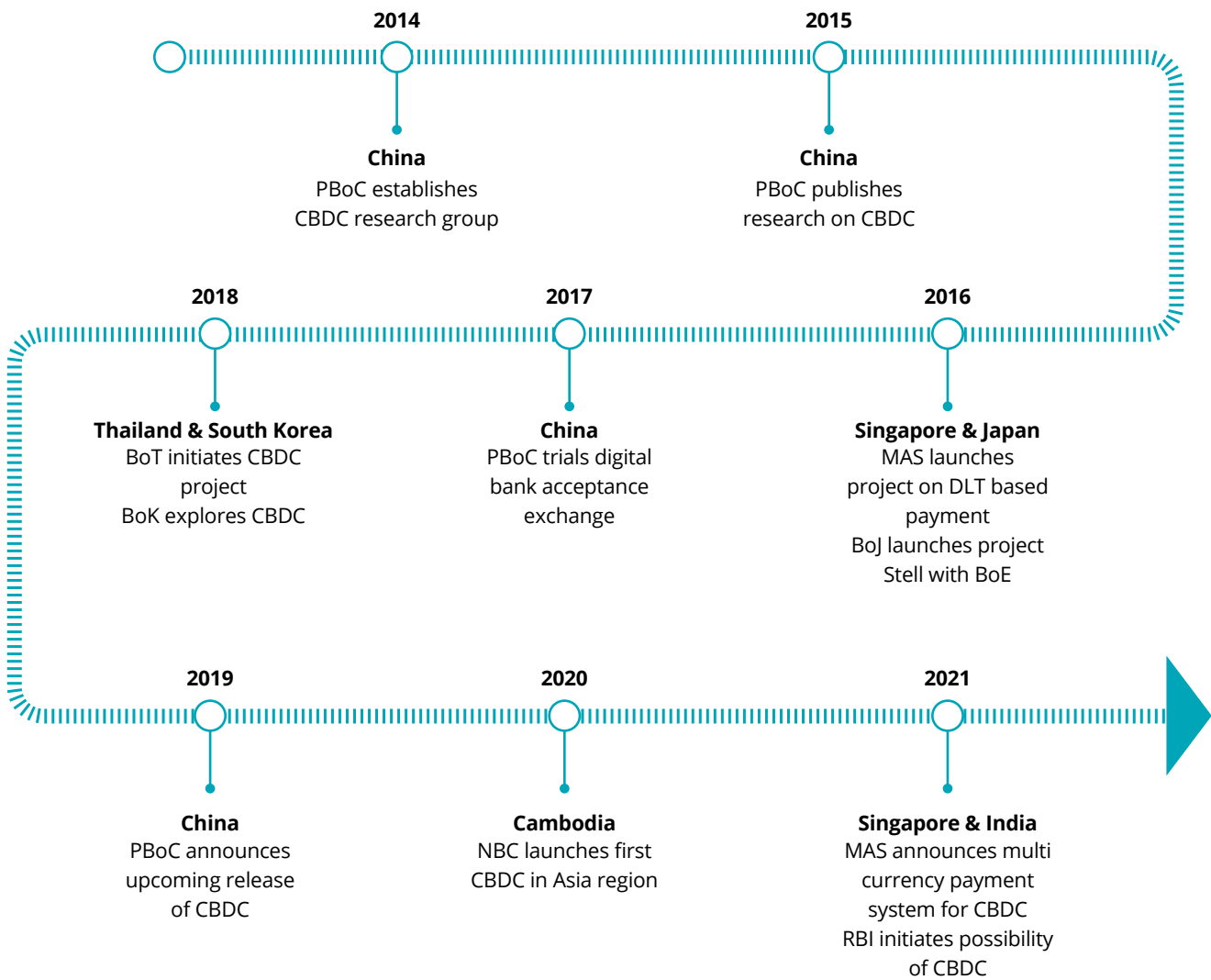
Figure 4: Summary of Live CBDCs

	China	Cambodia	Bahamas	Eastern Caribbean	Nigeria
Brief Description	The project was initiated in 2014 with intention to enhance the retail payment system. Pilot has been launched in 2021	Project Bakong has been sponsored by the National Bank of Cambodia with the goal to improve financial inclusion reach rural unbanked population	Central Bank of Bahamas launched its digital currency Sand Dollar for financial inclusion and interoperability of payments	Eastern Caribbean launched its CBDC involving 4 of the 8 member countries to reduce cost of transaction and make transactions possible to individuals without bank accounts	Central Bank of Nigeria launched its digital currency, eNaira, to facilitate financial inclusion, ease remittances, promote traceability and promote inclusion and security, among others
CBDC Form and Access Technology	Aimed towards retail based leveraging account-based technology for circulation	Retail based CBDC leveraging DLT on a hyper ledger platform	Retail based CBDC leveraging DLT	Retail based CBDC leveraging DLT	Retail based CBDC leveraging DLT
Offline Usability	✓	✗	✓	✗	✗
Transaction limit	No	Yes, different wallets will have different transaction limits	Yes, capped at \$500 and a maximum monthly transfer of \$1500	No	Yes, daily transaction limits and wallet balance limits have been specified
Issuance and Distribution of Currency	E-CNY follows a centralized approach with the Central Bank issuing the CBDC, while commercial banks are responsible for distributing it to general public	The currency is issued by the Central Bank and 16 banks are currently supported through the system and 10,000+ users adopting it, with a retails throughput of 2000 transactions/ second	While the currency will be issued by the Central Bank, banks, credit unions, PSPs or MTBs can circulate it to customers. Customer can also download the application to make transfers	Dcash will be issued to Eastern Central Caribbean Bank (ECCB) and will be distributed by licensed banks and non- banks in the region	CBN will issue eNaira and the financial institutions will act as intermediaries between CBN and customers

	China	Cambodia	Bahamas	Eastern Caribbean	Nigeria
Use case	 Domestic Payments	 Domestic Payments	 Domestic Payments	 Domestic Payments	 Domestic Payments
	 Offline Payments	 Cross border transactions	 Offline Payments	 Cross border transactions	
Stakeholders Involved	 Commercial Banks	 16 Banks	 Banks / Credit Unions	 Banks	 Financial Institutions
	 Central Bank authorized operator	 20,000 users	 PSPs / MTBs	 Non-banks regulated entities	 Merchants
					 Govt. agencies
Results / Next Steps	PBoC intends to explore new application models for economic and social development. At the same time, relevant regulations around the data security, business continuity measures will be taken	The project would extend to business use cases for financial market. Central Bank is also looking for features such as ATM withdrawal, term deposits, and tying into traditional settlements	The Central Banks is collaborating with various stakeholders to formulate legal framework needed to support payments system	ECCB intends to bring down the usage of cash by 50% by 2025 and use CBDCs as an alternative	CBN envisions eNaira to compliment traditional Naira as a less costly, more efficient, generally acceptable, safe and trusted means of payment. It is also hoped to improve monetary policy effectiveness and enhance of social interventions

Globally, efforts taken towards the development of CBDCs by Central Banks are very dynamic, and with the COVID-19 pandemic, it is likely that the momentum behind these efforts will increase even further. Jurisdictions in APAC have been frontrunners in this space, with seven out of the top ten global CBDCs projects being conducted in the APAC region alone. While China was the first country to embark on its journey back in 2014, India has been the latest to initiate research around CBDCs. A timeline view for some of the APAC countries is given in figure 5 below.

Figure 5: Timeline of countries undertaking CBDCs project in APAC



Singapore (Project Ubin): Project Ubin is a collaborative project between different industry bodies and was initiated in 2016 with a multi-phased approach, with each phase providing solutions to prevailing industry challenges. While the first 2 phases focused on domestic payments and building technology capabilities, the next 2 phases concentrated on the interoperability of network and cross-border facilities. The last phase of the project is shifting towards having a common platform improving efficiencies in payments systems to enable faster and quicker transactions. The project leveraged blockchain technology that caters to existing payment challenges and can be extended as a reference for the international, multi-country and multi-currency settlements.

From a cross border perspective, the Monetary Authority of Singapore (MAS) and the Bank of Canada (BOC) linked their respective experimental wholesale CBDCs networks, Ubin and Jasper, in 2019 to demonstrate how wholesale CBDCs could systematically eliminate pre-existing risk in settlement in cross-border, cross-currency transactions, by synchronizing payment actions irrespective of a third-party platform.

In 2020, Project Ubin broadened its work to explore how several digital currencies could be issued and transacted on a single common platform. With the conclusion of the experimental phases of Project Ubin in July 2020, industry players are building on the outcomes of the project to move towards the commercial development of Distributed Ledger Technology (DLT)-based multi-currency payments network aimed at enhancing commercial cross-border clearing and settlements globally. One example is Partior, a joint venture by DBS Bank, JP Morgan and Temasek. Unlike Project Ubin, Partior will be based on digitized commercial bank money rather than CBDCs.

Project Dunbar, a collaborative initiative between the BIS Innovation Hub Singapore Centre and MAS, plans to work with Central Banks, financial institutions and technology partners.

The platform proposes the native issuance of multiple wholesale CBDCs which are interoperable with other DLT platforms and traditional payment rails. This will enable the platform to accommodate wholesale CBDCs from Central Banks that issue on their own platform, and from Central Banks that wish to issue wholesale CBDCs but do not have their own platform.

Cambodia (Project Bakong): Cambodia has launched CBDCs named Bakong with the goal to reduce dependency on the US dollar. Currently, it has been adopted by 18 financial institutions and runs on Cambodia's legacy payment solution. It has onboarded 5.9 million users in its first year and has conducted around 1.4 million transactions with a total value of USD 500 million. The supported use case is for cross border transactions which aims to lower the transaction cost and simultaneously provide instant settlement. The service eliminates the dependency on a bank account by allowing the customer to transfer any amount directly to a Bakong wallet linked with

the recipient number. Bakong has also leveraged blockchain technology to build the platform.

China (e-CNY): China was one of the early adopters that initiated the research on CBDCs back in 2014, where it had set up a task force to study the digital fiat currency. In 2016, the Central Bank had established a prototype for digital currency. By the end of 2017, financial institutions were involved in testing the fiat currency. Presently, the pilot has been initiated in selected regions to ensure safe and efficient transactions. E-CNY has been developed for retail customers and leverages account-based hybrid payment instruments. It is a centralized management model with a two-tier operational system under which the Central Bank issues digital currency to the financial institutions and manages it throughout the lifecycle.

Japan (Project Stella): Japan, in collaboration with European Central Bank, conducted a study to assess the applicability of the DLT solution for the payment system. The study has been conducted across two phases, where the first phase focused on the operations within a DLT environment, while the second phase explored the possibilities of conceptually designing and operating securities settlements in the existing DLT environment. The insights from the reports were published in 2017 and 2018, respectively, highlighting the use of DLT for designing a Delivery versus Payment (DvP) in a same or cross ledger. Currently, the Central Bank has stated that it does not intend to introduce any CBDCs immediately but going forward; the Central Bank might provide general-purpose CBDCs as a payment instrument alternative to cash for retail customers. The Central Bank would opt for a two-tier payment and settlement system, where CBDCs would be issued indirectly through intermediaries. Japan has also been exploring offline CBDCs as the use case. The Central Bank explored it on a basic feature phone as well as on a smartphone, laying down five readiness criteria including storing of monetary value, communication between users, verification of the transaction, ability to provide payment instruction and how to transfer without internet. Some of the challenges that the Central Bank highlighted in the use case is security issues, combating AML/CFT transactions and avoiding double transactions by the users. Technology companies have worked on this issue and have come out with Offline Payment System (OPS) protocols that prevent double transactions through Trusted Execution Environment on a basic feature phone as well as on a smartphone.

India: In 2021, the Reserve Bank of India (RBI) announced a phased implementation strategy for introducing a CBDC. It has indicated that it will launch its first digital currency trial program by the end of 2021. The RBI had been studying various aspects with introducing CBDCs, including security, impact on financial institutions, monetary policy and currency in circulation. The Bank is also exploring the choice between having a centralized ledger or the DLT technology. The study covers the distribution mechanism, technology and model for CBDCs. It is expected that pilots will be conducted for both retail and corporate segments.

Australia (Project Dunbar): Central Banks in Australia, Singapore, Malaysia and South Africa are conducting trials for cross-border payments through CBDCs to assess if transactions can be settled cheaply and quickly. The Central Banks of these countries, along with the Bank of International Settlement's Innovation Hub, are leading the scheme. The platform will explore international dimensions of CBDC design to support G20 nation efforts on cross border transactions. The platform will leverage DLT technology and enable financial institutions to transact directly with each other in currencies issued by their respective Central Banks, thereby eliminating the need for an intermediary and reducing time and cost for transactions. It would also inspect different governance and operating designs to enable Central Banks to share CBDCs infrastructure, benefitting from public and private sector collaboration. A technical prototype of the platform is expected to be demonstrated in late 2021, while the result will be published in 2022.

Thailand: Bank of Thailand (BoT) has initiated retail-based CBDCs, with the pilot expected to be conducted in 2022. The pilot will be conducted in two phases, with the first phase laying a foundation to evaluate the use of CBDCs for cash equivalent transactions. It is expected to be piloted around the second quarter of 2022. The second phase will include innovation and new use cases, as well as collaboration from private players and technology partners. Some of the guidelines laid down by the Central Bank state that their CBDCs would be cash-like, non-interest-bearing distributions of digital currency to the general public, which would be completed by the financial intermediaries; and some of the conditions for converting CBDCs would be determined later. The Central Bank expects a gradual increase in usage of CBDCs and

expects it to become an alternative to cash and e-money. The Central Bank has stated that necessary steps would be taken to ensure that CBDCs do not impact monetary policy transmission, financial stability and banks or other financial institutions.

Hong Kong and Thailand (Project Inthanon – LionRock): In 2018, the Hong Kong Monetary Authority (HKMA) and the Bank of Thailand initiated the project with the goal to improve cross border wholesale transactions. The platform is built on a Corda R3 blockchain network leveraging DLT technology. Several commercial banks from both regions have participated in the project. The project aims to provide real-time cross-border wholesale transactions and would be completed in two phases, with the first phase focusing on tokenization of cash and bonds, while the second phase would focus on data reconciliation and management. The project would improve the cross-border settlement efficiency, liquidity management efficiency, and lay a foundation for a wider scope of extensible architecture and use cases.

The mCBDC Bridge project is run by the BIS Innovation Hub in collaboration with the HKMA, BoT, Digital Currency Institute of the People's Bank of China and the Central Bank of the United Arab Emirates.

The mCBDC Bridge is a multi-currency CBDCs platform that adopts DLT to facilitate real-time cross-border funds transfers and pursues the path of atomic payment-versus-payment for FX transactions. The project includes exploration of scalability, interoperability, privacy and governance.






CBDCs launch case study

Singapore Project Ubin

In 2016, the Monetary Authority of Singapore decided to explore the benefits of Central Bank Digital Currency. MAS partnered with R3 on the production of Proof of Concept (PoC) for interbank payment transfer using DLT. Some of the largest banks, including Bank of America, Credit Suisse, JP Morgan, Singapore Exchange, United Overseas Bank, etc., participated in the project.

Figure 6: Singapore's Project Ubin implementation

	Phase I	Phase II	Phase III	Phase IV	Phase V
Objective	The first phase of the project ran for weeks and laid the foundation to assess the feasibility study and implication of DLT and elements required for future enhancements	The second phase of the project focused on developing software prototypes for decentralizing inter-bank payment, liquidity saving mechanisms during settlement	Collaborating with Singapore exchange, the third phase focused on delivering Delivery vs Payment for settlement of tokenized assets, starting with Singapore Securities	The fourth phase of the project examined existing challenges, alternative models that could enhance cross-border payments and settlements	This phase explores how blockchain technology can be used to build a network that can provide additional feature to use case and benefit financial institutions

	Phase I	Phase II	Phase III	Phase IV	Phase V
Stakeholders Involved	<p>Central Bank: MAS Financial Institutions: Bank of America, Credit Suisse, DBS, etc. Technology Partner: R3 BCS information, Deloitte</p> 	<p>Central Bank: MAS and the Association of Banks in Singapore (ABS) Financial Institutions: Bank of America, Credit Suisse, DBS, etc. Technology Partner: R3 Accenture, IBM, etc.</p> 	<p>Central Bank: MAS and the Association of Banks in Singapore (ABS), Singapore Exchange, NASDAQ Technology Partner: Deloitte and Anquan Capital</p> 	<p>Central Bank: MAS Bank of Canada and Central Bank of England</p> 	<p>Central Bank: MAS Technology Partner: Temasek</p> 
Use Case	Proof of Concept for inter-bank payments	Inter-bank payment and settlement with liquidity saving mechanism	Distributed ledger technology in Capital Market	Models of wholesale cross-border transactions	Multi-currency payment network prototype
Key Findings	The model was designed to minimize credit and liquidity risk by allowing gross settlement and pledging cash in a custody account at Central Bank	This phase provided information on how different workstreams can transfer funds in a decentralized manner without compromising data security, expanded six future considerations and importance of regulator in the payment network	This phase enabled reducing the settlement cycle from T+3 to T+1 day, thereby lowering exposure to counterparty, principal and liquidity risk	The paper focused on the future models and capabilities required to provide cross-border transactions at minimum time and reduced costs by eliminating intermediaries	Provides insight on ways to provide better connectivity between transacting parties, automation of payment processes and adding functionality to existing prototypes
Lessons Learnt	Need for developing a testing standard, securing data in blocks via encryption to ensure data privacy	Requirement of a cloud-based infrastructure functionality such as environment administration, monitoring, to operationalize DLT based system on cloud	There is a need for analyzing the foreign exchange rate for non-SGD transactions, assessing operating hours and cut-off times between banks	Stakeholders need to consider end user transparency and security during cross-border transactions. Process should be made to enable faster processing	



Key considerations for a Regulator

While designing and implementing CBDCs, there are a set of key decisions that need to be evaluated at different stages relating to technology and access, privacy, and distribution model. CBDCs also requires the creation of payments infrastructure to cover everything from the database on which CBDCs are recorded to the applications and point of sale devices that are used to initiate payments. The key considerations for building the CBDCs solution as well as the platform have been evaluated in detail.

Underlying technologies and access options

CBDCs are often associated with Distributed Ledger Technology (DLT), though they could be built using more conventional centrally controlled databases. DLT includes some potentially useful innovations and functionalities, including decentralization and the use of smart contracts, which may be helpful when considering the design of CBDCs. However, the adoption of these features also comes with challenges and trade-offs that must be carefully considered. Centralized ledgers are the most common data storage device in finance today. Data can be stored in different physical nodes, but control is in the hands of a trusted administrator authorized to make changes to the database.

Web 3.0 and decentralized finance (DeFi), both with DLT as the founding technology concepts, are also producing interesting and important developments. Web 3.0 facilitates users to perform financial transactions directly with one another using smart contracts without the need for intermediaries. DeFi, similarly, has the potential to bring economic and social benefits by replacing

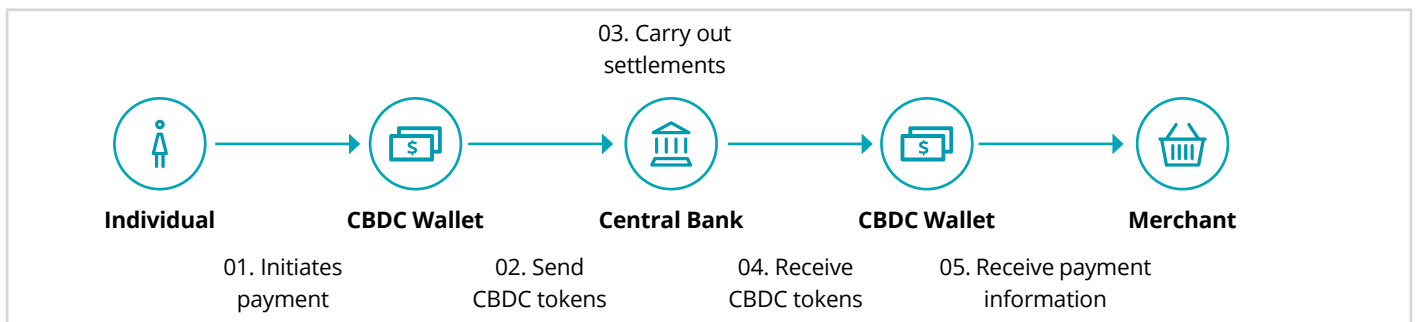
the need for intermediaries and bringing greater inclusion, potentially disrupting the world of finance.

Central Banks have a choice to decide whether they need to adopt a token-based or account-based approach.

Token based:

In the case of token-based CBDC, distribution of the currency will involve transfer of an object of value from one wallet to another. Token-based CBDCs ensures that the transaction is approved by the originator and beneficiary based public-private key pairs and digital signatures. Thus, the system provides a high level of privacy but adds more difficulty in tracing money laundering and fraudulent transactions. Further, customers need to remember their access keys, or they would lose out on access to funds. Figure 7 below depicts the process flow for a token-based transaction.

Figure 7: Payment process for token-based CBDCs

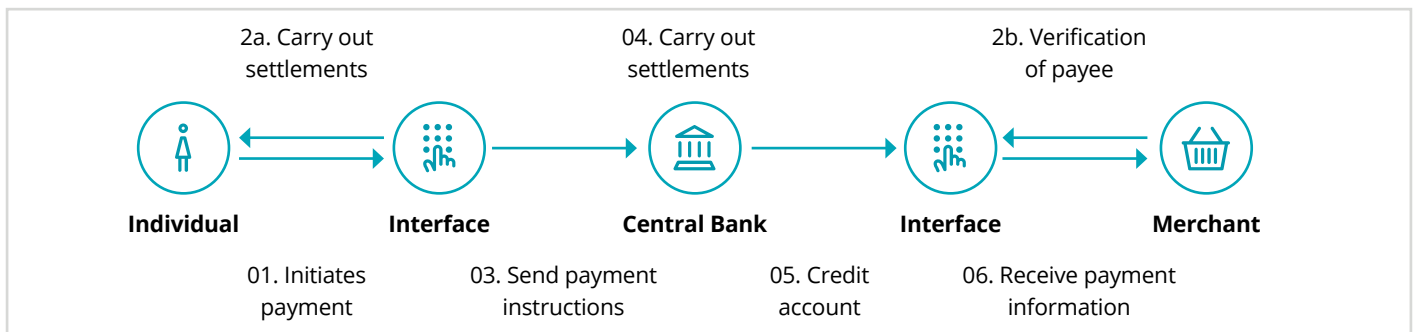


Account-based:

In account-based CBDC, the distribution of currency will involve transfer from one account to another. The model would ensure that the transaction is approved by the originator and beneficiary based on the verification of user identities. In issuing such accounts, Central Banks would have to ensure the existence of a digital account for every user. Figure 8 below depicts a typical account-based CBDC transaction.

While both the access technologies offer their advantages and disadvantages, generally, the token-based approach has been preferred by regulators for cross-border transactions, where both the entities only require having wallets to facilitate transactions. The token-based approach also facilitates financial inclusion goals as only an internet connection is required for both users to complete the payment. Also, the token-based approach provides a high degree of anonymity for users. On the other hand, an account-based approach allows regulators to monitor transactions more closely and have a relatively higher degree of involvement in the end-to-end payment process.

Figure 8: Payment process for account-based CBDCs



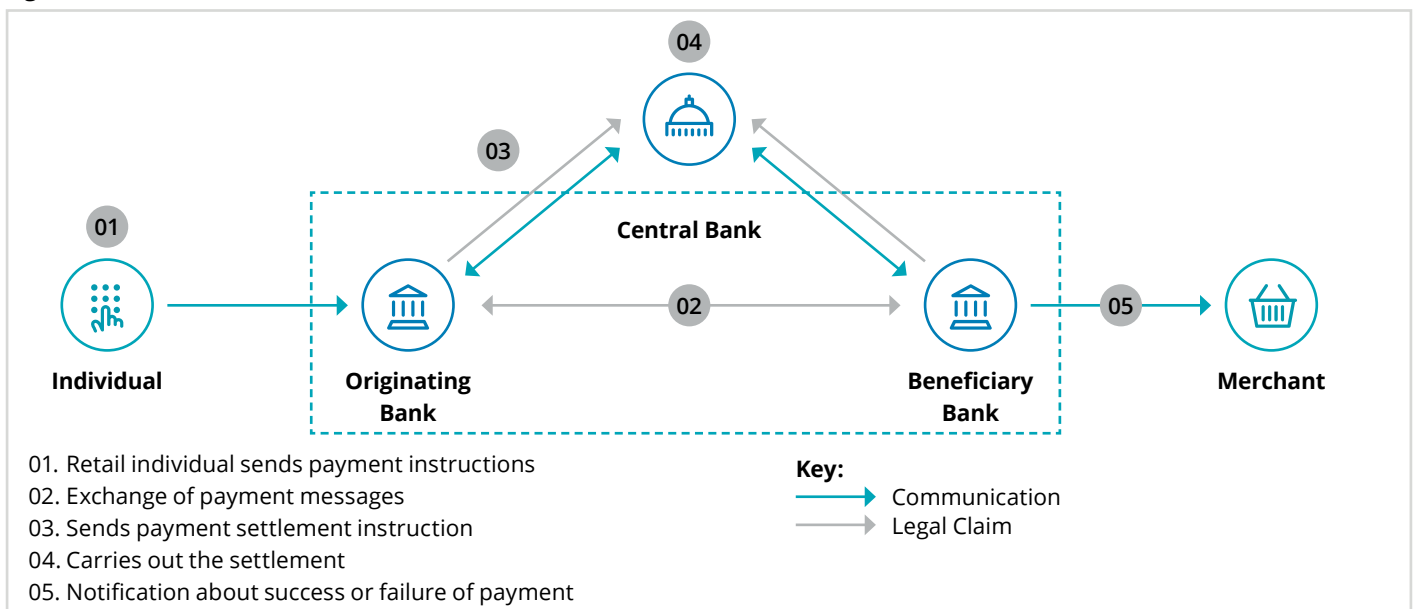
Choice of Retail CBDC and/or Wholesale CBDC

Retail based CBDC

Retail based CBDC focus on the issue of CBDC to households. The primary benefits of the adoption of retail-based CBDC are to promote financial inclusion, shift towards a cashless economy, and in reducing the cost of cash printing and management. Some of the retail models proposed include indirect retail CBDCs and direct retail CBDCs.

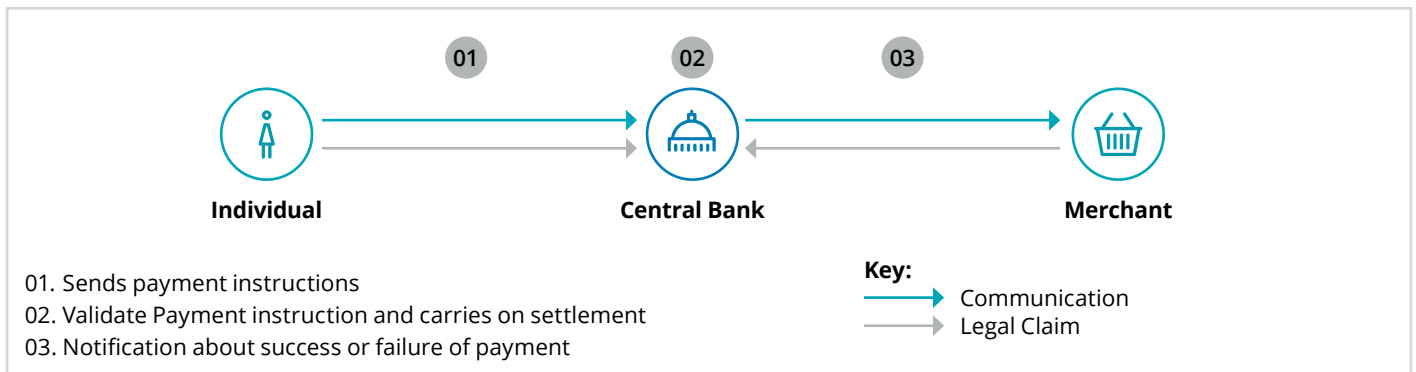
- **Indirect retail CBDCs:** Under this scenario, the issuance of digital currency is performed directly by financial institutions that are responsible for backing the money issued to individuals and businesses. They are also responsible for sending payment messages to other financial institutions and transmitting payment instructions to the Central Bank for payment settlement.

Figure 9: Indirect retail model



- **Direct Retail CBDCs:** In this scenario, individuals and businesses hold CBDCs through private accounts at a Central Bank, thus eliminating the intermediaries. This might affect the structure of the current financial system and increase the roles and responsibilities of the Central Bank.

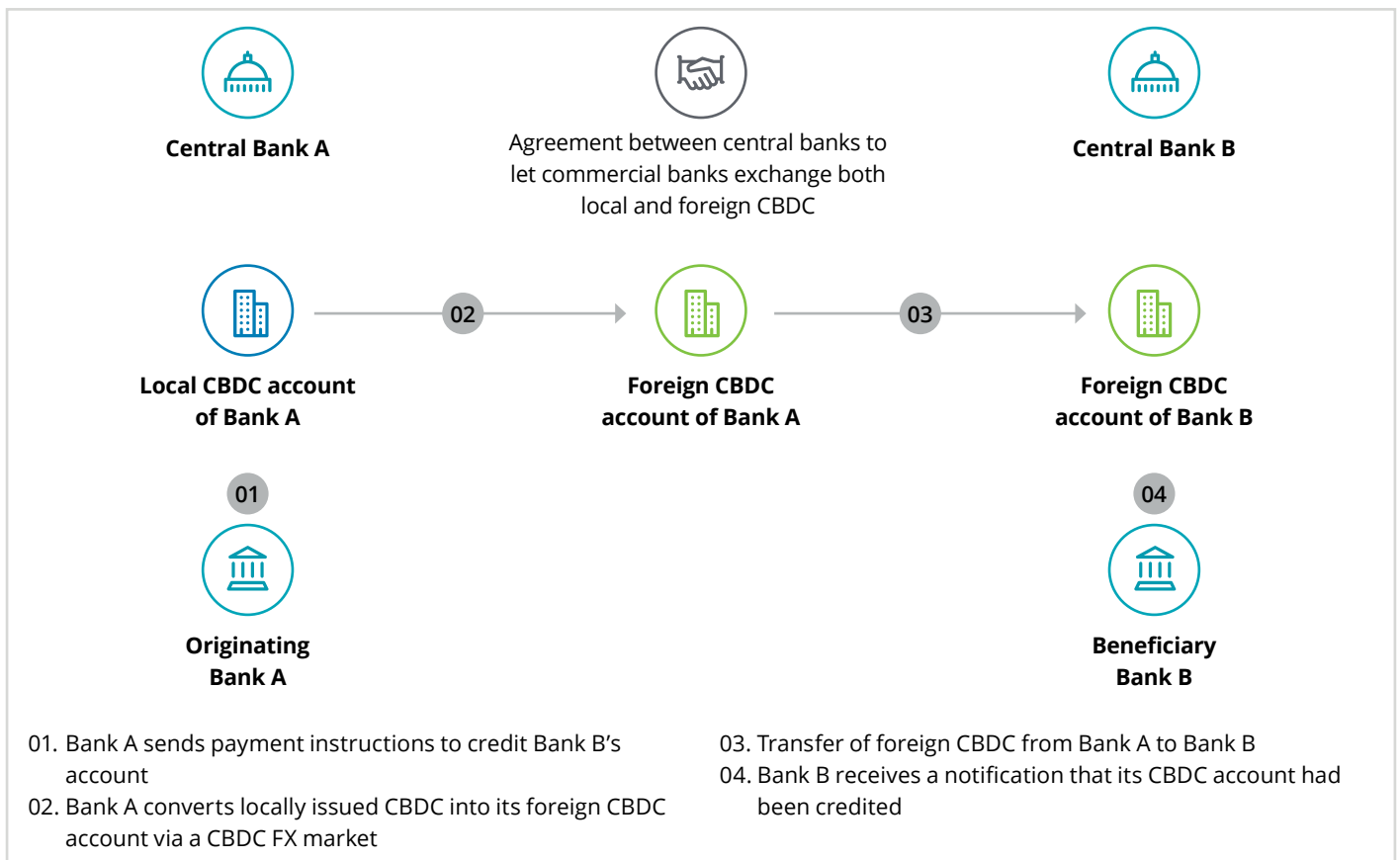
Figure 10: Direct retail model



Wholesale based CBDCs:

Wholesale CBDCs are used for interbank transactions for large-value payments between financial institutions. They are generally used for settling cross border settlements, improving settlement efficiency, security and reducing credit and settlement risk.

Figure 11: Wholesale CBDCs



Deciding on a specific approach will require an evaluation of the macro-economic conditions and payment maturity of the region. If the motive of introducing CBDCs is to improve financial inclusion, then a retail-based approach may be preferred. If there is a Faster Payment System (FPS) available in the region,

then the regulator can look to avoid or defer the complexities of introducing another retail payment system. Wholesale-based transaction models can significantly reduce settlement risks in large value payment transactions.

Interest bearing CBDC and non-interest-bearing CBDC

In the case where CBDC is proposed to be interest-bearing or remunerated, it is likely to compete directly with bank deposits. A non-interest bearing or unremunerated CBDC would be the digital version of cash. It is likely to have a lower impact on the banking system's liquidity and balance sheets.

Issuance and circulation of CBDCs

The distribution of CBDCs can be classified into two categories (One-tier and Two-tier) depending on how the currency is circulated within the economy. In the One-tier approach, the distribution of CBDCs is done by the Central Bank. This model would require a scale-up in manpower and infrastructure to cater to the ecosystem. In the Two-tier approach, the issuance of digital currency is done by Central Bank, but the distribution lies with financial institutions (most likely banks).

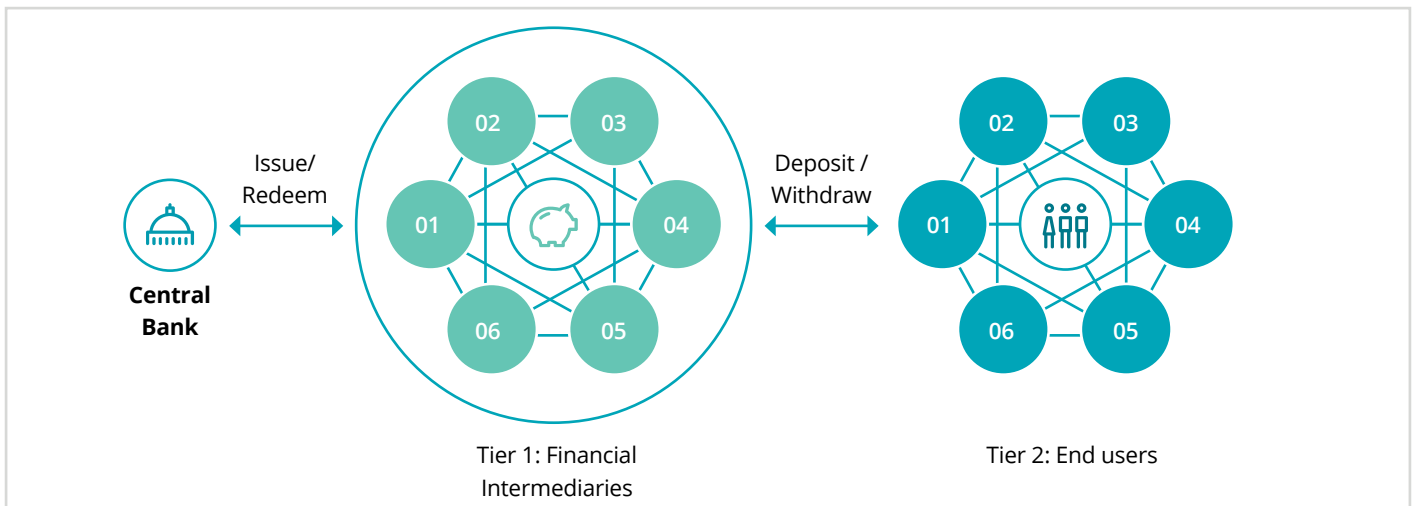
One-tier approach

In this scenario, the Central Bank will be solely responsible for the issuance and distribution of the digital currency. While it would enable full visibility on data from every payment, it would have serious implications on financial services institutions as their deposits would decrease significantly. The One-tier approach can be account or token-based CBDCs. In account-based, the Central Bank would need to develop customer-facing infrastructure and deal with stability risk. In the one-tier token-based approach, the Central Bank would provide a digital wallet directly to customers to store currencies.

Two-tier approach:

In this scenario, the currency would be distributed by banks to customers. The process would be similar to the normal distribution of currency. Banks can also offer token-based accounts to customers and cross-sell financial products to them. The diagram below provides an illustration of the Tier approach for CBDCs.

Figure 12: Tier based approach



The tier-based approach may have implications on the deposits of the bank. Under the one-tier approach, customers may prefer to open accounts directly with Central Banks (more so if they are remunerated) and potentially, a large portion of deposits may move away from bank deposits to central bank accounts. One-tier approach may be more feasible for smaller countries where there are fewer government-owned banks controlling the circulation of cash in the payment ecosystem.

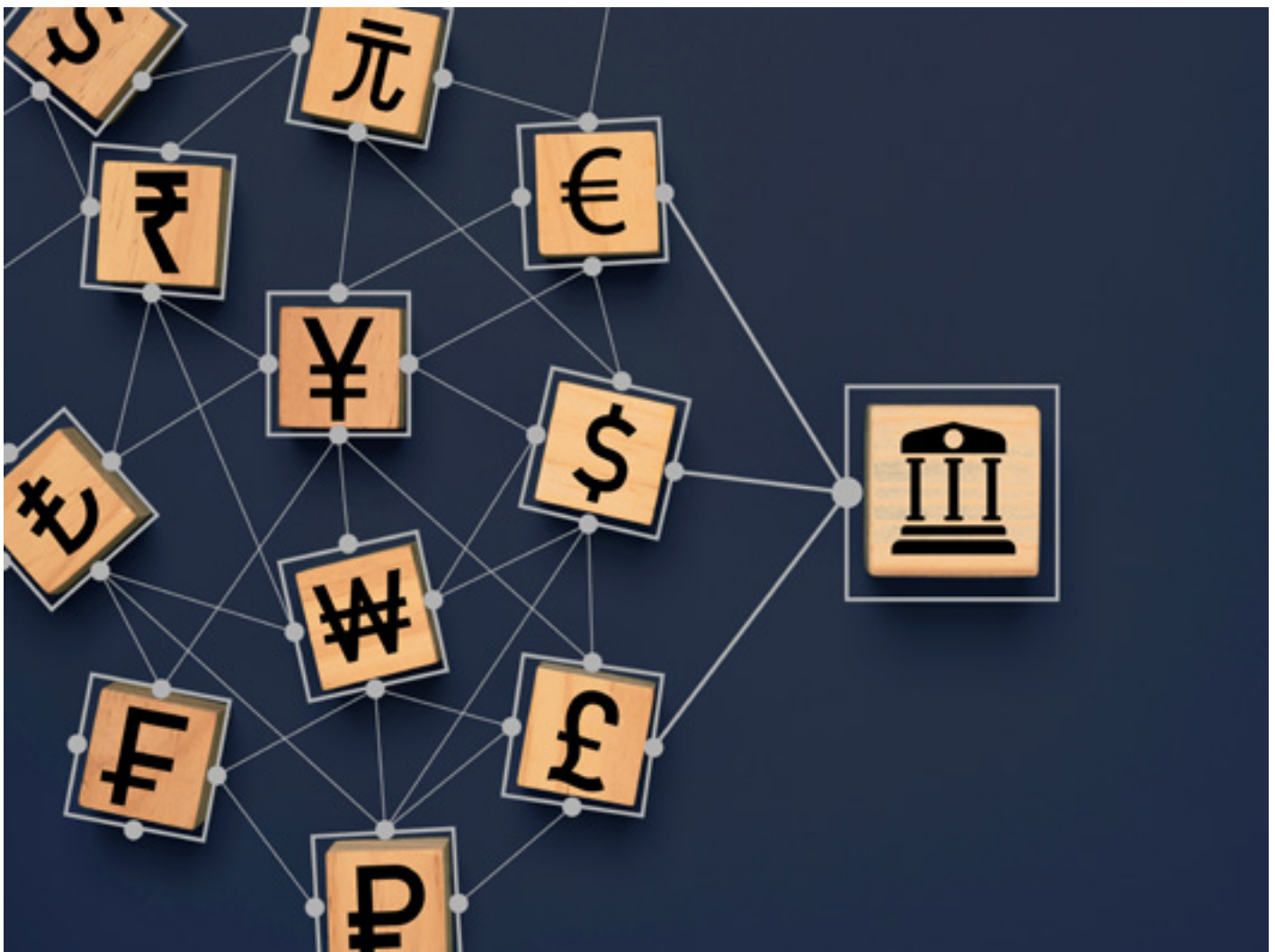
Central Banks may choose to design an ecosystem with different categories of CBDCs wallets with a varying transaction, balance and also time limits. This Tiered approach may prevent mass withdrawal of bank deposits under stressful conditions and maintain economic stability.

From a technology standpoint, the design of digital wallets can also be implemented in a distributed manner where the Central

Bank designs the rulebook for the development and use of wallets. This development and maintenance of wallets can be handled by private participants in partnership with the Central Bank. Not only can the wallets vary by transaction caps, but also by nature, i.e., personal or corporate wallets, software and hardware wallets, parent and sub-wallets etc.

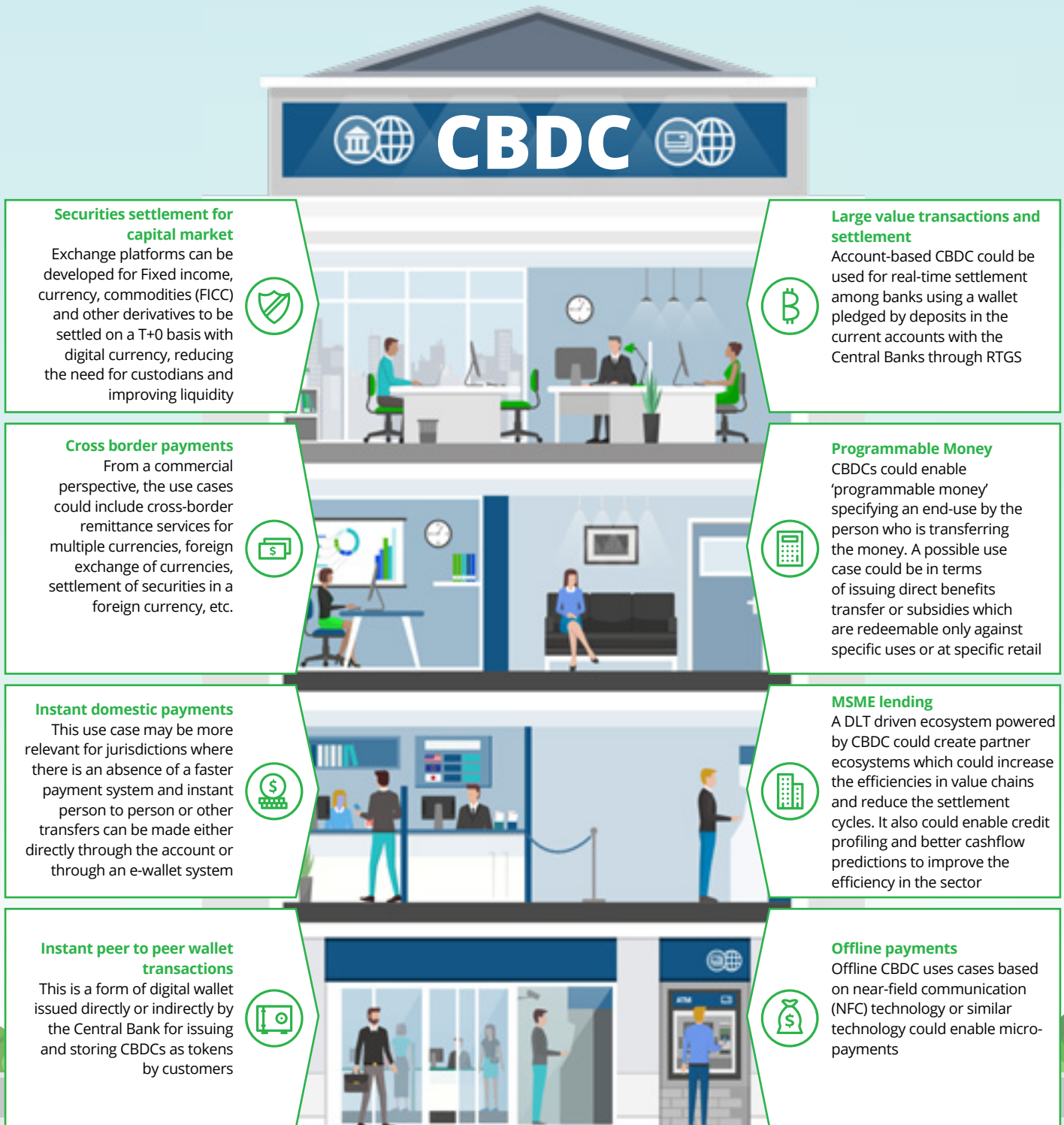
Central Banks need to ensure that the CBDCs program entails a comprehensive risk management framework defining roles and responsibilities for risk identification and management and establish a rigid risk tolerance policy defining required controls to mitigate risks.

Frameworks for risk monitoring, data analytics, economic vigilance must also be designed in alignment with the Tier approach adopted.



CBDC Use cases

Central banks have introduced various use cases depending on the need and payment maturity of the jurisdiction



Source: Deloitte report on CBDC

Several other use cases are being tested by regulators across the region, which include delivery versus payment for exchanges, procure to pay for trade and supply chain finance, and a digital asset for life cycle management in insurance, among others.

Impact of CBDCs and monetary considerations across the ecosystem



CBDC and Future of Value Transfer

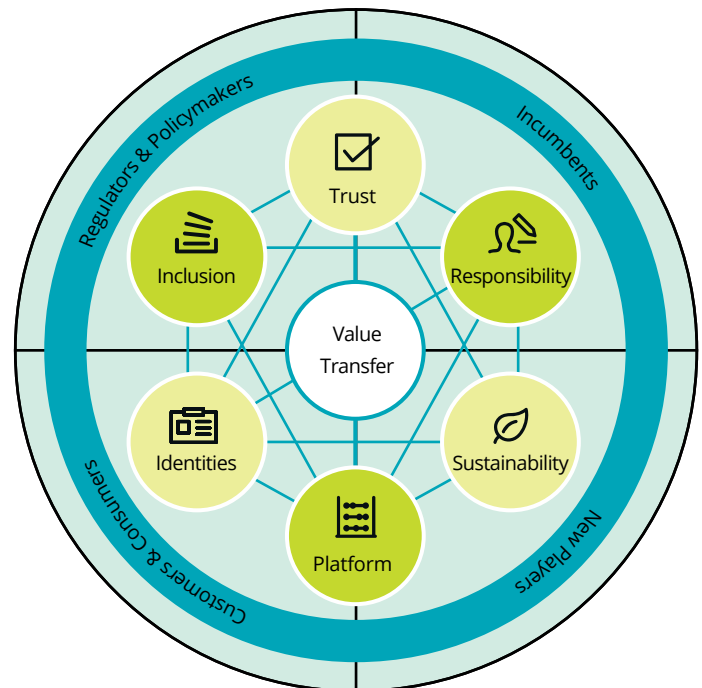
As Central Banks embark upon their inevitable digital journey with CBDCs, it will lead to a paradigm shift in the way global and domestic economies operate and have significant implications on the commercial banks, their profitability as well as operations.

Combined with the twin forces of Open Data regulation and cross-industry ecosystem play, CBDCs have the potential to play the role as a catalyst in disrupting the existing value transfer paradigm. In addition to the digital representation of currencies and other assets, the future of value transfer will entail value creation leveraging customer data. **The creation and representation of value in digital form will amplify the broader move from value chains to value webs.** As an integral part of the digital value web, CBDCs are likely to reduce costs, improve service and mitigate settlement risks, in addition to paving the way to better data gathering to fuel innovation.

The creation, capture and transfer of value are increasingly and irreversibly occurring in a multitude of digital forms. When you add to that the value-driven by digital presence, the move from customer centricity to empowerment, and the exponential pace of change in technology – the future of value transfer will have a profound and lasting effect on the future of financial services.

Digital currencies, including CBDCs, crypto, stable coins, fungible and non-fungible tokens, are just some of the ways that the very fabric of commercial and social transactions is being transformed. But that is just the beginning – in a world where we increasingly see the creation and representation of value in digital form, we believe that the future of value transfer will encompass the exchange of value derived from customer activity, in addition to digital representations of currencies, real and digital assets, fractions of assets, and entitlements to those assets.

Creating value from data ownership will be subsumed by the immensely more valuable concept of data access – value will not be about who has the data but rather about who can get the data. Customers will look to combine the value of their digital presence



with their other digital stores of value and will ultimately demand to be empowered to create and capture value from their choices. Success in the new world will go to those that best empower and enable the simultaneous creation, capture, and transferability of value – in any and all digital forms.

The future of value transfer will foster a change in mindset from market taking to market-making—from seeking market share by meeting current needs to creating a world of a new opportunity by redefining what future wants are going to be.

Learn more about what we believe the Future of Value Transfer will look like at deloitte.com/futureofvaluetransfer

CBDCs and Impact on Financial Services Players

Commercial banks are essential partners as well as key stakeholders in successfully rolling out CBDCs. Depending on the design of CBDCs, commercial banks will need to plan for changes in the following areas:

Figure 13: Impact of CBDCs on financial services players

Key impact	High-level scope of changes
Business model Benefit from CBDCs	<ul style="list-style-type: none"> • Banks could innovate current products and services across portfolios to leverage and adjust to CBDCs opportunities and behaviours (for example, designing an offline payment infrastructure or electronic vault to store CBDCs for large institutions). • Roll-out of CBDCs would generate large amounts of transaction data that can open opportunities for analysis and new real-time economic insights. • If Central Banks go the way of account-based design, it will disintermediate correspondent banking networks, as Central Banks would directly provide liquidity in each market. • Wholesale CBDCs would help banks manage counterparty and settlement risks while adding to their efficiencies and pricing. • mCBDCs are likely to provide higher volumes for cross border payments; however, margins are likely to be squeezed. • Banks would be motivated to hold a larger level of liquidity which could result in lower returns for commercial banks. • Banks will have to develop capabilities to advise their customers on CBDCs as an asset class, asset allocation strategies as well as payment and settlement instruments.
Regulation Maintain compliance	<ul style="list-style-type: none"> • Banks will need to maintain compliance with AML, KYC, and custodian-related regulations. • Existing legal frameworks may be reformed based on CBDCs design.
Technology Evolve infrastructure and interfaces	<ul style="list-style-type: none"> • Banks may need to adapt their infrastructure to process CBDCs transactions; enhance digital apps to introduce CBDCs functionality, leveraging existing processes; evolve customer interfaces; and enable open, compatible infrastructure (e.g., digital wallets) or hardware (i.e., physical cards). • For cross-border, FX transactions, or multi-currency wallets, banks may also need to manage designs unique to individual CBDCs. • Developing interoperability capabilities across different technologies and platforms to trigger automatically and atomically the settlement and accounting of transactions
Identity management Verify transactions	<ul style="list-style-type: none"> • Depending on the design decisions of a Central Bank, commercial banks may need to create real-time infrastructure for identity and access management.
Cybersecurity Proactively prevent cyberthreats	<ul style="list-style-type: none"> • Customer privacy and data security are expected to become key concerns due to cybersecurity threats and vulnerabilities.
Financial reporting Navigate tax changes	<ul style="list-style-type: none"> • Different accounting rules and audit and financial reporting requirements are expected for CBDCs transactions.
Talent Reorganize for change	<ul style="list-style-type: none"> • Organizations may need to develop training required to manage CBDC-related processes, technologies, and regulations.

(Source: Central Bank Digital Currencies: The next disruptor, Deloitte)

Depending on the extent of its use, CBDCs can result in a reduction in transaction demand for bank deposits. Interest bearing CBDCs are likely to compete directly with Bank deposits. Since CBDCs provide a risk-free alternative to bank deposits, they could result in a shift away from bank deposits. If CBDCs are designed to provide digital cash, Central Banks may prefer to issue non-interest-bearing CBDCs to create a level playing field.

A reduction of deposits in banks over time which may be caused by this disintermediation, could hamper their ability to create

credit. Banks could also lose a significant source of revenue in low-cost transaction deposits, causing their interest margin to decrease, in turn leading to an increase in the cost of credit.

Early participation in CBDCs pilots and early adoption with the Central Banks as well as counterparties would help Banking players in gaining early inroads into the new technologies as well as ecosystem plays.

Monetary considerations for ecosystem players

Depending on the framework adopted for CBDCs by Central Banks, there will be space for banks and newer fintech intermediaries to innovate and offer products linked to the CBDCs ecosystem. It may also allow FinTechs to directly transact with their retail customers without the need for a banking intermediary. CBDCs are also likely to provide additional customer data and hence provide data monetization opportunities to all ecosystem players.

While some experts believe CBDCs will have an impact on the profitability of card services, there have been proactive steps taken by these organizations. Mastercard, for example, has recently launched a proprietary virtual testing environment for Central Banks to evaluate CBDCs use cases and allow users to virtually customize the platform to replicate their environment. The platform would enable simulation of issuance, distribution, and exchange of CBDCs between banks, financial service

providers and consumers. Similarly, Central Banks, commercial banks, and tech and advisory firms are looking for an opportunity to partner with Mastercard to assess CBDCs tech designs, validate use cases and evaluate interoperability with existing payment rails available for consumers and businesses. Mastercard is looking to utilize its expertise and resources to enable the safe, and secure development of digital currencies.

Visa recently published a research paper that outlines a novel approach for offline point-to-point payments between two devices. Their technical solutions would allow users to download and store their digital money directly onto their personal device on secure hardware embedded on their device which would be monitored by a wallet provider. This would allow users to directly transact with another device without any intermediaries via Bluetooth or Near Field Communication (NFCs).

Conclusion

CBDCs are a fast advancing and inevitable innovation which is likely to impact most large national economies in the next 12-24 months. The issuance and design for CBDCs are likely to be sovereign decisions for each jurisdiction based on their own assessment of CBDC objectives, market maturities and related local factors.

Non-interest bearing tokenized CBDCs are closest to cash and may well be a stepping-stone for retail CBDCs. Wholesale CBDCs are likely to be easier to implement given the institutional nature of the system and may provide real and immediate benefits in financial markets where payments and settlements follow a lag. Multicurrency CBDCs may follow trade flows and countries that are large trading partners are likely to innovate earlier in this space.

As digitization and globalization increase, CBDCs have an important role to play in providing a safe, risk-free digital medium of exchange, store of value and unit of account.

Banks and other financial services players need to prepare for this new category of asset class, its impact on their balance sheets, as well as customer value propositions and the benefits that it offers in terms of atomic transactions and reducing settlement risks.

Endnotes

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