



Co-creating the future ecosystem of banking with Central Bank Digital Currencies (CBDCs)

A whitepaper on CBDCs in the Greater Bay Area
and beyond

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Foreword

Richard Li

Deputy CEO, and Managing Director of Consumer, Private and Business Banking, China, Standard Chartered Bank

CBDCs are one of the key areas of focus for Standard Chartered globally, while China was one of the first countries to study and pilot CBDCs. Having been present in China as a commercial bank for 165 years, Standard Chartered is optimistic about the development of CBDCs and excited to explore how they could enable new propositions to advance the financial services industry worldwide. We are therefore pleased to take part in this joint study with PwC China on potential ways to innovate with CBDCs in commercial contexts, and to present the findings in this paper:

1. CBDCs backed by central banks could enable programmable banking services, which could integrate data silos to better meet the financing needs of industry.
2. CBDC-based programmable loyalty and deep-tier financing solutions could bring radical change to financial services for individuals and for small-to-medium-sized enterprises.
3. The Greater Bay Area (GBA) comprises jurisdictions with different systems and currencies. With its fast-growing economy, the GBA could be a launch pad to test the potential of CBDC use cases in domestic and cross-border contexts.

Enabling policies and technology, as well as support from the market, will all be key to driving the widespread adoption of CBDCs. With this whitepaper, Standard Chartered looks forward to obtaining insights from regulators and related government departments, and driving further exploration and innovation of CBDCs with fellow commercial banks and other industry players.

Ricky Kaura

Head of Transaction Banking, Asia Pacific, Africa and Middle East, Standard Chartered Bank

As more and more central banks actively explore the value of CBDCs, it has become clear that a new generation of banking is seeking them out. The CBDC trade finance model in this paper offers a glimpse into how financial services may evolve to meet corporate clients' complex financing needs, and provides a radical shift for how the deep-tier supply chain is financed.

Our participation and contribution in international industry and regulatory fora such as G20, BIS CPML and FSB is central to the innovative solutions and seamless banking services we are increasingly providing corporate clients.

With Greater Bay Area a strategic region for Standard Chartered, our business here will play an integral role in this exciting CBDC journey.

James Lee

Partner, Advisory Digital, PwC China

As a trailblazer in driving FinTech adoption to solve complex business problems, PwC China is pleased to jointly develop this whitepaper with Standard Chartered and to share CBDC thought leadership in the industry. We recognise the potential of CBDCs and have been actively involved in various initiatives, such as mBridge and the CBDC Global Index report. We aim to contribute to the development of a new era of digital payments underpinned by trust, interconnectedness and innovation. We look forward to continuing conversations with regulators and banks to explore commercial scenarios on CBDC, as well as bringing perspectives from industry to foster the ecosystem's establishment.

1 Executive Summary

Over the past few years, Central Bank Digital Currencies ("CBDCs") have become a core component of the monetary innovation agenda for many of the world's central banks. PwC's Global CBDC Index and Stablecoin Overview 2022 report states that there are currently at least 68 central banks engaged in CBDC development, with the central banks of Mainland China and Hong Kong ranked among the most mature in terms of deploying CBDCs in retail and wholesale contexts¹.

In recognition of the potential of CBDCs, as well as the development plans of the People's Bank of China ("PBOC") and the Hong Kong Monetary Authority ("HKMA") in the Guangdong-Hong Kong-Macao Greater Bay Area ("GBA"), Standard Chartered Bank ("Standard Chartered") and PwC China have jointly conducted a study into the potential opportunities for the use of CBDCs in local and cross-border commercial scenarios. This paper aims to encourage the financial services industry to participate in CBDC ecosystem discussions and development, and to explore the rollout of innovative and practical use cases in the GBA.

A CBDC is the digital form of a fiat currency issued by a central bank. CBDCs are underpinned by trust and could reshape the payments landscape through their infrastructure, which is designed for interoperability with other CBDCs. Recent advances in payment ecosystems have led to many private and public digital wallets and payment solutions becoming

the go-to payment methods for consumers domestically. They offer convenience in both online and in-store retail, and in peer-to-peer payments. However, connecting such solutions across jurisdictions remains a challenge, with international money transfers relying on the services of various financial and payment institutions.

Meanwhile, cryptocurrencies and stablecoins are disrupting the market by offering decentralised payment and real-time settlement that extends beyond individual jurisdictions and is based on self-executing conditions. The financial stability implications of these new payment solutions remain a concern for regulators², particularly the need to design comprehensive oversight mechanisms that provide effective protection for consumers and businesses, while permitting a seamless customer experience that enables day-to-day usage in domestic and cross-border contexts³. Central banks are therefore exploring CBDCs and their potential to combine the merits of differ-

¹ PricewaterhouseCoopers (April 2022). Global CBDC Index and Stablecoin Overview 2022.

<https://www.pwc.com/gx/en/new-ventures/cryptocurrency-assets/pwc-global-cbdc-index-stablecoin-overview-2022.pdf>

² International Monetary Fund (September 2022). Regulating Crypto.

<https://www.imf.org/en/Publications/fandd/issues/2022/09/Regulating-crypto-Narain-Moretti>

ent payment solutions and digital currencies for widespread adoption – domestically and cross-border – leveraging the trust established by the central banks.

Apart from being a tool for digital payments, CBDCs could also unlock the potential of programmability in banking services, thus disrupting the market and offering a new approach to cross-industry innovation.

Programmability refers to the deployment of smart contracts to programme self-executing transactions with pre-defined conditions. An ecosystem built on CBDC infrastructure could include additional layers that facilitate the use of programmability. This could then connect siloed but interrelated business ecosystems and enable participants to collaborate and reimagine their offerings. Such a technological advance will introduce a paradigm shift in the roles and responsibilities of banks and other participants, such as payment service providers, merchants, central banks and regulators, and could reshape how they serve their customers and deliver new values.

This paper explores the opportunities of programmable CBDCs within commercial

scenarios in the retail, trade and supply chain finance domains. It examines how existing retail customer loyalty models and supply chain finance solutions could be transformed by CBDCs. Our findings from research and industry interviews suggest that programmability of CBDCs could be applied to retail scenarios with relatively little complexity, while applications in trade and supply chain financing may require a more radical change in technology and global collaboration. All use cases hinge on four common building blocks: (i) smart contract design and operations; (ii) data management and sharing mechanisms; (iii) interoperability between CBDCs and other ecosystems; and (iv) local and cross-jurisdictional regulatory support.

Looking ahead, the successful rollout of these use cases could be the catalyst for a new era of programmable banking: where technologies such as smart contracts connect banks and industry participants to create new service propositions. For this to happen, participants will need to collaborate in shaping the future of CBDCs together – testing and pioneering disruptive new use cases.

³Bank for International Settlements (December 2022). Prudential treatment of cryptoasset exposures. <https://www.bis.org/bcbs/publ/d545.htm>; Financial Stability Board (October 2022). Regulation, Supervision and Oversight of Crypto-Asset Activities and Markets: Consultative report. <https://www.fsb.org/2022/10/regulation-supervision-and-oversight-of-crypto-asset-activities-and-markets-consultative-report/>

2 Introduction

The growing need for trusted and efficient digital payments – especially cross-border – along with the proliferation of unregulated cryptocurrencies, has prompted global regulators and industry players to study CBDCs and to explore their potential to transform the payment landscape.

This paper aims to set out perspectives and promote discussions around (i) a future CBDC-enabled banking ecosystem; (ii) potential CBDC use cases for retail and trade (both domestic and cross-border), implications for stakeholders, and the building blocks required to enable them; and (iii) a potential way forward for CBDCs in the GBA.

2.1 What is a CBDC?

A CBDC is a new, digital form of a fiat currency, issued and governed by a central bank in a monetary system which ensures the legitimacy of the currency and all transactions. CBDCs are designed to address existing challenges in the payment ecosystem and to enable local and cross-border payment innovations. More than 80% of central banks globally are engaged in CBDC development, driven by (i) the growing trend for cashless payments; and (ii) the need to introduce regulatory oversight over privately issued cryptocurrencies, as illustrated below⁴.

With the pandemic that has bolstered ongoing global digitalisation, there has been increasing adoption of cashless

payments, such as contactless cards and digital wallets. According to a study by PwC, there were 1,035 billion global cashless payments in 2020. This figure is expected to increase by 82% in 2025 and to almost triple by 2030⁵. Research by the World Bank finds that two-thirds of adults worldwide have made or received a digital payment⁶.

Meanwhile, cryptocurrencies and stablecoins have arisen as alternative means of digital payment, with the potential to deliver efficiency and automation in payment processes based on pre-defined conditions (i.e. programmability). Most of these infrastructures are privately owned and applicable regulations and stan-

⁴ PricewaterhouseCoopers (April 2022). Global CBDC Index and Stablecoin Overview 2022.

<https://www.pwc.com/gx/en/new-ventures/cryptocurrency-assets/pwc-global-cbdc-index-stablecoin-overview-2022.pdf>

⁵ PricewaterhouseCoopers (2021). Navigating the Payment Matrix – Charting a Course amid Evolution and Revolution.

<https://www.pwc.com/gx/en/financial-services/fs-2025/pwc-future-of-payments.pdf>

⁶ The World Bank (June 2022). COVID-19 Drives Global Surge in use of Digital Payments.

<https://www.worldbank.org/en/news/press-release/2022/06/29/covid-19-drives-global-surge-in-use-of-digital-payments>

dards are still being studied and developed. Risks of manipulation, fraud and cyberattack remain, posing challenges for further commercial adoption. While regulators globally are introducing legislation for cryptocurrencies, there is still a gap in the protection provided to holders of crypto compared to fiat currencies.

These trends have prompted central banks to further explore the potential of CBDCs. There is clear market demand for a trusted means of digital payment with high operational resilience and which can be universally accepted within and across jurisdictions.

2.2 Key features of CBDCs

CBDCs could shift the existing payments landscape because of the following features:

(a) Higher efficiency and transparency in cross-border applications

Existing payment services that rely on the correspondent bank model are facing challenges in further improving the speed and lowering the cost of cross-border payments. This is primarily due to the complexity of settlement across multiple currencies involving various counterparties and infrastructures, along with their respective controls, such as procedures to comply with Anti-Money Laundering (“AML”), Counter-Terrorism Financing (“CTF”) and other laws and regulations across jurisdictions.

Various initiatives have been launched to test the feasibility of using CBDCs for cross-border transactions. For example, Project mBridge aims to offer a single

platform with interoperability across domestic clearing systems⁷. A pilot has been completed with USD22 million of cross-border trade between four jurisdictions (Hong Kong, Thailand, Mainland China and the United Arab Emirates) to demonstrate the potential of CBDCs for real-time cross-border payment⁸.

Transparent, irreversible and traceable CBDC transactions on a common infrastructure could offer a new communication channel to connect siloed but interrelated business ecosystems. This would enable industry players to enhance existing cross-border applications or launch new ones. For example, governed access to CBDC transaction data could help with AML and CTF compliance, which is difficult when data is fragmented across banks and other business stakeholders/ecosystems. Compliance procedures overall could be simplified through CBDC-enabled post-transaction controls.

⁷Bank for International Settlements (October 2022). Project mBridge - Connecting economies through CBDC. <https://www.bis.org/publ/othp59.pdf>

⁸Bank for International Settlements (October 2022). BIS and four central banks complete successful pilot of real-value transactions on cross-border CBDC platform. <https://www.bis.org/press/p221026.htm>

(b) Programmability for conditioned payment

Similar to cryptocurrencies, CBDCs could support automated payments based on the pre-defined business logic in smart contracts (programmability). Contracts could be established to a CBDC with specified terms and conditions that are verifiable and executed automatically upon fulfilment. Trusted sources that are validated by industry participants or credible institutions could be enabled to support the internal or external triggers of such smart contracts. These triggers eliminate the need for error-prone manual intervention to calculate and confirm payment before execution. For example, transactions between a merchant and customer could be facilitated by payment in a CBDC and conditions that validate the digital identity of both participants.

(c) A higher level of trust beyond domestic jurisdictions

Private-sector digital payment solutions, such as digital wallets, are typically limited to use within a given jurisdiction. These

providers may be required to reserve a percentage of clients' funds with centralised custodians or central banks to provide a layer of customer protection. However, the associated services, operations and governance of the digital solutions are still primarily managed by the private providers. As a result, users are essentially trusting the provider's ability to manage their data and funds. Domestic users tend to be comfortable with the payment solutions of a familiar local provider, but adoption by foreign users could be limited due to a lack of familiarity and trust.

In addition to having a cash-equivalent legal status, a CBDC's foundational systems and infrastructure are provided by its central bank. In the case of cross-border applications, multi-jurisdiction platforms such as mBridge are also managed by central banks and regulators, who are more likely to be recognised by its users. CBDCs could therefore potentially bring a higher level of trust for domestic and cross-border users.

2.3 Opportunities in the GBA

Given its multi-currency, multi-jurisdictional nature, the GBA could be an appropriate launch pad for CBDC pilots:

(a) Growing cross-border economic activity

One of the strategic focuses of China's 14th Five-year Plan, statistics in the GBA indicates great economic potentials for

⁹ Leading Group of Guangdong Province for the Development of the Guangdong-Hong Kong-Macao Greater Bay Area (April 2022) Greater Bay Area surpasses 12 trillion yuan GDP mark in 2021.

https://www.cnbayarea.org.cn/english/News/content/mpost_895560.html

National Bureau of Statistics of China (December 2022) Announcement of the National Bureau of statistics on the Final Verification of GDP in 2021.

http://www.stats.gov.cn/english/PressRelease/202212/t20221227_1891279.html

Census and Statistics Department of the Hong Kong Special Administrative Region (February 2022) 2021 Gross Domestic Product.

https://www.censtatd.gov.hk/en/data/stat_report/product/B1030002/att/B10300022021AN21E0100.pdf

Government of Macao Special Administrative Region Statistics and Census Services (March 2022). Produto Interno Bruto Gross Domestic Product 2021.

https://www.dsec.gov.mo/getAttachment/e71ebee4-70ed-4e97-bec2-a926d11a0246/E_PIB_PUB_2021_Y.aspx

cross-border interaction between consumers and businesses. It is an important driver of China's economic growth, with a total GDP of CNY12.6 trillion in 2021, equivalent to 10% of the combined GDP of Mainland China, Hong Kong and Macau⁹. There was CNY3.8 trillion of cross-border settlement in 2021, more than Hong Kong's GDP of nearly HKD2.9 trillion¹⁰. Despite improving connectivity in the GBA, there are still gaps that CBDCs could fill to provide simpler, faster and trusted cross-border transactions.

(b) Appropriate environment for multi-CBDC applications

Since April 2020, the PBOC has carried out domestic pilot testing of e-CNY. Focussed on retail B2C applications, the pilot has covered 26 areas in Mainland China and

accounted for CNY100 billion of transactions in retail, financial and public services¹¹. In parallel, the HKMA has highlighted the e-HKD as part of its FinTech 2025 strategy and published three whitepapers on the feasibility of retail CBDCs in Hong Kong. In its latest publication, the HKMA lays out a roadmap for implementing e-HKD, beginning with multiple pilots in 2022 Q4¹². Recent PBOC and HKMA initiatives to drive CBDC adoption and cross-border use in the GBA include the e-CNY pilot for Hong Kong citizens in Shenzhen (a GBA city)¹³. The GBA could hence provide an appropriate environment for large-scale, multi-CBDC pilots. These would facilitate regulator-industry collaboration cross-border and thus enable mass adoption.

“There is an undeniable need for more efficient, accessible, and innovative ways to conduct payments. We are excited to see how the CBDC journey will unfold in meeting market demands, in particular the model that consists of overlaying private sector innovation on top of public infrastructure.”

– Global Payment Service Provider

¹⁰ People's Daily Online (March 2022). People's Bank of China: Renminbi has become the largest cross-border settlement currency in the Guangdong-Hong Kong-Macao Greater Bay Area.
<http://finance.people.com.cn/n1/2022/0308/c1004-32369554.html>

¹¹ People's Daily Online (December 2022) The expansion of the digital renminbi pilot project will play a positive role in promoting the steady growth of consumption.
<http://finance.people.com.cn/BIG5/n1/2022/1220/c1004-32590396.html>

¹² Hong Kong Monetary Authority (September 2022). e-HKD – Charting the Next Steps.
<https://www.hkma.gov.hk/media/eng/doc/key-information/press-release/2022/20220920e4a1.pdf>

¹³ People's Daily Online (November 2022). Shenzhen Luohu will carry out digital RMB cross-border consumption test.
<http://sz.people.com.cn/BIG5/n2/2022/1104/c202846-40181751.html>

3 The future of banking enabled by CBDCs

3.1 From programmable money to programmable banking

Banks and FinTech players have been actively seeking to unlock new opportunities through innovative technologies. For example, open banking APIs promote the secure exchange of customers' financial data between institutions. However, the accuracy of the data is dependent on the data providers. Contract execution may also lack transparency. Smart contracts and CBDCs can provide traceability and verifiability of executed transactions. A high level of trust and transparency will encourage further innovation and industry collaboration – helping to usher in a new era of programmable banking.

Programmable banking depends on a trusted, digital medium of exchange which can be automatically triggered by different conditions. While industry players have provided options such as stablecoins and digital payment platforms,

there has yet to be a solution that offers sufficient trust for mass adoption on a global scale. CBDCs may be able to fulfil that role.

Programmable banking could not only enable automated banking services, but also help to integrate traditional banking with other industries' offerings and value chains. For example, banks could improve their retail, trade and supply chain finance services through CBDC-based programmed value transfer (see section 4). They could deliver new values and reimagine business models to better serve their clients. The GBA could be the starting point to pilot a programmable banking ecosystem, accelerating cross-border industry collaboration and deepening economic integration in the region and beyond.

3.2 Core components in programmable banking

The programmable banking ecosystem could consist of three layers: (i) Foundational infrastructure; (ii) Application-level smart contracts; and (iii) Programmable banking services.

Potential Programmable Banking Ecosystem

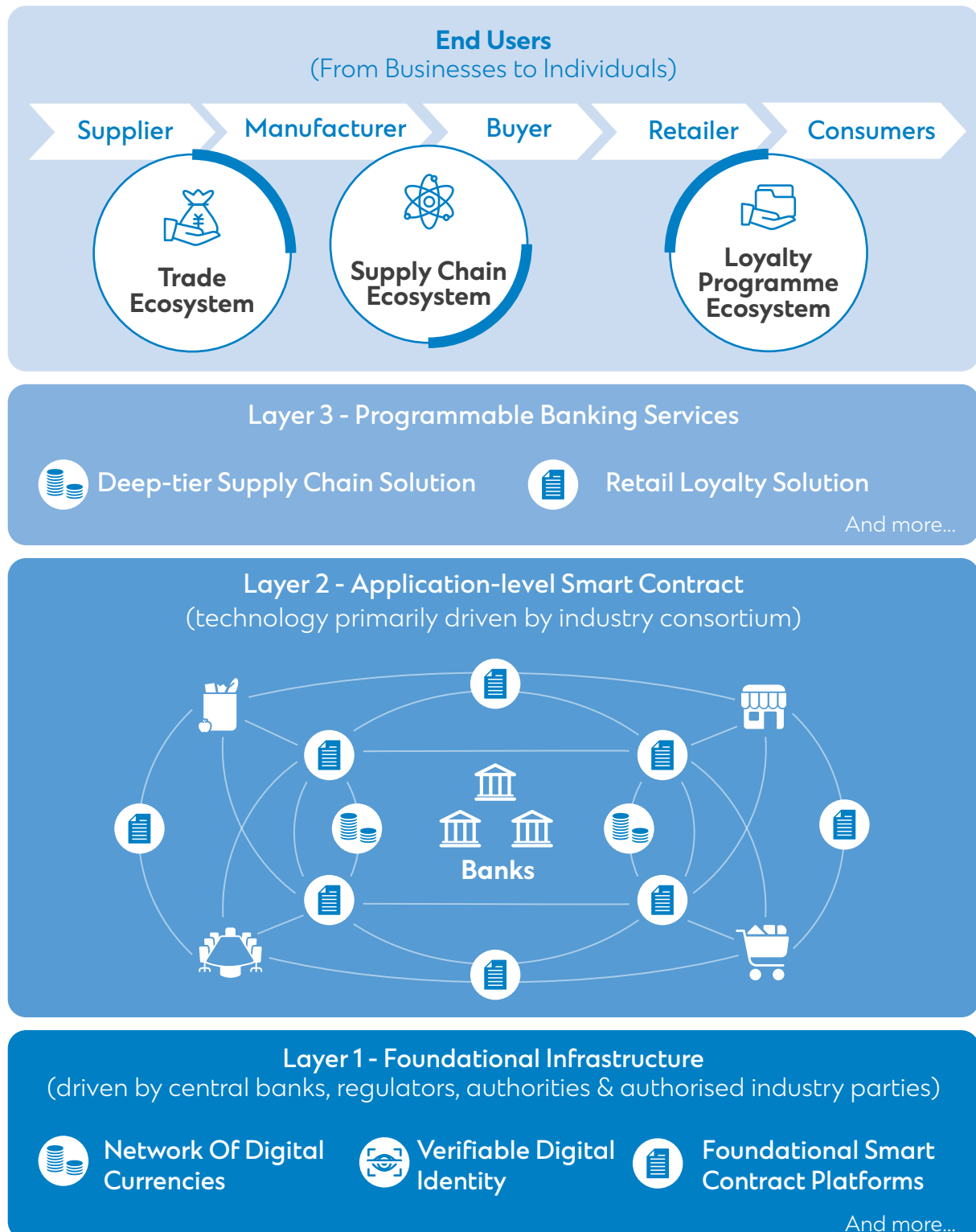


Figure 1. The programmable banking ecosystem

Layer 1: Foundational infrastructure

This is a digital foundation, driven by regulators, which enables seamless, trusted transaction executions between banks and stakeholders across different industries. Trust is built upon common or interoperable protocols to enable each stakeholder to communicate and validate the context of transactions. In particular, these include the identities of transacting parties; the trusted medium of exchange backed by authorised parties; and the traceable and verifiable contract conditions for executing transactions. These infrastructures form a baseline to enable banks and industry participants to implement programmable features in their respective domains. Set out below are the essential components to support trusted execution of digital transactions:

1. Verifiable digital identity

A common and mutually accepted digital identity for each participant enhances the legitimacy and traceability of transactions. It enables individuals and businesses to represent themselves, and act with permission on behalf of others, across multiple digital services and transactions. Ideally, this identity is tied to digitally verifiable proofs of identity issued by governments or other reputable organisations. The machine-readable identity is verified automatically and simplifies Know Your Customer (“KYC”) and other procedures across CBDC infrastructures and other collaborating platforms.

2. Network of digital currencies

Being legal tender, CBDCs are a trusted medium of exchange in digital form, and each CBDC is recognised within its jurisdiction. It can be programmed and embedded into different digital services to enable conditional monetary payment

between parties.

For business transactions involving multiple currencies, interoperable networks or “CBDC bridges” can facilitate the transfer of value in both online and offline transactions across jurisdictions. The bridge extends trust beyond the domestic jurisdiction by keeping track of cross-platform CBDC movements in traceable shared ledgers.

3. Foundational smart contract platforms

A foundational infrastructure layer is essential to govern the logic of smart contracts and execute transactions. Smart contracts contain self-executing conditions and rules, and can be digitally signed by transacting parties to form agreements. Smart contracts across networks can also be connected and cascaded to implement complex logic within agreements. For instance, smart contracts can be connected in CBDC infrastructures and trade and supply chain finance platforms to enable conditional payment based on smart contract-driven trade agreements. In addition to foundational smart contract platforms, CBDC and other general-purpose smart contract platforms could allow authorised parties to create custom and industry-specific smart contracts in Layer 2 to enable business innovation.

Layer 2: Application-level smart contracts

Smart contracts at the application level can be driven by individual participants or an industry consortium. They leverage Layer 1 infrastructure (foundational smart contract platforms, digital identity and CBDC) to define industry-specific business rules and validation logic, enabling trusted agreement between industry participants¹⁴. This allows industry players to apply more complex and tailored logic to the smart contracts in order to develop

new services and a future programmable ecosystem.

The applications developed by industry participants will connect with trusted data sources to trigger the execution of smart contracts, thereby enabling the automation of end-to-end business processes based on industry-specific events.

Layer 3: Programmable banking services

Banks can create programmable smart contracts to provide event-driven services, such as programmed payments and loans. These can be embedded into industry-specific processes, such as retail loyalty operations or trade and supply chain financing (see section 4). Banks can also connect smart contracts across industries or jurisdictions to enable wider collaboration and innovation in embedded financial services.

3.3 Implications for stakeholders in the ecosystem

Programmable banking provides opportunities to enhance existing offerings and deliver new values. This can lead to changes in the ecosystem's roles and responsibilities. The following lays out the implications for participants, including banks, payment service providers, key industry players, central banks and regulators.

(a) Commercial banks

Commercial banks play a significant role across the three layers of programmable banking. In Layer 1, banks connect the foundational infrastructure with banking and other industry services. These include digital wallets, KYC processes, transaction risk and compliance monitoring, and exchange between cash and CBDCs. Banks also connect the industry-driven smart contract networks in Layer 2 with the foundational smart contract platforms in Layer 1.

In Layer 2, banks can move beyond providing financial services and act as business facilitators to drive the development of programmable services. For example, banks could coordinate with industry participants to set up cross-industry standards and provide smart contract-driven services. This could ensure

interoperability of the smart contracts required in event-driven banking services. In Layer 3, banks can rethink their existing business and empower business units to collaborate in the development of new products. This requires banks to develop the technical and operational capabilities to deploy disruptive programmable banking services across the industry value chain. For example, banks will need smart contract development capabilities to support the programmability of banking services.

(b) Payment service providers ("PSPs")

In addition to connecting payment ecosystem participants, PSPs can take up a new role as the interface to smart contract services between banks and businesses. Traditionally, PSPs provide services such as payment instruction manage-

¹⁴ Bank of England (February 2023). The Digital Pound, Technology Working Paper.

<https://www.bankofengland.co.uk/-/media/boe/files/paper/2023/the-digital-pound-technology-working-paper.pdf>

ment, transaction validation and processing, and participant coordination. In the realm of programmable banking, while payments can be settled automatically in real-time without the need for reconciliation, PSPs could bridge between businesses and banks in smart contract services, while continuing to provide merchant-centric services.

PSPs can leverage the foundational infrastructures to enhance their service offerings. For example, they can streamline transaction party verification by incorporating digital identity in the payment gateway. Depending on the ecosystem's design, PSPs could gain access to CBDC transaction data, including historical transaction data with other PSPs. They could then combine data from CBDC and non-CBDC transactions to enhance transaction risk management, such as fraud detection, and thus provide better insights to merchants. With smart contracts, PSPs can also innovate their payment services. These could facilitate a seamless and secure payment experience for customers and merchants.

PSPs could move beyond payments by leveraging their in-depth understanding of their customer network and network partners. They could partner with banks to develop smart contracts that embed banking services within their payment services. They could also develop innovative service offerings, such as aggregating merchants to establish a new form of loyalty programme alliance (**see section 4.1**).

(c) Key industry players

With programmable banking, businesses could obtain financing at lower cost.

They could also enjoy better customer profiling and event-driven banking services. Enhanced credit assessments using CBDC data could be key to enabling SME financing for small merchants and businesses. For example, trade and supply chain financing could be developed by extending liquidity and financing from the buyers to their suppliers (**see section 4.2**).

Businesses can also provide alternative payment options to customers using CBDCs. This could lower operating costs and drive better customer engagement. Conditioned payment transfers could increase trust on the part of customers. They can include clawback conditions in the event of a merchant default, or transfer of money only upon confirmed service delivery. With these facilities available at no or low transaction cost, the operational costs associated with payment collection could be lower. Businesses can also create innovative services, such as loyalty points in CBDC (**see section 4.1**) that support a loyalty programme alliance and cross-border use of loyalty points.

With these features, industry players can help shape the future programmable ecosystem. Industry consortiums could be established to set standards and build common infrastructures, such as data requirements and smart contract governance. Collaboration within and across industries could help establish a programmable ecosystem, with industry services that interact with each other. These elements can empower businesses to adopt common smart contract standards and to maximise the potential of programmable services.

The PBOC has launched a pre-payment function known as “Secured Pay” in its digital wallet “e-CNY APP (pilot)” in which pre-paid funds are held by Authorised Operators and can be refunded if the merchant is no longer able to render the services ordered – thus offering a layer of protection to the customer¹⁵.

(d) Central banks and regulators

Programmable banking innovations enabled by CBDC could drive the need for central bank money, ensuring its role as the anchor of monetary and financial stability. Central banks and regulators would also be able to reinforce trust and stability in the financial system and have better visibility over monetary transactions. With infrastructures backed by the central bank, end-customer trust in associated services could also be strengthened. Central banks and regulators could provide better oversight based on pre-defined rules in smart contracts, as well as better traceability of transaction data (for AML, CTF or other purposes). These infrastructures could also support cross-jurisdictional oversight of international services.

The development and adoption of a programmable banking economy are dependent on an open, inclusive and collaborative ecosystem for industry play-

ers. Central banks can support this by providing regulatory clarity on the governance framework (for example, on cross-border data flows) and by facilitating cross-industry collaboration on innovative designs.

Extending the impact of programmable banking beyond their domestic jurisdiction, central banks and regulators could continue to coordinate with their international counterparts in developing the required common or interoperable infrastructures and standards for cross-border scenarios. One example of such an initiative is the mBridge project. Led by the Bank for International Settlements (“BIS”) and central banks, it explores a potential cross-border CBDC transaction infrastructure design and prototype, which caters to both international and local payment standards. Such initiatives could be essential in extending programmable banking use cases beyond payments and across jurisdictions.

¹⁵ People's Bank of China (2022). e-CNY App

4 Commercial applications of CBDCs

There are many potential business uses of CBDCs. This section illustrates how programmability could be leveraged to transform retail and trade and supply chain finance.

The use cases in this section are underpinned by the following key assumptions:

- (i) Design and application of smart contracts to CBDC and/or CBDC wallets will be enabled;
- (ii) The CBDC transaction data of businesses and individuals can be shared with other parties upon consent; and
- (iii) Self-executing payments can be programmed, with authorised external data sources as triggers.

4.1 Programmable retail platform

The retail payment experience currently consists of one or more of these three components: (i) payment with physical cash, debit card, mobile wallet or other stored-value digital solution; (ii) personal financing via credit card or services such as ‘buy now, pay later’; and (iii) accumulation and spending of loyalty points via physical loyalty cards and digital loyalty apps, which typically require consumers to use separate cards and mobile apps, and could be cumbersome to manage. CBDCs and the programmability feature

could potentially be leveraged to create a new programmable retail platform to transform the consumer retail market, which totalled CNY44 trillion in sales in China in 2021¹⁶.

The following two use cases explore how the three components of retail payments could be integrated into a cohesive experience by using CBDC infrastructure. They build on the programmability enabled by CBDC infrastructure, which could also help realise the cross-jurisdiction potential of loyalty programmes.

¹⁶ PricewaterhouseCoopers (August 2022). 2022 Global Consumer Insights Survey China Report. <https://www.pwccn.com/en/retail-and-consumer/publications/2022-global-consumer-insights-survey-china-report-aug2022.pdf>

“Customers are at the core of our loyalty programme. We see huge potential for CBDCs to help connect and implement a streamlined cross-border experience for customers while reducing operational complexity.”

– Loyalty Programme Operator in the GBA

4.1.1 Cross-border loyalty platform

Many medium-to-large-sized merchants, such as physical shopping malls and online retail platforms, have established loyalty programmes for their retail businesses and have a presence in more than one jurisdiction. Despite recognition of the commercial value of cross-jurisdiction loyalty programmes for travellers, many programmes are operated in silos geographically, despite being under the same brand, especially when merchants have yet to achieve sizable scale internationally. Loyalty rewards earned across various geographical areas cannot, therefore, be collectively used for redemption in all jurisdictions where the merchants have a presence.

Merchant networks often face challenges in implementing cross-border loyalty programmes due to the complexity and associated costs of programme manage-

ment across jurisdictions. Complexities include tax implications and compliance with regulations, such as on cross-border capital and data flows. As a result, loyalty programmes under the same brand may be operated separately in certain jurisdictions. Their customers may need to manage two or more accounts or mobile apps to store and use the loyalty points earned, which is inconvenient and less effective in driving customer loyalty.

A CBDC programmed to be payable only to specific merchants could be a solution to this. If the CBDC is programmed to work cross-border it could help merchants to bridge their established loyalty programmes in different jurisdictions. This could be a game changer for merchants such as shopping malls, as they can create a unified retail experience at scale for their customers internationally.

Overview of the potential use case

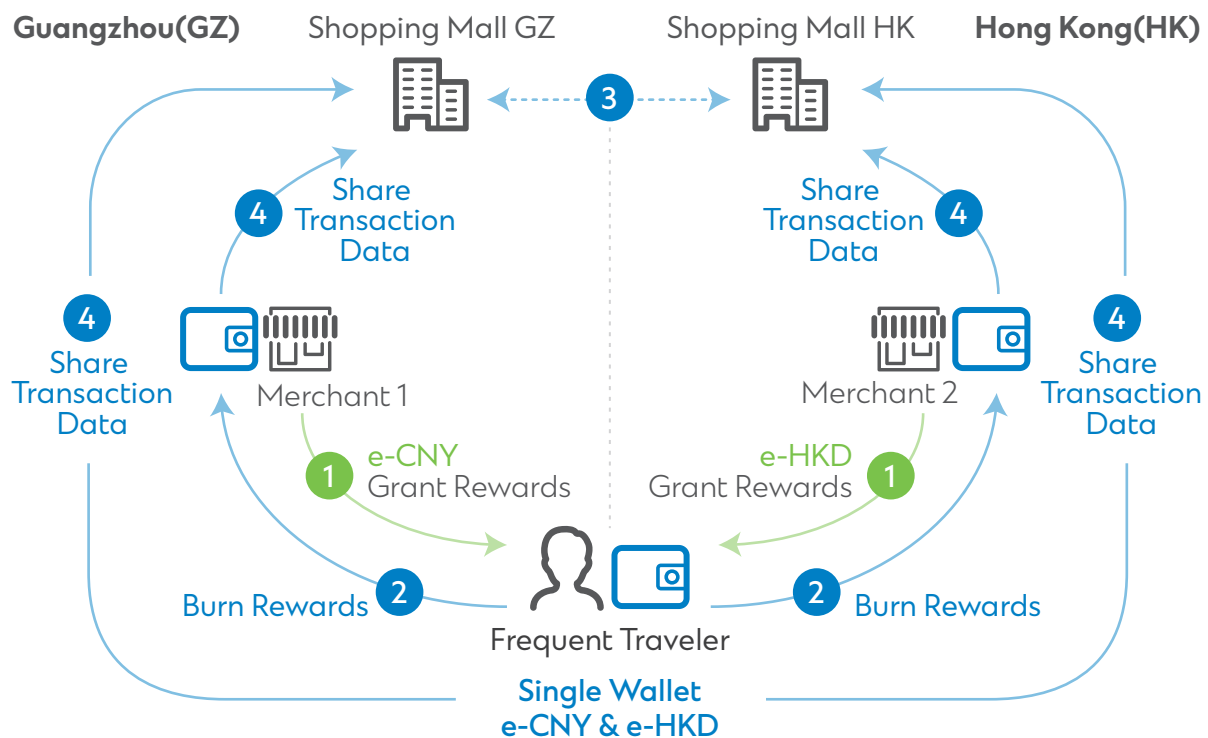


Figure 2. Example of a CBDC-enabled cross-border loyalty platform

With a programmed CBDC that spans different jurisdictions, a customer could potentially earn the CBDC from a merchant in one jurisdiction and carry it cross-border in a multicurrency-CBDC wallet that incorporates currency-specific sub-wallets (similar to a multicurrency account). The customer can then directly settle with merchants in another jurisdiction, using the CBDC like cash, as illustrated in Figure 2.

This use case also applies where the same currency is commonly accepted in both jurisdictions, such as CNY in Mainland China and Hong Kong, and USD in the United States, Ecuador, Bahamas and

other areas. Subsequently, the use case could be expanded to involve two or more currencies with features such as foreign exchange. In this case, the underlying CBDC of the loyalty reward could be converted to the CBDC of another currency, without impacting the smart contract that programmes the CBDC.

Retail and loyalty programme transaction data captured in the CBDC wallets of the merchants and consumers could, with consent, be shared with the merchant network for analysis and management of the loyalty programme, as well as to better understand customer preferences for tailored services.

Potential benefits

(a) Simplified cross-border settlement and reconciliation

Merchants could grant and accept programmed CBDCs as loyalty rewards, to be settled upon payment without the need for further clearing and reconciliation between the two entities of the same merchant network – even if they are located in different jurisdictions. Since cross-border settlement between merchants is no longer required, the associated complexities relating to tax, capital flows and data transfers may also be simplified or resolved.

(b) Streamlined customer experience with a single wallet

A multicurrency wallet offers convenience and a streamlined customer experience across different jurisdictions for payment, access to personal financing and management of loyalty rewards. It may bring associated benefits, such as quicker accumulation of CBDC-based loyalty points and greater flexibility in spending the points for rewards with different merchants under the same network in various jurisdictions.

Key considerations

(a) Data privacy and sharing

Sharing data related to consumers' wallet transactions and their use of loyalty programme services will be a critical factor for the adoption of this CBDC use case by the merchants and the network. Data management, a mechanism for sharing data and related privacy features will need to be considered. One possibility would be privacy features that only extract transaction data related to specific merchants from CBDC wallets. This data can then only be shared with merchants on the network's registry of members.

(b) Guidance on applicable laws and regulations

Consultation with regulators will be required to fully agree the implications for the use case of the current legal and regulatory requirements. These may relate to tax, capital flows and data transfers, and AML / CTF concerns raised by stored value facilities. New guidelines may need to be designed for this reimagined, CBDC-enabled loyalty programme.

4.1.2 Loyalty programme alliances

Small merchants may not be accepted into the loyalty programmes of established merchant networks. They may then launch their own loyalty programme – typically in the form of a mobile app or a physical loyalty card. Managing several of these small loyalty programmes is cumbersome for consumers to manage. This results in lower customer engagement, as they prioritise enrolment to and usage of loyalty programmes with a wider network. This is a difficulty for smaller-sized businesses seeking to improve customer loyalty.

Loyalty programmes with manual elements, such as stamps on physical cards or manual records in a merchant's internal system, are often difficult to maintain and prone to human error. While digital solutions offered by third

parties have emerged in recent years, their costs could still be burdensome to some merchants and may lack interoperability with other merchants or networks as the business grows.

A programmed CBDC payable only to specific merchants could be leveraged to develop a low-cost loyalty programme solution. It would facilitate the digitalisation of the paper-based programmes operated by smaller merchants, and would help to create a level playing field for merchants of all sizes by lowering the barriers to collaboration. With programmed CBDC, new approaches to alliances between merchants selling different goods and services could be made possible. For example, these could be based on specific customer types, backed by data analytics.

Overview of the potential use case

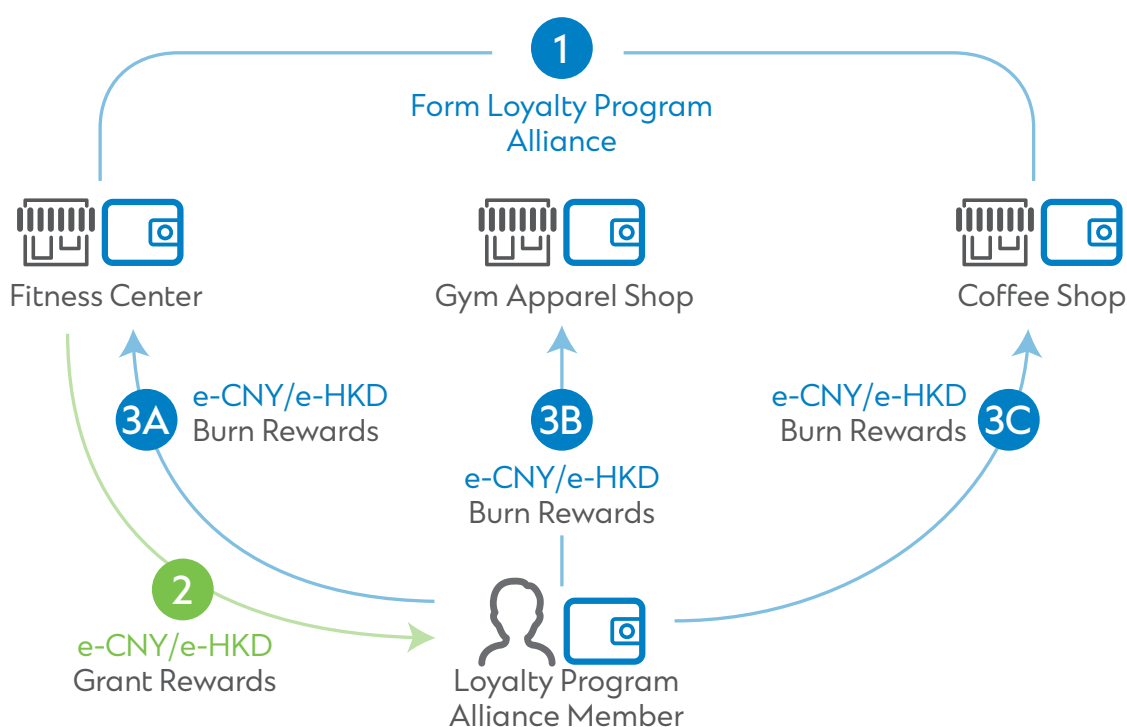


Figure 3. Example of CBDC-enabled loyalty programme alliance with e-CNY and e-HKD in the GBA

As discussed above, merchants could use innovative approaches to form loyalty programme alliances with lower barriers. For example, as illustrated in Figure 3, a fitness centre, a gym apparel shop and a coffee shop could partner to offer a loyalty programme to consumers who exercise regularly and are coffee enthusiasts. In such cases, the CBDC could be programmed to be payable only to the merchants within the alliance.

Consumers who join the loyalty programme can manage it through a single app/wallet and earn and spend loyalty rewards in the form of programmed CBDC from any of the mer-

chants within the alliance. Consumers can also purchase the programmed CBDC from businesses in the alliance, and transfer it to friends, just as they do with cash vouchers and gift cards.

As with the use case in Section 4.1.1, the underlying CBDC could be converted to the CBDC of a different currency without altering the smart contract used to programme the CBDC, should different currencies be accepted by merchants in the alliance. These alliances could also be cross-border to provide more convenience to travellers and enlarge the customer base for the merchants.

Potential benefits

(a) Lower barrier for collaboration and innovation

With programmed CBDC as a common reward currency, the interoperability between loyalty programmes is increased. This provides flexibility around participation in existing loyalty programmes or the formation of new alliances. The lowered barrier to forming alliances could also promote innovation among merchants of varying sizes and types. In this way, loyalty programmes can be formed beyond a single brand or category of goods and services, so as to better target and serve customers.

(b) Empowering smaller merchants

Programmed CBDCs could help the digitalisation of manual approaches in operating loyalty platforms and improve interoperability among merchants. Smaller merchants who adopt programmed

CBDCs as loyalty rewards will be able to bridge their loyalty programmes with lower technology and operational barriers. This could increase customer engagement with smaller merchants and strengthen their position in the market. Merchants could also exit and switch loyalty programme alliances with greater flexibility.

(c) Streamlined consumer experience

The digitalisation of paper-based loyalty programmes and the formation of alliances among merchants could significantly enhance the customer experience by reducing the number of loyalty programmes and associated mobile apps that customers need to manage. Consumers will also be able to consolidate loyalty rewards from merchants in the alliances and redeem rewards more quickly.

Key considerations

In addition to those mentioned in Section 4.1.1, there are some specific considerations for CBDC-enabled loyalty programme alliances:

(a) Development of a low-cost CBDC loyalty programme solution

Medium-to-larger players could adopt programmed CBDC for their loyalty rewards with relative ease, given their know-how and existing infrastructure, such as loyalty rule engines and mobile apps. Adoption by smaller merchants, who lack this technology foundation, may not be as straightforward. As such, there may be a need for new or existing third-party vendors to leverage CBDCs and develop loyalty programme solutions targeting smaller merchants and providing essential features, such as front-end interfaces and basic analysis tools.

(b) Formation and operation of loyalty programme alliances

Given the limited resources of smaller merchants, it may be challenging for them to drive the formation of alliances. These require analysis of potential syner-

gies, alignment of loyalty reward rates and other associated terms and conditions. At the same time, mature merchant networks that were formed based on physical premises (such as shopping malls) or an industry-based service (such as airlines) may not have commercial incentives to broaden their networks.

In such cases, parties with an in-depth understanding of merchants may be needed to propose and facilitate the formation of new or expanded alliances. Such merchant aggregators would need data-driven insights. Payment service providers who currently provide merchant-focused services and capture merchant and consumer transaction data could be suitable candidates. This effectively opens up new roles which existing or new service providers could play in the CBDC ecosystem, providing an additional source of revenue to these players.

4.2 Programmable trade and supply chain financing

Currently, up to 80% of global trade is facilitated by financing solutions or credit insurance¹⁷. These solutions are typically used when buyers prefer to make payment at the end of the invoice period or upon the receipt of goods/services, while sellers require working capital earlier to support their operations.

Most trade and supply chain financing solutions are accessible to buyers and suppliers with sound credit ratings, but

may not be available to or adopted by ‘deep-tier’ suppliers, who are often SMEs that lack scale or an adequate credit history. This suggests that there is a significant addressable market that is currently underserved. According to the Asia Development Bank, this ‘trade finance gap’ widened from USD1.5 trillion in 2018 to USD1.7 trillion in 2020 – equivalent to 10% of global trade¹⁸.

¹⁷ World Trade Organization (2016). Trade Finance and SMEs. https://www.wto.org/english/res_e/booksp_e/tradefinsme_e.pdf

¹⁸ Asia Development Bank (October 2021) 2021 Trade Finance Gaps, Growth, and Jobs Survey. <https://www.adb.org/sites/default/files/publication/739286/adb-brief-192-trade-finance-gaps-jobs-survey.pdf>

There are two major challenges in providing either traditional financing or secured lending to SME suppliers. First, they generally lack assets to pledge as collateral for secured lending. Second, they may face difficulties in demonstrating the legitimacy and sustainability of their business for credit analysis. These result in high costs and intensive due diligence processes when evaluating the credit risks of deep-tier suppliers¹⁹.

FinTech partnerships with trade banks have helped mitigate the complexities of providing SME financing. For example, some trade banks have partnered with solution providers to enable deep-tier

supply chain financing in Mainland China through blockchain-based solution. In addition, there are also digitalised trade platforms that connect investors who wish to invest in alternative asset classes, such as supply chain financial assets, with businesses that require supply chain financing. There are also emerging decentralised finance (“DeFi”) platforms that leverage cryptocurrencies and smart contracts to fulfil the financing needs of SMEs. They typically provide trade and supply chain financing through the over-collateralisation of the underlying trade assets to mitigate the risk of price volatility.

“While legal documents and payment instruments are being digitalised, digitalisation of payment via programmability could be the last mile to enabling full digitalisation of supply chain finance.”

– Supply Chain Finance Technology Solution Provider in the GBA

CBDCs can potentially bring the next wave of innovation by reimagining existing service offerings and enabling next-generation trade and supply chain finance. Powered by the programmability of CBDCs and the data captured in CBDC infrastructure, the credit or liquidity of ‘anchor enterprises’ could be passed on to their supply chains more effectively. This could provide SMEs with sufficient working capital and enhance the resilience and competitiveness of the overall supply chain.

¹⁹ The Organization for Economic Cooperation and Development (May 2021). Trade Finance for SMEs in the Digital Era. <https://www.oecd.org/cfe/smes/Trade%20finance%20for%20SMEs%20in%20the%20digital%20era.pdf>

Overview of the potential use case

“Worldwide acceptance will be key to the success of the next generation supply chain finance solutions. CBDCs driven by central banks have the potential to be the trade instruments of the future – standardised and interoperable across industries and jurisdictions.”

- Digital Supply Chain Financing Provider based in Hong Kong

In the conceptual model below, banks can leverage the programmability of CBDCs to provide a trusted, transparent and efficient supply chain solution to participants. By combining trade and payment information, the CBDC can be programmed according to payment conditions so as to become a new form of trade finance instrument. Anchor enterprises can pass the programmed CBDC to

their suppliers, who can subsequently use it to pay deep-tier suppliers. Conditions in the smart contracts can be removed upon fulfilment by suppliers. This can be demonstrated by, for example, submitting a bill of lading as proof of shipment. Alternatively, the programmed CBDC could serve as collateral for suppliers to obtain financing.

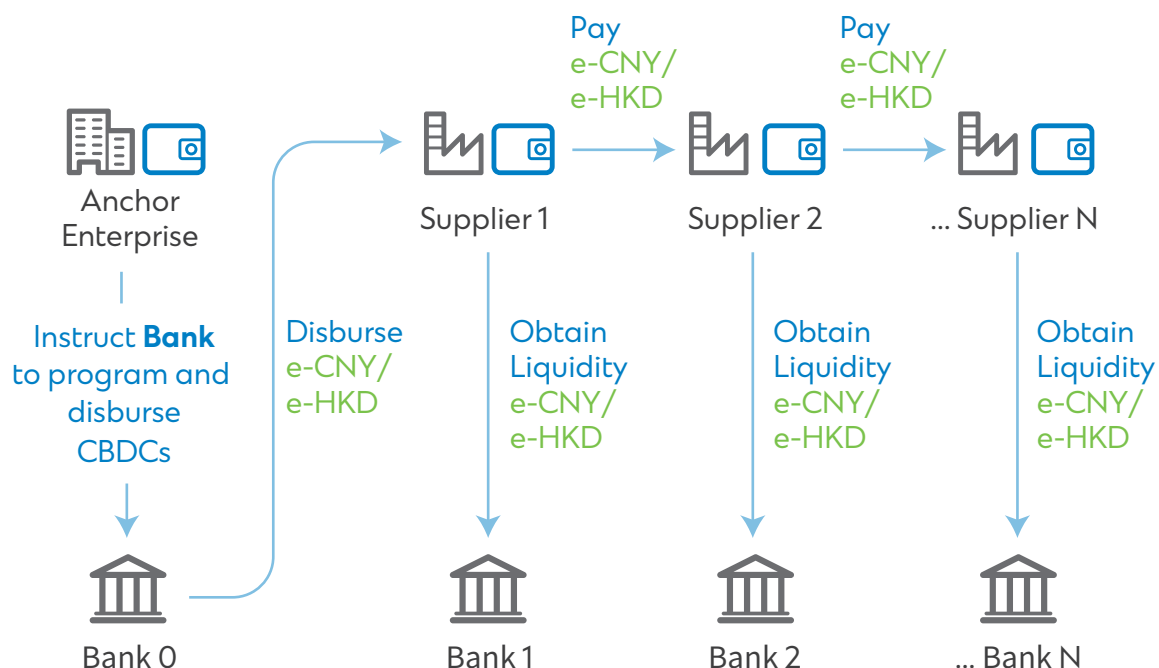


Figure 4: Example of programmable CBDC in the supply chain

While the details of the smart contracts can be determined by the anchor enterprises, banks – being highly regulated – are well positioned to be the trusted parties who programme the CBDC in accordance with instructions. Banks could also support smart contract development, leveraging their experience in providing trade and supply chain financing solutions.

As we can see in Figure 4, the bank has a critical role in programming the CBDC (according to the anchor enterprise's payment instruction) and in facilitating financing for the suppliers. The anchor enterprise can apply for a financing arrangement with the bank or use its own liquidity for payment to Tier-1 suppliers, and the bank can programme and disburse the CBDCs upon request. In the former case, the bank can provide financing on favourable terms if the anchor enterprise commits CBDC locked in the wallet as collateral, as this collateral-based financing could simplify the bank's credit assessment process and thus lower credit risk. Unlike in DeFi, no over-collateralisation is required, as CBDCs are cash equivalent and have low price volatility. The anchor enterprise could also seek other incentives for making payments in programmed CBDC to the suppliers. For example, it could ask to access supplier information stored in the CBDC infrastructure for better supply chain management or negotiate favourable terms with suppliers.

A programmed CBDC could be used for payments from the anchor enterprise to Tier-1 suppliers and, subsequently, to deep-tier suppliers upon the supplier's validation and acceptance of the

programmed CBDC as a means of payment. Conditions can be programmed into the CBDC to accommodate the financing arrangement between the anchor enterprise and bank. This can be based on different payment scenarios, such as the supplier's obligation in goods or services delivery, or different payment terms between deep-tier suppliers. These conditions can be lifted upon fulfilment, such as delivery of goods or services or payment due date for direct cash usage. Supply chain participants can decide whether to accept the programmed CBDC as a means of payment based on the information that is captured in the CBDC infrastructure and disclosed. The information may include the anchor enterprise from where the programmed CBDC originates, and the delivery capabilities and reputation of related participants in that supply chain, depending on the design of the solution.

Should fiat currency be required to fulfil other settlement obligations or to support working capital needs before contract fulfilment, suppliers could use the programmed CBDC as collateral to apply for financing with their respective banks. The banks will be able to trace the origin of the collateral to the anchor enterprise, which could potentially reduce the risk of the financing request. Supplier transaction data could also be shared among banks upon consent. This arrangement may significantly simplify the future credit assessment process for suppliers, enabling better credit risk assessment and reducing suppliers' financing costs. Alternatively, the programmed CBDC could serve as collateral for suppliers to obtain financing.

Potential benefits

This conceptual model could radically change how the deep-tier supply chain is financed and presents significant opportunities to deliver commercial and operational benefits to stakeholders.

(a) Enhanced flexibility for supply chain transactions

For supply chain transactions, deep-tier suppliers will be able to use the programmed CBDCs from anchor enterprises to settle payment obligations in the supply chain and enjoy more flexibility in working capital. If suppliers would like to obtain fiat currency before the conditions on programmed CBDCs are lifted, the bank could also provide financing with the programmed CBDCs (which originate from the anchor enterprises) as collateral.

(b) Better access to subsequent financing for deep-tier suppliers

Deep-tier suppliers or SMEs who adopt this conceptual CBDC solution may also obtain financing in general more easily without the need to go through a traditionally costly and complex credit assessment process. The use of CBDCs as a means of payment between suppliers, banks and anchor enterprises can serve as an additional data source for banks, so that they can associate the deep-tier suppliers with the relevant anchor enterprise, improve customer profiling and enhance credit assessment for the provision of financing. It is worth noting that

consent for data disclosure from related participants will be required.

This enriched data can also improve banks' understanding of the suppliers and their relationships within the supply chain, reducing the information gap between banks and SMEs. As a result, banks could reduce the operational costs of performing AML/CTF, ESG monitoring and reporting, etc. They could potentially also lower the costs of financing offered to deep-tier suppliers.

(c) Improved resilience and transparency for the overall supply chain

SMEs could improve operational stability and grow their business with more flexibility in working capital and better access to financing, which could improve the resilience of the supply chain.

CBDC transaction data brings greater transparency to supply chains, giving anchor enterprises better visibility of their upstream supply chains, and helping them work better with their suppliers. This transparency also improves other aspects of supply chain management, such as sustainability management and ESG reporting.

Key considerations

Successful adoption of this model in global trade requires joint efforts from commercial banks, regulators and other ecosystem players.

(a) Maturity of CBDC-enabled deep-tier financing

Given the scale and complexity of trade and supply chains, this conceptual model will require joint efforts by industry players and regulators across different jurisdictions. In particular, there will be a need for standardised smart contract templates for programming CBDCs, as well as agreements on data definitions and standards for cross-border scenarios, such as the appropriate span of data types and the granularity of the data elements. It will also be critical to identify a dispute resolution process among anchor buyers, suppliers and banks, as well as the technical accounting rules and capital treatment of CBDCs across jurisdictions.

(b) Adoption by anchor enterprises to settle invoices during the payment period

The transfer of programmed CBDC from the anchor enterprise to a supplier involves the locking of the CBDC during the payment term. This can either be in the anchor enterprise's or the supplier's wallet, or a digital vault managed by a custodian bank. This new solution requires the anchor enterprise to use its direct liquidity or a facility with its correspondent bank. Therefore, the solution will be highly dependent on the anchor enterprise's participation. Incentives in addition to enhancement of the resilience and transparency of supply chain will need to be considered. For example, financing could be offered by banks at lower cost, subject to the anchor enterprise's participation.

4.3 Enablers for CBDC use cases

The underlying CBDC infrastructure will need to enable banks and related parties to leverage the programmability feature to develop the aforementioned applications. An appropriate model to govern the design and operations of such a feature will also need to be fleshed out. Set out below are four key building blocks that regulators and industry stakeholders will need to address before the next phase of development.

1. Smart contract design and operation

In terms of technology, guidance from central banks will be required to determine whether a smart contract can be applied to CBDC tokens and/or a wallet. Encryption methods to safeguard against cybersecurity threats and unauthorised access, use or modification of smart contracts or related personal data will be key. From a governance perspective, a properly audited control mechanism will need to be established with appropriate parties to govern the design and use of smart contracts, and to prevent misuse, such as fraudulent transactions. From an operational perspective, considering the scale of CBDC adoption, appropriate parties with in-depth industry knowledge will need to carry out day-to-day activities, such as review and approval of smart contract design (taking business context into consideration), as well as the application of smart contracts to CBDC tokens and/or wallets. The commercial issue of whether fees should be charged by the authorised parties that operate the smart contracts will also need to be determined.

2. Data management and sharing

The substantial volume of transaction data captured in the CBDC wallet could allow businesses to generate insights (with customers' consent) to provide better and more innovative services. An appropriate data management and sharing mechanism will need to be put in place, so that the data captured can be

shared and utilised without compromising the data privacy of consumers and businesses or violating any relevant regulation, such as rules governing cross-jurisdiction sharing of data.

Transaction data is currently stored in silos among banks and payment service providers, and is not widely accessible to other businesses. It will be important for regulators and industry to explore the overall approach to standardise data formats and transfer protocols, and to facilitate commercial usage. Regulatory requirements around the consent mechanism, and privacy-preserving features, such as limitation of data sharing on a "need-to-know" basis, can be implemented as additional safeguards.

3. Interoperability between CBDCs and other ecosystems

Self-executed transactions via smart contracts depend on accurate and trusted data, which may not be available in the CBDC ecosystem. For instance, in trade financing, to achieve automated settlement from banks to suppliers upon delivery of goods, accurate data will be required regarding when the goods were delivered, along with other data that could be sourced from logistics and trade platforms that currently store such data. Different use cases should identify and examine appropriate data sources. Collaboration may be needed between CBDCs and other ecosystems, including trade and logistics, trade finance and digital identity. As data from outside the

CBDC infrastructure will be leveraged to trigger financial transactions, arrangements such as data governance and legal liability will also need to be agreed upon with other data ecosystems, so as to ensure data accuracy and to protect users in case of a dispute.

4. Local and cross-jurisdictional regulatory support

Implementing CBDC use cases and collaborating with other ecosystems will depend on central bank and regulatory approval. CBDCs could transform the underlying business models upon which government services and regulatory frameworks are built. This will require review and consultation with government bureaus, departments and related organisations on tax, personal information laws and regulations, and other related compliance matters. For instance, the CBDC-enabled loyalty platform may

impact how cross-border usage of loyalty points may be taxed in the future (see Section 4.1.1). Apart from central banks, it will be important to involve government bodies and regulators to review CBDC use cases at the proof-of-concept (“POC”) stage, so as to ascertain the regulatory feasibility and initiate necessary studies in preparation for the production stage.

Additionally, given the objective of achieving interoperability between CBDCs in various jurisdictions, central banks and regulators could engage in discussions early on to ascertain potential design requirements, such as digital currency conversion and foreign exchange controls, interoperability and cross-border data transfer between wallets and smart contracts issued under different CBDC infrastructures, as well as how CBDC use cases involving deep-tier financing could be adopted globally.

5 The way forward

While many central banks and industry players are exploring the opportunities of CBDCs, the key to maximising their potential could lie in their programmability and the establishment of an ecosystem that encompasses public-private collaboration. Beyond digitalising physical cash, CBDCs could disrupt existing local and cross-jurisdictional payment systems, leading to a paradigm shift in the way banking services interact with the rest of the economy.

As one of the fastest-growing regions in Mainland China, the GBA has significant economic potential, with maturing cross-border CBDC developments. It could be an appropriate environment for the incubation of CBDC applications, such as those set out in Section 4 of this paper. The successful launch of programmable use cases in the GBA could provide a foundational framework for how other CBDCs could interact in cross-border commercial scenarios. This could pave the way for a network of more interconnected and efficient economies across the globe, utilising digital currency.

While CBDCs encourage advances in banking services and payment models, widespread commercial adoption hinges on collective efforts between industry participants to better serve their customers. It will be imperative to jointly assess how programmable CBDCs could bring opportunities that impact the current roles of stakeholders. Set out below are three practical steps that could be taken promptly by stakeholders to formulate strategies and identify amendments to the surrounding legal and regulatory framework in order for CBDCs to reach their full potential:

(a) Internal assessment

In line with central bank plans to conduct CBDC pilots (such as the e-CNY and e-HKD pilots driven by the PBOC and HKMA), industry stakeholders could establish a task force to study and explore potential CBDC POC use cases, advise what regulatory changes may be required, and examine the implications of CBDCs for their businesses, customers and stakeholders.

(b) Public-private collaboration

Regulators, central banks and industry leaders in banking, payment services and other areas could help form working groups within or across industries to generate additional CBDC use cases, drive partnerships for CBDC POCs and promote industry discussions.

(c) CBDC ecosystem enablement

Regulators, central banks and industry stakeholders could jointly develop and test the CBDC use cases with the foundational infrastructure, including the issuance of applicable guidelines and standards for CBDC adoption. Socialisation with central banks in other jurisdictions could also be explored to validate cross-border use cases involving multi-CBDC. In the longer term, CBDCs can potentially enable a data-driven, programmable banking ecosystem to better serve businesses and individuals. This could also provide a foundation for integrating the smart cities with emerging Web3 concepts to create a digital economy with highly efficient, innovative, and immersive experiences in banking and other industries.

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