

Reimagining a Future Empowered by e-HKD, Tokenised Deposits and Stablecoins

March 2024

BCG

DLA PIPER

HKT

paywith.glass

VSFG

ZA Bank



Acknowledgements

This report incorporates inputs from



HONG KONG MONETARY AUTHORITY
香港金融管理局

The Hong Kong Monetary Authority (HKMA) is Hong Kong's central banking institution and an integral part of the Hong Kong Special Administrative Region Government. The HKMA has four main functions: maintaining currency stability within the framework of the Linked Exchange Rate System; promoting the stability and integrity of the financial system, including the banking system; helping to maintain Hong Kong's status as an international financial centre; and managing the Exchange Fund.

For more information, visit www.hkma.gov.hk.

Disclaimer

This report (“Report”) is for informational purposes only and is not, and should not be construed as, financial, investment, legal or tax advice, or promotion of any services relating to regulated activities under the laws of the Hong Kong Special Administrative Region.

No information set out or referred to in this Report shall form any endorsement, guarantee or assurance as to the legal certainty of any aspects of the pilot (“Pilot”) conducted under Phase 1 of the e-HKD Pilot Programme, the viability of real-life commercialisation of the Pilot and the accuracy or completeness of potential benefits or risks in relation to the Pilot. For the avoidance of doubt, the Consortium does not endorse, guarantee or assure legal certainty, permissibility or enforceability of the Pilot, or any of the activities involved in or in connection with the Pilot, under the existing laws of Hong Kong, including, without limitation, tokenisation or fractionalisation of any asset involved in the Pilot, or collateralisation of such asset and any security interest created over the asset. The Pilot is strictly a simulated trial and does not represent, and is not intended to represent, a real-life product or service, or commercialisation of such product or service, and should not be relied upon in that regard. For the purposes of the Pilot, the Consortium is not responsible for, and has not verified or confirmed the need for, obtaining any regulatory, governmental, or any other types of approval, consent and/or license in relation to any of the activities involved in or in connection with the Pilot, including, without limitation, tokenisation and collateralisation of the asset involved in the Pilot, management of real-world asset (RWA) tokens, operations of digital wallets involved in the Pilot, and the holding and transfer of e-HKD stored in such digital wallets.

The co-authors of this Report shall not be liable to any parties for the correctness of the opinions or statements regarding the Pilot expressed in any material (including but not limited to this Report), and expressly disclaim any liability whatsoever for any loss howsoever arising from or in reliance upon the whole or any part of such opinions or statements, or the contents of this Report. The approval, publication and/or dissemination of this Report by the co-authors shall not be construed as confirmation of the legal certainty, permissibility or enforceability of, and commitment to, real-life commercialisation of the Pilot by any of the co-authors, and should not be relied upon in that regard.

The information contained in this Report is provided for informational purposes only and should not be construed as legal advice on any matter and does not create a lawyer-client relationship with any recipient. It is not intended to be, and should not be used as, a substitute for taking legal advice in any specific situation. The material in this Report may not reflect the most current legal developments, and the content and interpretation of the law addressed herein is subject to revision.

Whilst this Report incorporates inputs from the HKMA, any positions taken or statements made by the co-authors in this Report may not necessarily represent the views of the HKMA, and accordingly should not be interpreted as positions or statements which have been endorsed by the HKMA. For the avoidance of doubt, this includes any positions taken or statements made pertaining to evolving terms and concepts (which may be subject to regulatory review and market consultation at or following the time of publishing this Report), as well as to any studies or literature reviews conducted and presented in this Report. The HKMA does not warrant that all or any part of the information provided in this Report is fit for any particular purpose, up to date, or complete, and shall not be responsible nor accountable for any use, replication, or interpretation therein of the information, data, text or views expressed in this Report. The HKMA and the co-authors of this Report shall not have any liability, duty or obligation for or relating to the information contained herein, any errors, inaccuracies, omissions or delays in the information, or for any actions taken in reliance thereon.

The co-authors of this Report retain the sole intellectual property rights of this Report and deserve copyright of the information within this Report. The reproduction, adaptation, or public dissemination of the whole Report or parts of it for commercial purposes is strictly prohibited unless written authorisation from the co-authors have been agreed and provided in advance. Replication, quotation, or reference to any part of this Report in articles, reports, or any form of communication shall be conducted accurately without causing any misunderstanding or damage to the HKMA and the co-authors, and must acknowledge copyright ownership of the information and data to the co-authors.

Foreword



Tjun Tang

Managing Director &
Senior Partner,
Boston Consulting Group

The evolution of money has been a catalyst for transformative economic growth throughout history, with recent advancements such as e-commerce being a prime example. Different new forms of regulated mediums of exchange could emerge rapidly in the next five years, underpinned by ongoing efforts from public and private sectors working together. We are proud to be at the forefront with our partners around the world to explore this important topic.

DLT-empowered digital medium of exchange has the potential to innovate, grow and transform business and economies. New features such as richer and complex programmability could generate productivity uplift, democratise financial offerings for better inclusivity, and most importantly, enable innovations such as open banking, embedded finance and Web3.

With the right rules and foundation, Hong Kong could leverage these new mediums of exchange to further strengthen its position as an international financial centre and an innovation and technology hub.



Kristi Swartz

Partner & Technology
Sector Lead (Asia),
DLA Piper

“On-chain is the new online.” The tokenisation of real-world assets (RWAs) is the key to unlock the full potential of on-chain finance. And it all starts with tokenising the base layer of finance – money (and its many forms).

Hong Kong has made no secret of its ambitions to become an international hub for digital assets, and it is well-positioned to do so thanks to pioneering minds in the fintech space. DLA Piper is delighted to have advised the pioneers behind this report on what the law is around the e-HKD Pilot Programme, and what the law should be to facilitate mass adoption of digital currencies.

This report includes thoughtful analysis and recommendations on how industry players should move forward to explore potential use cases of e-HKD and incorporate tokenised RWAs into financial services. It is an excellent example of fruitful collaboration between the private and public sectors, which is what we need to accelerate Hong Kong’s move towards a thriving on-chain economy.



Monita Leung

Chief Executive Officer,
HKT Digital Ventures
& Chief Executive,
HKT Payment Limited

At HKT, we are committed to supporting digital economy development by being at the forefront of technology and a fast-responding builder of relevant underlining infrastructure. As one of the first and largest regulated fintech pioneers, Tap & Go has been a dedicated contributor to the latest initiatives driving e-money and digital wallet adoption in Hong Kong.

As game-changing blockchain technology proliferates, the potential of CBDC and stablecoin has been ever-increasing. Under holistic regulatory guidance, together with our partners, we have explored e-HKD pilot features that enable programmability, near-instant settlement and transparency, conducive to the evolution of payment and financial services for better enterprise efficiency and customer protection.

We will continue to promote the development of the digital economy with a view to reinforcing Hong Kong's role as a global Web3 hub, a stronghold for innovation, and a predominant international financial centre.



Paul Sisnett

Chief Executive Officer,
paywith.glass

At paywith.glass, we are positioned at the forefront of the revolution in finance. Our team has over two decades of experience in critical telecommunications and cloud infrastructure design and today we have embarked on a journey to build digital asset infrastructure. We collaborate with experts in payments, cryptography, macroeconomics and AI, serving as the architects of the paywith.glass digital currency/electronic payments infrastructure.

Today, we find ourselves at the crossroads of real-time payment networks and the digital asset economy. Blockchain and Web3 technologies are reshaping finance, unlocking liquidity in once illiquid markets, and enabling new transaction types. We envision a future where real-world assets are tokenised, enhancing global liquidity and uniting previously isolated financial markets. To realise this vision, we partner with progressive regulators to get ready to embrace this transformation. This report offers a glimpse into the possibilities when innovation meets regulation. It is a preview of a future where DeFi and TradFi coexist for the benefit of all.

This is the dawn of a new era.



Lawrence Chu

Chairman, VSFG

We stand at the dawn of Finance 2.0 led by blockchain technology. This technology is transforming wealth management and reshaping institutional digital asset allocation. Just as past infrastructure like copper mines, commercial real estate and toll roads drove growth, today we can invest in digital infrastructure powering tomorrow's financial system.

Stablecoins and decentralised finance provides the foundation for a more open, transparent financial ecosystem. But as with any new technology, there are risks alongside opportunities. Guidance from established institutions is critical at this juncture. Organisations like VSFG are illuminating the path forward. In partnership with venerable institutions like BCG, we are blazing a trail towards responsible innovation.

The future of finance is digital. Financial institutions, investors and regulators must work together to foster innovation while protecting consumers. By cooperating, we can build an equitable, productive and empowering financial system. The opportunities are boundless. The time to lay the foundation is now.



Ronald Iu

Chief Executive Officer
& Executive Director,
ZA Bank

In this joint report, we discussed the potential application of retail CBDC in a token-backed secured loan with ring-fenced usage. Secured loan (such as residential mortgage) has been in the market for many years, yet innovation within this product category has been limited. Through the e-HKD Pilot Programme, we explored the use of different CBDC features to offer consumers with flexibility to borrow for smaller nominal amounts and enjoy preferential lending rates by ring-fencing the loan usage. Whilst this was a one-off exercise to generate insights for the HKMA's research on retail CBDC, we do see a great potential to apply retail CBDC in various use cases in the future.

ZA Bank is pleased to have the opportunity to collaborate with co-authors of this report, and to build knowledge and capabilities to support ZA Bank's "Banking for Web3" ambition.

Table of Content

Foreword	4
Executive Summary	8
1. Development of CBDC, Tokenised Deposits and Stablecoins.....	13
1.1 Global Development of CBDC, Tokenised Deposits and Stablecoins.....	13
1.2 CBDC and Stablecoin Development in Hong Kong	18
2. Potential Benefits of New Mediums of Exchange in Hong Kong.....	22
2.1 Opportunities for New Mediums of Exchange in Hong Kong	22
2.2 Strategic and Economic Value Enabled by New Mediums of Exchange.....	24
3. Deep Dive on e-HKD Pilot Programme Use Case	27
3.1 Potential Benefits Identified in the Pilot Use Case	27
3.2 Requirements to Capitalise on the Benefits of e-HKD.....	33
3.3 Technical Considerations	39
4. Actions for the Path Forward	45
Conclusion.....	48
Appendix	49
References.....	50
About the Authors.....	51

Executive Summary

The world is evolving at a rapid pace, and the evolution of money has played a pivotal role in economic growth over the past decades. This joint report has been co-developed by industry leaders to explore a future where retail central bank digital currency (CBDC), tokenised deposits and stablecoins could potentially be well received as mediums of exchange in Hong Kong to facilitate the sale and purchase of goods and services in the future. With hands-on experience in the inaugural e-HKD Pilot Programme organised by the Hong Kong Monetary Authority (HKMA), first-hand perspectives from consumer surveys and industry interviews, as well as lessons learnt from other markets, this report aims to share the potential benefits and considerations of using new mediums of exchange, with a focus on retail CBDC.

Global development of CBDC, tokenised deposits and stablecoins

The evolution of money forms has empowered tremendous growth in the global economy. With latest advancements in technology such as distributed ledger technology (DLT), we can now make money “smart”.

Both the public and private sectors are taking an increasingly proactive role in researching and conducting pilots on forms of digital medium of exchange. About 90% of central banks surveyed by the Bank of International Settlements (BIS) are studying retail and wholesale applications of CBDCs; around 200 types of stablecoin exist globally, with a total market capitalisation of approximately HK\$1 trillion as of February 2024; and financial institutions are exploring the use of tokenised deposits to improve transaction efficiency.

While specific design and functionalities of each emerging form of digital medium of exchange may differ, this report discusses five possible features that they can technically provide:

- **Near-instant payment.** Immutable distributed ledgers reduce the need for time-consuming reconciliation between multiple parties and provide trusted book-keeping for instant payments, especially for cross-border transaction.
- **Atomic settlement with tokenised assets.** Tokenised assets can be traded and settled on the immutable distributed ledgers against emerging digital mediums of exchange to reduce settlement and counterparty risk.

- **Programmable features.** Money can be encoded with flexible business logics and stay effective across multiple money operators to stipulate conditions for usage (e.g., transfer destination, timing).
- **Operation via transparent protocols.** Money and assets can be operated under a high level of transparency with immutable smart contracts governing business and operational logics.
- **Connection with virtual assets (or “crypto-assets”)/Web3 economy.** Emerging digital mediums of exchange can work effectively with different types of tokens on public blockchains without fiat on-ramp and off-ramp processes.

Potential benefits of emerging forms of digital medium of exchange in Hong Kong

Hong Kong, as an international financial centre and an innovation and technology hub, is well positioned to capture opportunities from the development of emerging forms of digital medium of exchange such as retail CBDC, tokenised deposits and stablecoins.

The report suggests that these emerging forms of digital medium of exchange could add value to the Hong Kong economy through four opportunity pillars: 1) deeper liquidity unlocked via tokenisation and by facilitating the movement in tokenised real-world assets; 2) improved financing solutions through programmability features; 3) the development of business activities in the Web3 economy; and 4) enhanced cross-border business connectivity.

By delivering these four pillars, BCG’s base case estimates an ecosystem of retail CBDC, tokenised deposits and stablecoins in Hong Kong could potentially generate an additional 0.5% in GDP growth per year for the next ten years (or an additional HK\$160 billion of GDP for Hong Kong by 2032), with several important caveats. The estimation assumes these digital mediums of exchange and their related use cases can be introduced and adopted at scale in the near term, which is dependent on a wide range of factors, including but not limited to the development in related infrastructure (such as asset tokenisation), commercial viability of use cases, legal and regulatory considerations, as well as wider development in Web3 and virtual assets (or “crypto-assets”).

In the case of retail CBDC in Hong Kong (i.e., e-HKD), it should be noted that the HKMA has not yet made a decision on whether or when to introduce the e-HKD. Whilst the first phase of the pilot programme has uncovered three areas that e-HKD could add unique value, which are programmability, tokenisation and atomic settlement, we echoed that realisation of the unique benefits of e-HKD at scale requires further investigation as the scale and testing environment of the pilot use cases could be different from real-world applications.

e-HKD pilot use case: tokenised property-backed secured lending with ring-fenced usage

As part of assessing the potential features and benefits of the e-HKD, three of the co-authors (BCG, HKT Payment Limited and ZA Bank) took part in the HKMA's inaugural e-HKD Pilot Programme and detailed benefits and learnings in this report to support development of innovations.

Pilot benefits and key learnings

BCG, HKT Payment Limited and ZA Bank, as part of their pilot in the HKMA's e-HKD Pilot Programme, made use of a hypothetical e-HKD to test its viability in enabling tokenised property-backed secured lending with ring-fenced usage. This use case highlighted three potential benefits for users:

- **More competitive financing rates.** When money usage is enforceable across platforms (and even after refund), lenders have a new function to better manage credit risk, and thus potentially offer preferential financing rates for different loan usage.
- **Improved flexibility and access to financing.** Asset tokenisation leads to reduced operational costs and facilitates improved flexibility for smaller loan amounts for secured lending. Theoretically, any other real-world assets in tokenised forms can also be used as collateral.
- **Faster loan disbursement process.** Using smart contracts, the loan amount can be disbursed to users automatically once pre-defined conditions for loan approval are met (e.g., users complete pledging certain tokens to the bank within a specified timeframe).

Three key requirements to realising benefits of an e-HKD were identified:

- **e-HKD use cases with focus on new value for users.** Based on a recent consumer survey¹ conducted by some of the co-authors, more than 50% of survey respondents found use cases that featured programmability (e.g., ring-fenced usage loans, conditional payments) attractive if they create financial benefits.
- **e-HKD design with high level of security and privacy protection.** While Hong Kong consumers value the new potential features enabled by e-HKD, they are also concerned about the potential risks. Around 70% of survey respondents cited cybersecurity and data privacy as key concerns around a possible future adoption of e-HKD. These consumer attitudes match industry practitioners' perspectives; many have highlighted the balance between traceability and data privacy as a critical challenge.

¹ The consumer survey conducted in August 2023 received responses from a total of 1,840 Hong Kong consumers across different age groups, educational backgrounds and occupations.

- **Development of a clear legal and regulatory framework for e-HKD.** For example, a framework for the “linking” or “stapling” of a legal right or interest in a real-world asset to governance of on-chain operations (e.g., smart contracts that maintain new mediums of exchange), is needed to protect consumers, merchants and industry players like banks.

Technical considerations

Native use of DLT is one of the fundamental distinctions between digital mediums of exchange (such as retail CBDC, tokenised deposits and stablecoins) and the established forms (such as e-money and physical money).

In the pilot use case, we adopted a hybrid-DLT design to leverage the benefits of both DLT and off-chain technologies:

- DLT allows cross-entity automation being conducted on-chain for trust, and important data managed on blockchain (e.g., creation of real-world asset tokens, setting ring-fenced usage of hypothetical e-HKD).
- Off-chain technologies ensure confidential data are stored and business logics are processed safely to protect sensitive business logics such as proprietary credit assessment capabilities.

Four technical design best practices and key lessons are highlighted below for consideration:

- Leverage existing technical standards and DLT-native programmability (smart contracts) to reduce development and infrastructure cost
- Modularise smart contracts with data exchange format and application programming interface (API) specifications agreed in the design to enable cross-company collaboration
- Solid review and audit process on smart contract is required to protect users and operators from cybersecurity risks
- Non-transferable digital identity token at wallet level to facilitate user verification across entities

Call for action

Industry players can no longer deprioritise or ignore the emergence of digital mediums of exchange given its potential benefits and impact on the economy. Going forward, we believe four areas of public-private sector collaboration will be important to drive further development:

- On-chain ecosystem building (e.g., on-chain assets and on-chain operations)
- Standards development (e.g., token standards, interoperability setup, regulation of on-chain assets/operations)
- Industry participation (e.g., industrywide adoption, funding support)
- Network building (e.g., education, talent development, support for open-source projects)

With both public and private sectors working together, we can reimagine the future by unlocking the potential through using unique features from e-HKD, tokenised deposits and stablecoins.

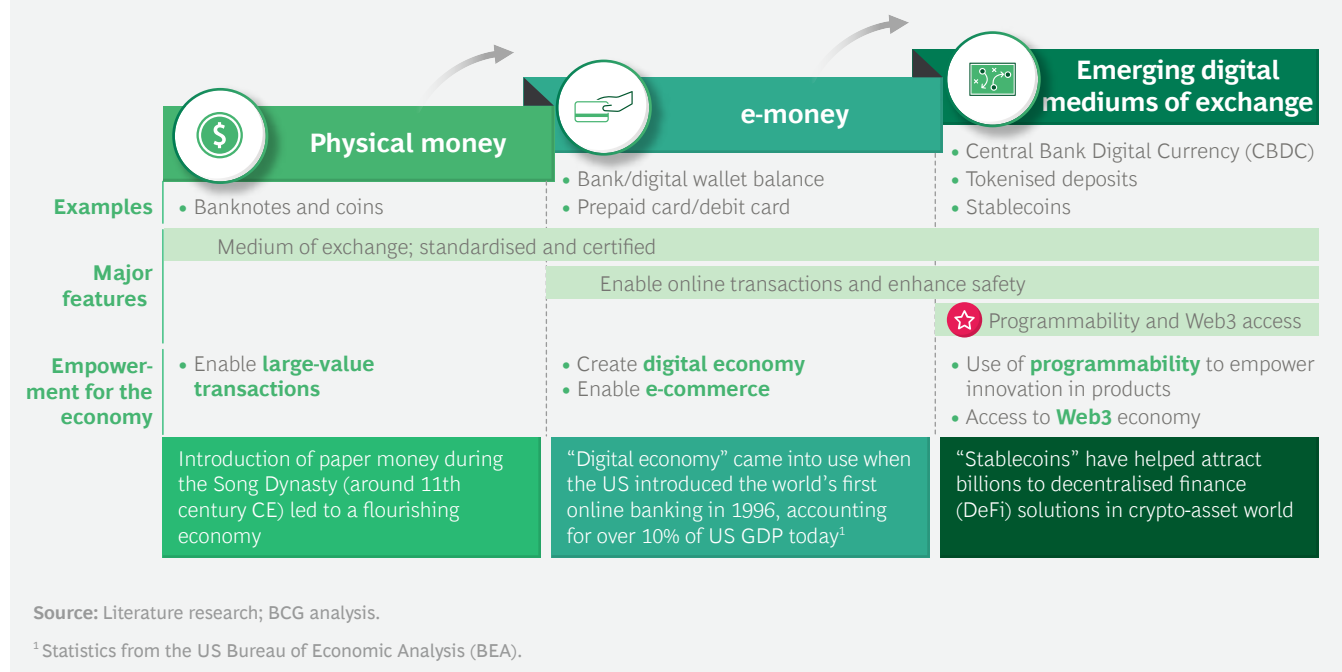
1. Development of CBDC, Tokenised Deposits and Stablecoins

Globally, central bank digital currency (CBDC) is rapidly developing with around 90% of central banks² and numerous private institutions proactively researching and/or conducting pilots on tokenised deposits and stablecoins. This chapter provides a broad context on the development of CBDC, tokenised deposits and stablecoins, and how Hong Kong is responding to these global trends.

1.1 Global Development of CBDC, Tokenised Deposits and Stablecoins

The transition from physical money (e.g., banknotes and coins) to electronic money can potentially unlock new economic drivers by facilitating new types of business activities and ways of transacting. With further advancements in technology, new forms of digital medium of exchange (such as CBDC, tokenised deposits and stablecoins) have now emerged, potentially offering more functional programmability features that are not readily available in physical money or e-money. (See Exhibit 1.)

EXHIBIT 1 | The evolution of money forms and medium of exchange

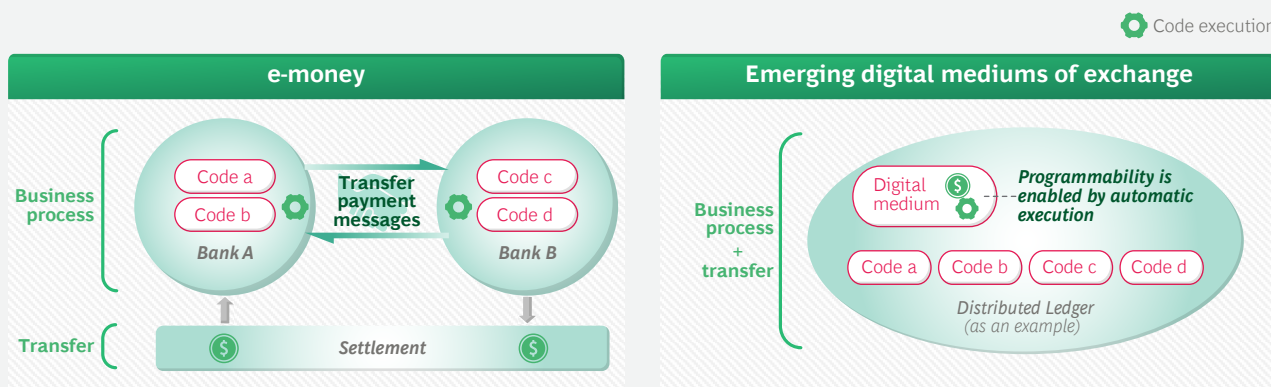


2 BIS paper #136 "Making headway – Results of the 2022 BIS survey on central bank digital currencies and crypto", July 2023.

EXPLAINER: How are e-money and emerging digital mediums of exchange different?

Native and richer programmability features are a key differentiator. This refers to the capability for money (or medium of exchange) to function logically and seamlessly across systems for more complex operations.

Such programmability is typically offered using smart contracts on a distributed ledger (an example: blockchain with Ethereum Virtual Machine). Below is a simplified illustration:



Business and operational logics to manage the money are designed and executed separately (outside the money).

Company A's controls (e.g., code a) are not enforceable after money is transferred to Company B. For Company A's logic to be enforceable, Company B will need to recreate the logic through its own operations or technology (e.g., code c).

Often third parties are engaged to support the money management (e.g., standing instructions by banks).

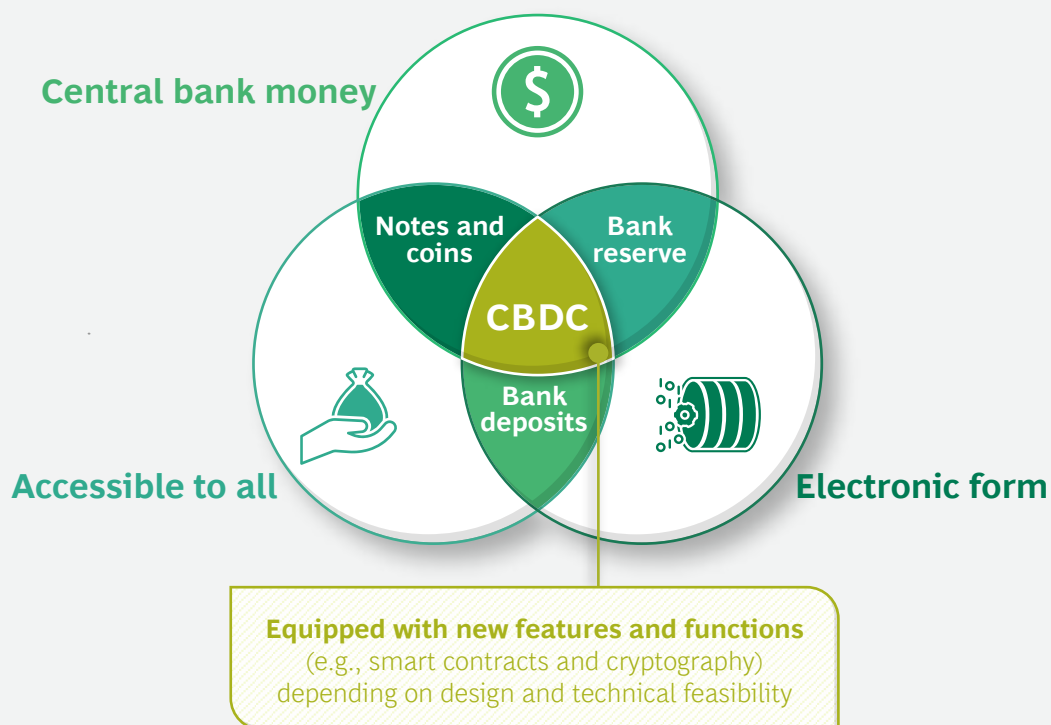
Business and operational logics to manage the money are designed and executed as part of the money. Imagine the instruction(s) are written on a banknote (and every user needs to follow the instructions).

Richer business logics can be incorporated into transactions and payments through richer programmability features to create new products. For example, ring-fenced loans enforce borrowers to apply funding for dedicated purposes at preferential financing rates.

1.1.1 Central bank digital currency (CBDC)

CBDC is a new form of central bank money that is electronic and may be made available to all, with potential new features and functions depending on design and technical feasibility. (See Exhibit 2.)

EXHIBIT 2 | Introduction of CBDC



Source: HKMA whitepaper “e-HKD: A Policy and Design Perspective”; BCG analysis.

Central banks and regulators across the globe are exploring whether or not to issue CBDC, and many have focused on CBDC’s potential retail applications. In particular, developing economies such as the Bahamas, Cambodia and Nigeria have already implemented retail CBDC³, with financial inclusion and payment efficiencies at the forefront of publicly stated ambitions. (See Exhibit 3.)

³ BIS paper #123 “CBDCs in emerging market economies”, April 2022.

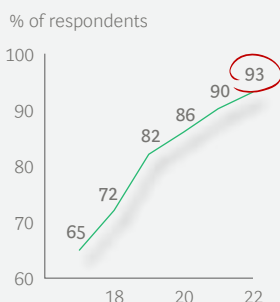
EXHIBIT 3 | Global development of CBDC



Deeper central bank involvement in CBDC

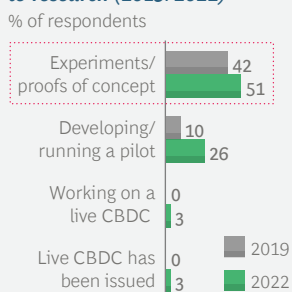
- 93% of central banks engaged in some form of CBDC work in 2022

Engagement in CBDC work



- With >50% taking more steps to make CBDC happen

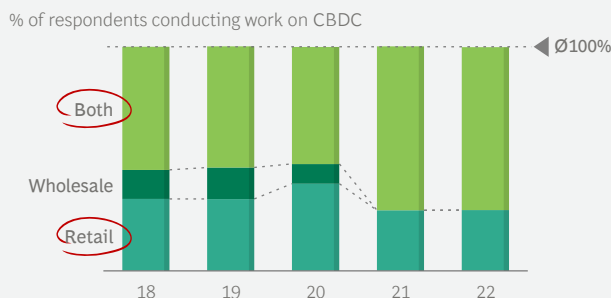
Types of work in addition to research (2019/2022)



Retail CBDC¹ is the consistent focus for those working on CBDC

- ~75% explore both retail CBDC and wholesale CBDC²...
- ... the remainder focuses on retail CBDC

Focus of work



Source: BIS paper #136 "Making headway – Results of the 2022 BIS survey on central bank digital currencies and crypto".

¹ Retail CBDC (rCBDC): Digital form of central bank-issued currency that is widely accessible to the public and intended for use by households and firms for everyday transactions.

² Wholesale CBDC (wCBDC): A digital currency issued by the central bank that is meant for use for transactions between banks, central banks, and other financial institutions.

1.1.2 Tokenised deposits and stablecoins – two emerging forms of medium of exchange

Aside from CBDC, the private sector is proactively tapping into stablecoins and tokenised deposits. As of February 2024, the market capitalisation for stablecoins globally was about HK\$1 trillion⁴ (for comparison, Hong Kong money supply (M2) was about HK\$17 trillion⁵, United States money supply (M2) was about HK\$163 trillion⁶). Leading financial service providers are also experimenting with use of tokenised deposits to automate complex transactions, such as JP Morgan (JPM Coin), HSBC, Hang Seng Bank and Visa (e-HKD pilot use case on tokenised deposits)⁷.

⁴ DeFiLlama, total stablecoins market cap, extracted on 26 February 2024.

⁵ HKMA, Monthly Statistical Bulletin, as of end of December 2023.

⁶ US Federal Reserve, as of end of December 2023; A currency conversion ratio of 1 USD to 7.8 HKD was used to estimate the HKD value.

⁷ Hang Seng Bank Limited, The Hongkong and Shanghai Banking Corporation Limited and Visa Inc. jointly explored a case study on tokenised deposits, as part of the HKMA's e-HKD Pilot Programme.

EXPLAINER: what are the key emerging types of digital medium of exchange?

Key emerging types of digital medium of exchange that are live or under pilot today include stablecoins, tokenised deposits, and retail CBDC. These digital mediums of exchange have emerged gradually since the 2010s, and they are differentiated primarily by their backing assets.

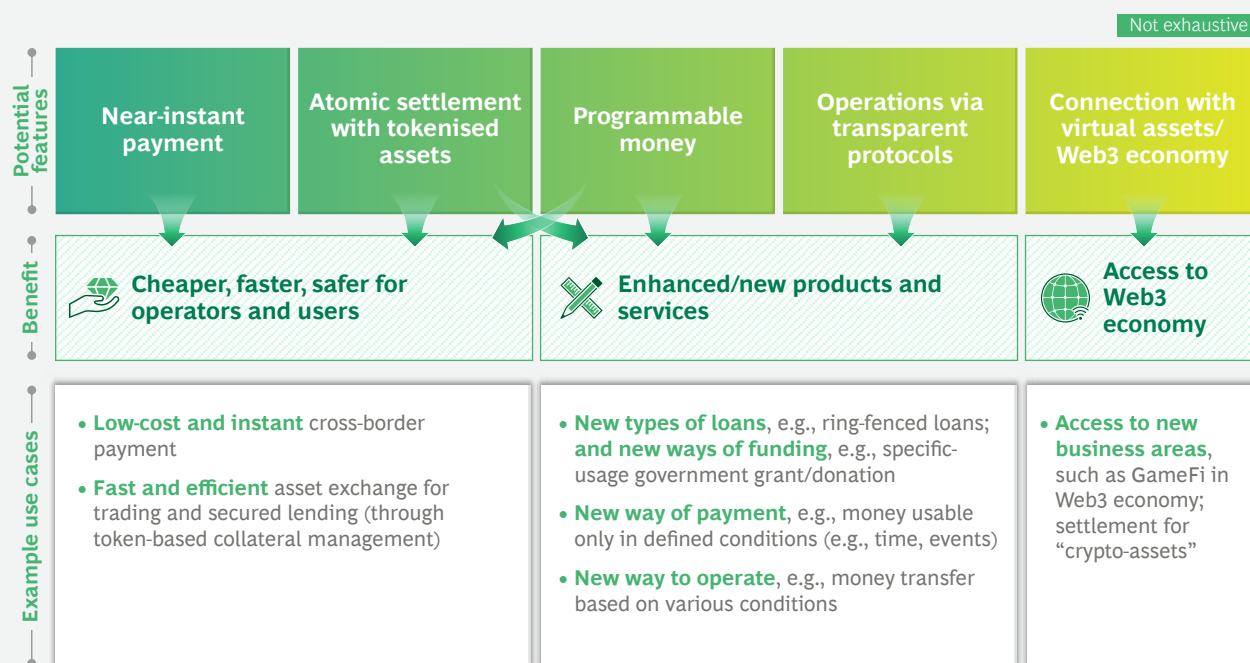
	Stablecoin	Tokenised deposits	Retail CBDC
Emerged since	• Mid 2010s	• Late 2010s	• Mid 2010s
Typical issuers	• Non-banks, such as payment companies and fintech companies	• Banks	• Statutory authorities such as central banks
Typical backing assets	• A mix of assets, such as fiat currencies, commodities, and debt instruments	• Commercial bank balance sheet	• Central bank's statutory authority

Source: BCG analysis.

1.1.3 Potential differentiating features of emerging types of digital medium of exchange

Whilst the specific design and functionalities of each digital medium of exchange may differ, five possible features that are not present in physical and electronic forms of money today are observed. (See Exhibit 4.) Together, these features can deliver incremental benefits to the economy, including efficiency improvements, enhanced or new products and services, and access to the Web3 economy.

EXHIBIT 4 | Five potential differentiating features of emerging types of digital medium of exchange



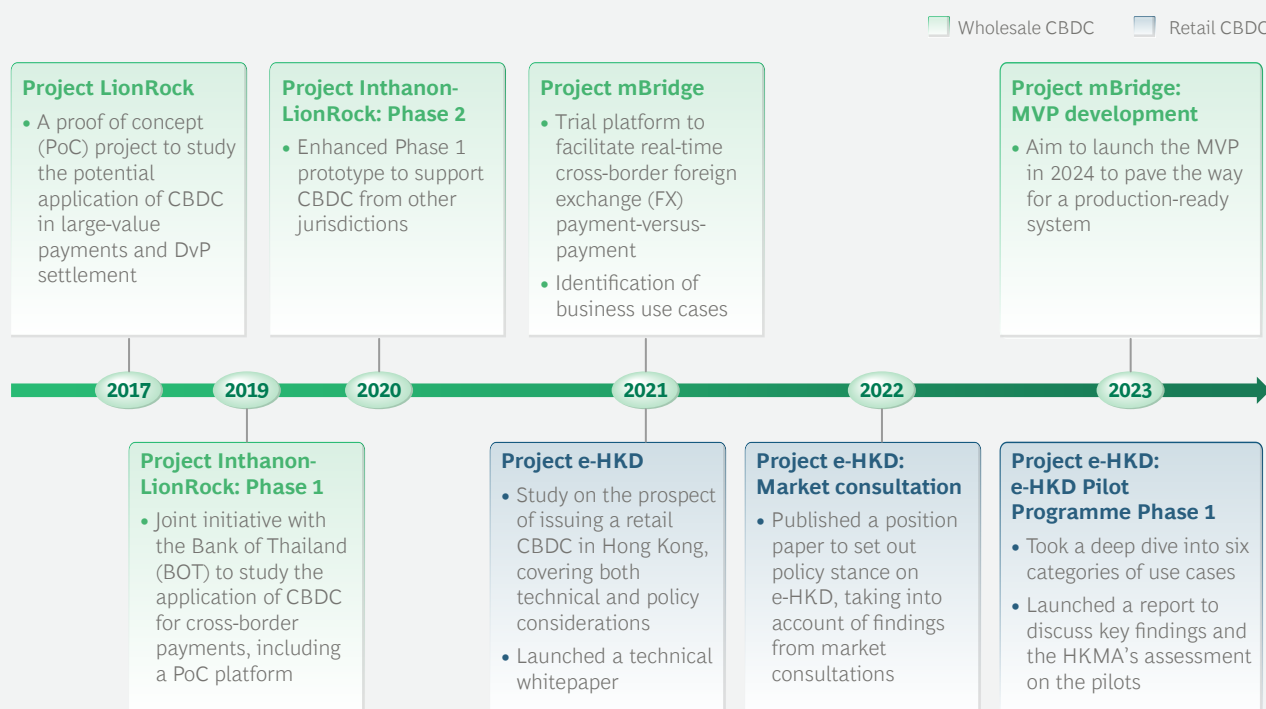
Source: BCG analysis.

1.2 CBDC and Stablecoin Development in Hong Kong

Hong Kong, as an international financial centre, has been actively exploring the potential applications of virtual assets (or “crypto-assets”) and various emerging types of medium of exchange (such as CBDC and stablecoins). The Government of the Hong Kong Special Administrative Region (HKSAR Government) issued a policy statement on the development of virtual assets in Hong Kong in October 2022, setting out its stance towards the development of a virtual assets ecosystem. The Hong Kong Monetary Authority (HKMA) is also actively researching and engaging with industry stakeholders on the topics about emerging digital mediums of exchange. In December 2023, the Financial Services and the Treasury Bureau (FSTB) and the HKMA jointly released a public consultation paper, which proposes legislative measures to implement a regulatory framework for stablecoin issuers in Hong Kong, inviting feedback from the public and stakeholders. Furthermore, in February 2024, the HKMA issued guidance for firms providing digital asset custodial services. These collective efforts by the government signify their commitment to facilitating the healthy and sustainable development of the virtual asset ecosystem in Hong Kong.

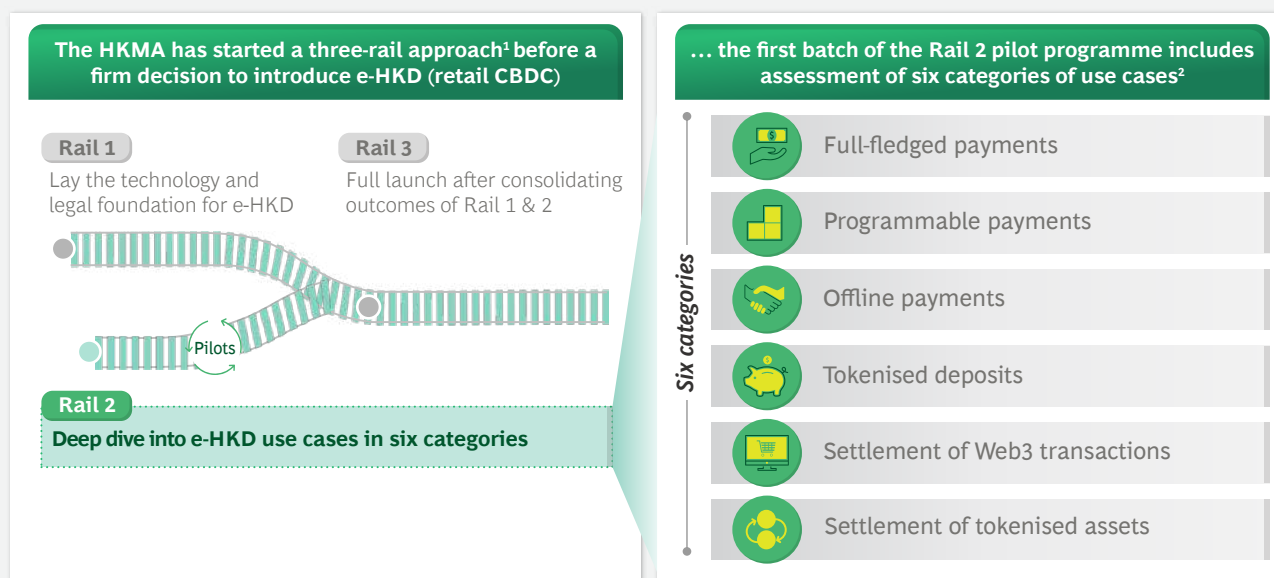
On CBDC, the HKMA has been conducting research and pilots since 2017 and has made significant progress. (See Exhibit 5.) Alongside its efforts in CBDC in general, the HKMA is assessing the potential implementation of retail CBDC (i.e., e-HKD) via a three-rail approach. Specifically, rail 2 involves collaboration with industry players (e.g., financial institutions, payment providers, technology companies) to take deep dives into potential retail CBDC use cases and generate practical insights to inform a potential e-HKD roll-out. In May 2023, the HKMA launched the first phase of e-HKD Pilot Programme. 16 firms were selected to participate, conducting a total of 14 pilots across six use case categories. (See Exhibit 6.)

EXHIBIT 5 | Hong Kong's progress in CBDC development



Source: HKMA website.

EXHIBIT 6 | HKMA's three-rail approach to assess feasibility of e-HKD



Source: Literature research; BCG analysis.

¹ HKMA whitepaper “e-HKD: A Policy and Design Perspective”.

² HKMA press release “Commencement of the e-HKD Pilot Programme”.

e-HKD pilot use case: tokenised property-backed secured lending with ring-fenced usage

A pilot use case co-led by BCG, HKT Payment Limited and ZA Bank, with strategic support from paywith.glass and VSFG and legal advisory support from DLA Piper, has been shortlisted to participate in the e-HKD Pilot Programme. (See [Exhibit 7](#).) The pilot use case features a secured lending product with ring-fenced usage, backed by tokenised assets, where e-HKD was assumed to share most of the potential differentiating features of emerging types of digital medium of exchange discussed in [Exhibit 4](#). Each co-author played a key role as part of the pilot use case, as shown in [Exhibit 8](#).

To supplement learnings from the e-HKD pilot use case, some co-authors of this report also conducted a consumer survey and a series of interviews with industry practitioners. The consumer survey, which received responses from a total of 1,840 Hong Kong consumers⁸ across different age groups, educational backgrounds and occupations, was conducted in August 2023. Industry interviewees included traditional banking providers (including virtual banks), stored value facilities (SVFs) providers, other financial institutions, and Web3 operators and investors. Both the consumer survey and the industry interviews focused on gaining general perceptions of e-HKD, tokenised deposits and stablecoins, and potential demand for use cases such as secured lending (refer to [Appendix](#) for more details on the survey).

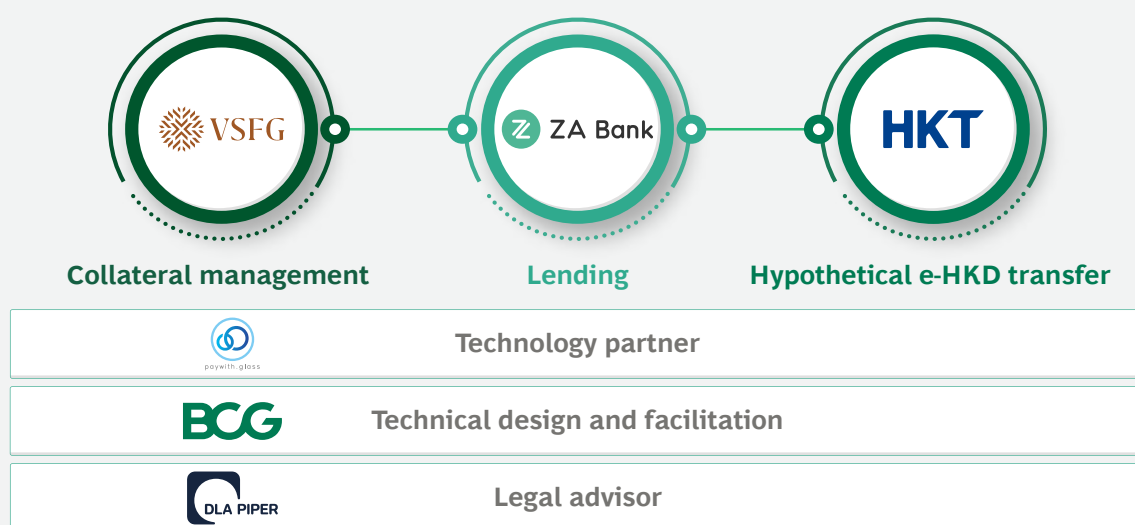
⁸ Hong Kong Consumer Survey on CBDC, Tokenised Deposits and Stablecoins and Property-Backed Secured Lending, conducted by BCG, HKT Payment Limited, VSFG and ZA Bank in August 2023.

EXHIBIT 7 | Co-authors of this report



¹ Data as of 31 August 2023.

EXHIBIT 8 | Each co-author played a specific role in the pilot use case



2. Potential Benefits of New Mediums of Exchange in Hong Kong

Hong Kong, as an international financial centre and an innovation and technology hub, is well positioned to capture opportunities from the new mediums of exchange such as retail CBDC, tokenised deposits and stablecoins. The report suggests that new mediums of exchange could add value to the Hong Kong economy through four opportunity pillars: 1) deeper liquidity on existing real-world assets via tokenisation; 2) improved financing solutions through programmability features; 3) more advanced business activities in the Web3 economy; and 4) enhanced cross-border business connectivity.

By delivering these four pillars, BCG's base case estimates an ecosystem of retail CBDC, tokenised deposits and stablecoins in Hong Kong could potentially generate an additional 0.5% in GDP growth per year for the next ten years (or an additional HK\$160 billion of GDP for Hong Kong by 2032), with several important caveats.

To assess the potential features and benefits of new mediums of exchange, the co-authors took part in the HKMA's inaugural e-HKD Pilot Programme with detailed benefits and learnings highlighted in Chapter 3 of this report.

2.1 Opportunities for New Mediums of Exchange in Hong Kong

2.1.1 Opportunities for payment innovations in Hong Kong

Hong Kong already has a well-established financial services sector that operates on top of robust payment infrastructure, such as the Faster Payment System (FPS) which facilitates round-the-clock fund transfers, and has robust regulations and a strong network of regulated financial services providers (such as banks and SVF operators) to lay the foundation of a holistic payment system.

However, there are still opportunities to further enhance Hong Kong's current payment system. For example, payment settlement can take up to T+2 days for merchants using point-of-sale (PoS) systems today; in addition, material costs could incur for administering ring-fenced payments. As a reference, the administrative expenses incurred for the 2022 Consumption Voucher Scheme

amounted to around HK\$400 million (approximately 0.6% of total financial commitment)⁹. Some of these areas could potentially be addressed by typical features of new mediums of exchange, such as programmability.

2.1.2 Demand for new regulated mediums of exchange for Hong Kong's Web3 economy

The HKSAR Government has indicated its support for the development of Web3, with its eye on becoming the hub of Web3 in Asia. Hong Kong has introduced regulations and initiatives, including setting up the task force on promoting Web3 development to stimulate Web3 economy growth in Hong Kong. The HKSAR Government has allocated HK\$50 million in the 2023-2024 budget¹⁰ to develop a Web3 ecosystem, in addition to many other existing support schemes for businesses.

Market interest in virtual assets (or “crypto-assets”)/Web3 is growing in Hong Kong. According to a survey conducted by the Investor and Financial Education Council (IFEC), 23% of young respondents have invested in virtual assets and related products in the 12 months to July 2023¹¹. Within the private sector, Cyberport is now home to over 170 Web3 companies¹². However, access to Web3 via currently available mediums (e.g., credit cards, unregulated stablecoins) is expensive, unstable and unsafe (See Exhibit 9), which calls for a need for new mediums of exchange, especially those denominated in HKD to lower transaction costs.

EXHIBIT 9 | Potential barriers to access Web3 via currently available mediums



Expensive

Estimated 2%-5% fee for buying stablecoin

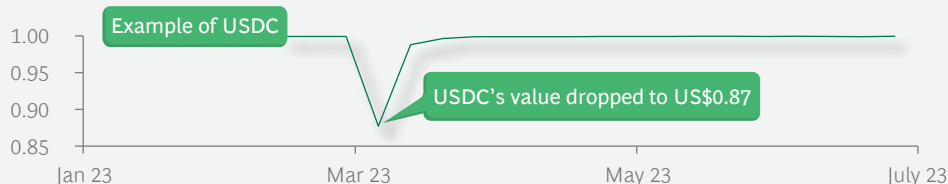
Overseas/credit card fee
(e.g., 1.95% fee for overseas credit cards¹)

Spread for the exchange
(e.g., ~2% if 1 USD stablecoin = 7.97 HKD¹)



Unstable

Even stablecoins that are 1:1 pegged to the USD exhibit **unstable value**:



Other

Lack of AML/KYC mechanisms to protect users from transactions with illicit parties

Absence of regulations or procedures to safeguard users against defaults or issuer misconduct

... and more

Source: Literature research; BCG analysis.

¹ Fee rate based on Binance.

⁹ Financial Services and the Treasury Bureau, “Replies to initial questions raised by Legislative Council Members in examining the Estimates of Expenditure 2023-24”.

¹⁰ HKSAR Government, “HK set to tap Web3 potential”, 25 August 2023.

¹¹ IFEC, Retail Investor Study 2023, released in September 2023; 1000 correspondents were surveyed.

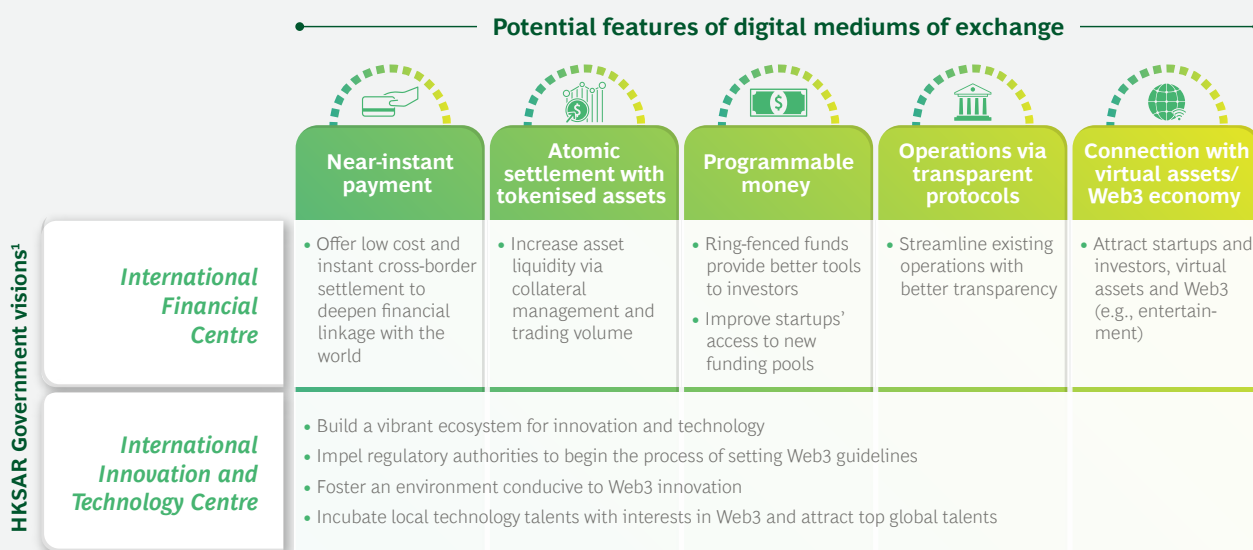
¹² Remarks from Paul Chan, the Financial Secretary of Hong Kong, at the Digital Entertainment Leadership Forum 2023 taking place in August 2023.

2.2 Strategic and Economic Value Enabled by New Mediums of Exchange

2.2.1 Strategic value of new mediums of exchange for Hong Kong

Reinforced in recent policy addresses, the HKSAR Government has made clear commitment to enhance the city's status as an international financial centre and an international innovation and technology centre. These two visions could be supported by leveraging potential features of new mediums of exchange. (See Exhibit 10.)

EXHIBIT 10 | Hong Kong can fulfil its strategic ambitions with digital mediums of exchange



Source: HK 2023-2024 budget; BCG analysis.

¹ International Financial Centre and International Innovation and Technology Centre are two visions launched by the HKSAR Government in the 2023-2024 budget.

2.2.2 Economic value of new mediums of exchange for Hong Kong

BCG's base case estimates that new mediums of exchange (such as stablecoins, tokenised deposits and retail CBDC) could increase Hong Kong's GDP by HK\$160 billion by 2032 (or an additional 0.5% in GDP growth per year for the next ten years). Underpinning such growth are four pillars:

- **Unlock liquidity.** Much liquidity sits in assets and cannot be redirected to a more productive environment (or utilised effectively). New mediums of exchange facilitate the movement of tokenised assets as collateral to unlock liquidity to asset owners at a personalised financing rate, and hence, the value of the assets can be redirected for use in the real economy.

- **Improve money distribution.** If new digital mediums of exchange can be programmed for specific purposes, investors and the government could deliver funding support to specific sectors or groups that need help (examples include small and medium-sized enterprises (SMEs) or COVID-hit businesses) and reduce administrative processes. The programmability feature of new digital mediums of exchange can enable the government to roll out more targeted policies to support specific areas of the economy.
- **Support the new economy.** Hong Kong aims to be a Web3 hub in Asia, but access to the new economy is expensive, unstable and potentially unsafe via current mediums that may require foreign currencies. If a widely accepted, regulated and HKD-denominated new medium of exchange is launched and used for settlement, this can not only reduce the costs of transactions, but also help increase social confidence in Web3 developments, bringing talent, capital and corporate imports into its ecosystem.
- **Facilitate cross-border connectivity.** A variety of pain points including manual processes and delayed settlement mean that cross-border collaboration can incur high costs and be slow. If cross-border payment settlement could be achieved through new mediums of change, Hong Kong could enhance its role as an international financial gateway.

The ability to deliver the aforementioned economic value is dependent on new mediums of exchange and related use cases being introduced and adopted at scale in the near term, which will be driven by a wide range of factors, including but not limited to the development of related infrastructure (such as asset tokenisation), commercial viability of use cases, legal and regulatory considerations, as well as wider development in Web3 and virtual assets.

In the case of retail CBDC in Hong Kong (i.e., e-HKD), whilst the first phase of this pilot has uncovered three areas where the e-HKD could add unique value, which are programmability, tokenisation and atomic settlement, the realisation of such value at scale requires further investigation as the testing environment could be different from real-world applications. It should also be noted that the HKMA has not yet made a decision on whether or when to introduce the e-HKD.

We have identified a non-exhaustive list of use cases where new mediums of exchange would be able to address specific business and operational challenges, ultimately driving economic growth. (See Exhibit 11.)

EXHIBIT 11 | Potential use cases of digital mediums of exchange

Not exhaustive

Drivers for GDP	Live/pilot use cases
• Stimulate growth of local SMEs, startups and ventures, such as improving access to funding, enabling new products	1 Innovative lending solution (such as ring-fenced loans) Our focus 2 Cash hand-out programme with specific usage limitations (such as time, location) 3 Innovative client engagement/loyalty programme 4 Government grant with ring-fenced usage for various purposes (such as education, startup support) 5 Donation with ring-fenced usage 6 Conditional pre-payment enabled by smart contract (e.g., unlock payment when product/service is delivered) Our focus
	7 Financing solutions for assets (such as tokenised real estate, tokenised private shares) 8 Marketplace to lend, invest or trade tokenised assets (e.g., fundraising for artists)
• Unlock liquidity through tokenised assets, stimulating the economy and investment	9 Virtual asset marketplaces and exchanges for crypto and NFT 10 Virtual asset financial products (such as ETFs, derivatives, lending, liquidity pool, insurance) 11 Web3 infrastructure (such as blockchain, Oracles, decentralised identity service provider) 12 Web3 ancillary services (such as smart contract audit, IT security, KYC solution) 13 Web3 entertainment (such as metaverse and Web3 gaming)
	14 Lower cost and faster cross-border payment 15 Cash hand-out programme for foreign visitors in Hong Kong with specific usage limitations (such as location, purpose) 16 Foreign currency exchange with ring-fenced purpose 17 Conditional pre-payment enabled by smart contract (such as cross-border purchase, supply chain financing)
• Enable access to the growing Web3 economy	
• Enhance the cross-border business environment by providing a more functional currency	

Source: Industry interviews; CBDC pilots across regions such as e-CNY and pilot CBDC in Australia; BCG analysis.

3. Deep Dive on e-HKD Pilot Programme Use Case

The e-HKD pilot use case detailed in this report demonstrates proof points about how features of a digital medium of exchange can facilitate access to funding and unlock liquidity.

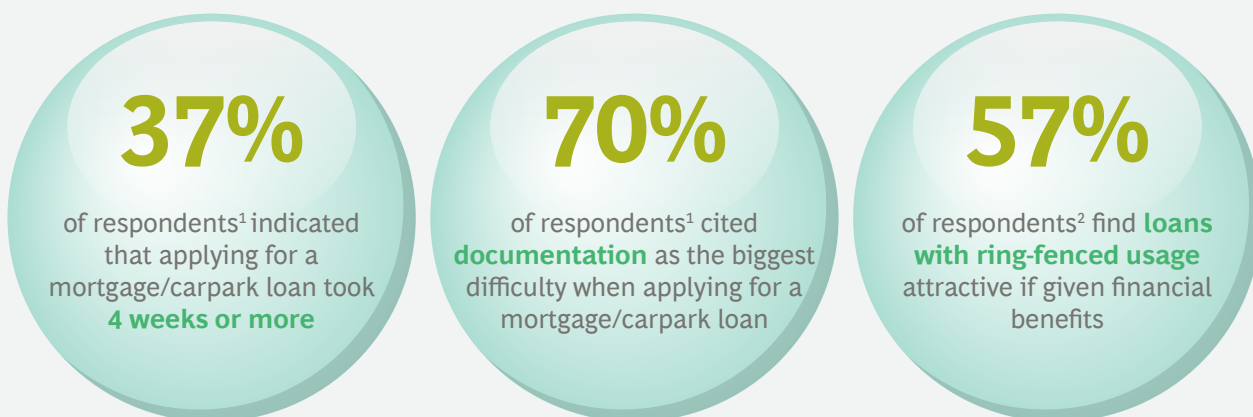
In the pilot use case, known as “tokenised property-backed secured lending with ring-fenced usage”, we explored the potential benefits of e-HKD, including provision of a more efficient loan application process and preferential financing rates enabled by atomic settlement with tokenised assets and programmable money. In addition to these benefits directly observed in the pilot use case, we are envisioning a future where a wider range of assets can serve as collateral, and on a broader scale, the potential of open application programming interface (API) in Hong Kong to drive fintech innovation.

This chapter is divided into three sections: potential benefits identified in the pilot use case, key building blocks to capitalise on the benefits of e-HKD if introduced, and technical considerations.

3.1 Potential Benefits Identified in the Pilot Use Case

In the pilot use case, we attempted to address some of the current pain points associated with secured lending, such as mortgages and carpark loans today. We reimagined conventional secured lending processes by incorporating new features enabled by new mediums of exchange, such as ring-fenced usage of loan, which corresponds to a recent consumer survey conducted by some of the co-authors find attractive. (See Exhibit 12.) Overall, the pilot use case identified large potential benefits, such as unlocking liquidity in assets.

EXHIBIT 12 | Selected findings from consumer survey



Source: Hong Kong Consumer Survey on CBDC, Tokenised Deposits and Stablecoins and Property-Backed Secured Lending, conducted by BCG, HKT Payment Limited, VSFG and ZA Bank in August 2023.

¹ Answered by respondents who have applied for a mortgage or carpark loan before.

² Answered by respondents who have not applied for a loan before, and those who have applied for loans other than a mortgage or carpark loan.

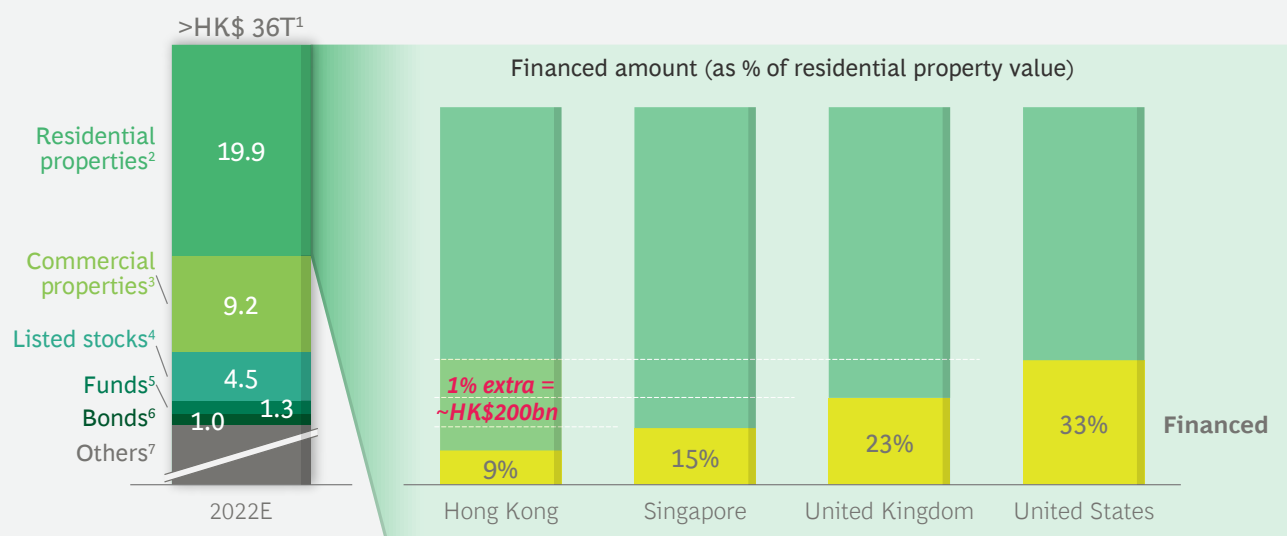
3.1.1 Opportunity deep dive: unlock liquidity

As discussed in previous sections, through tokenisation, new mediums of exchange can help unlock liquidity that currently sits in assets. (See Section 2.2.2.) At present, the size of assets potentially available for tokenisation in Hong Kong is around HK\$36 trillion; the majority of which are in residential property, at HK\$19.9 trillion. The tokenisation potential of the residential property is also reflected in the ratio of financed home property to property value, which represents the extent to which liquidity has been unlocked from assets. In Hong Kong, this ratio stands at 9%, compared to higher figures in other markets like the UK (23%) and the US (33%). (See Exhibit 13.)

While the scale of such potential is influenced by multiple factors, a secured lending solution that can offer personalised preferential financing rates depending on the loan's purpose and accept tokenised asset as collateral, can potentially allow people to release liquidity more easily from their capital assets. Taking residential property as an example, a 1% increase in the financed amount of Hong Kong's residential property represents HK\$200 billion which asset owners could use for local spending and investment, ultimately stimulating Hong Kong's economic growth.

EXHIBIT 13 | Value of selected illiquid assets in Hong Kong that could potentially be unlocked by new mediums of exchange

Selected assets in Hong Kong (HK\$ trillion) that could be tokenised



Source: Rating and Valuation Department; Census and Statistics Department; Securities and Futures Commission; Hong Kong Monetary Authority; Organisation for Economic Co-operation and Development; Literature research; BCG analysis.

¹ Estimated based on 2022 total value of selected assets.

² Includes 1.7 million private permanent quarters, 444,000 subsidized sale flats, and ~800,000 car parks.

³ Includes multiple types, e.g., offices, retail, flattened factories.

⁴ Includes companies listed on HKEX's Main Board & GEM.

⁵ Includes HK-domiciled unit trusts and mutual funds.

⁶ Includes HKD, CNH, and G3 debt/bonds in Hong Kong.

⁷ Cars, private shares, private funds, horses, commodities, arts.

3.1.2 Pilot solution design

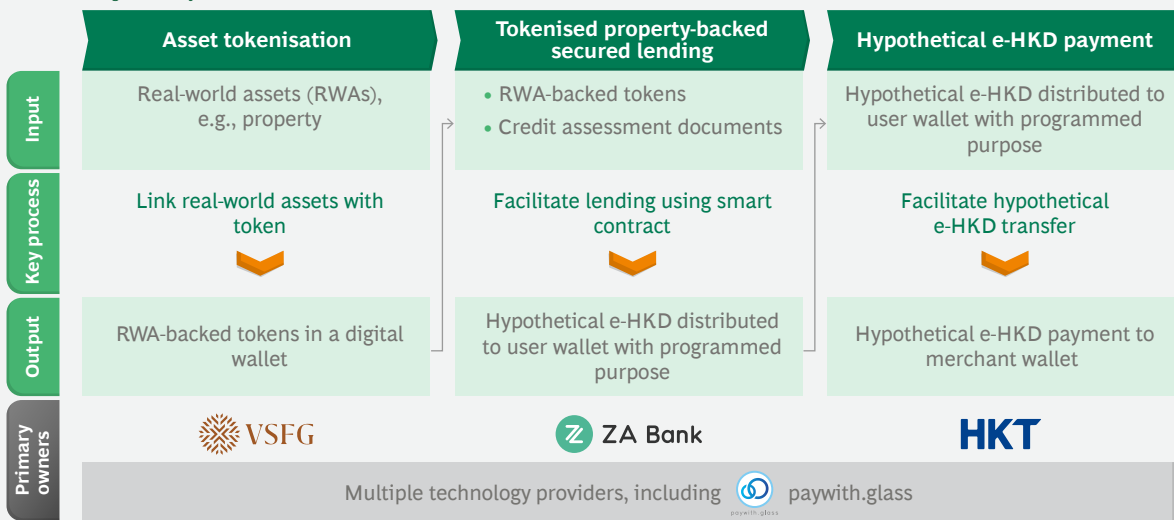
Our e-HKD pilot solution attempts to provide a flexible and personalised secured lending experience to borrowers through three interconnected modules: asset tokenisation, token-backed secured lending, and hypothetical e-HKD payment. The three-module design of the solution aims to explore the following:

- Advance tokenisation of assets before a specific lending need arises, allowing assets to serve as collateral for different types of loans when required.
- Holding of ring-fenced loan in any digital wallet of borrower.

Each of the co-authors played a specific role in the pilot solution (co-led by BCG, HKT Payment Limited and ZA Bank, with DLA Piper, paywith.glass and VSFG providing strategic/legal advisory support), as demonstrated in [Exhibit 14](#):

EXHIBIT 14 | Design flow of our e-HKD pilot solution

Secured lending backed by real-world asset tokens



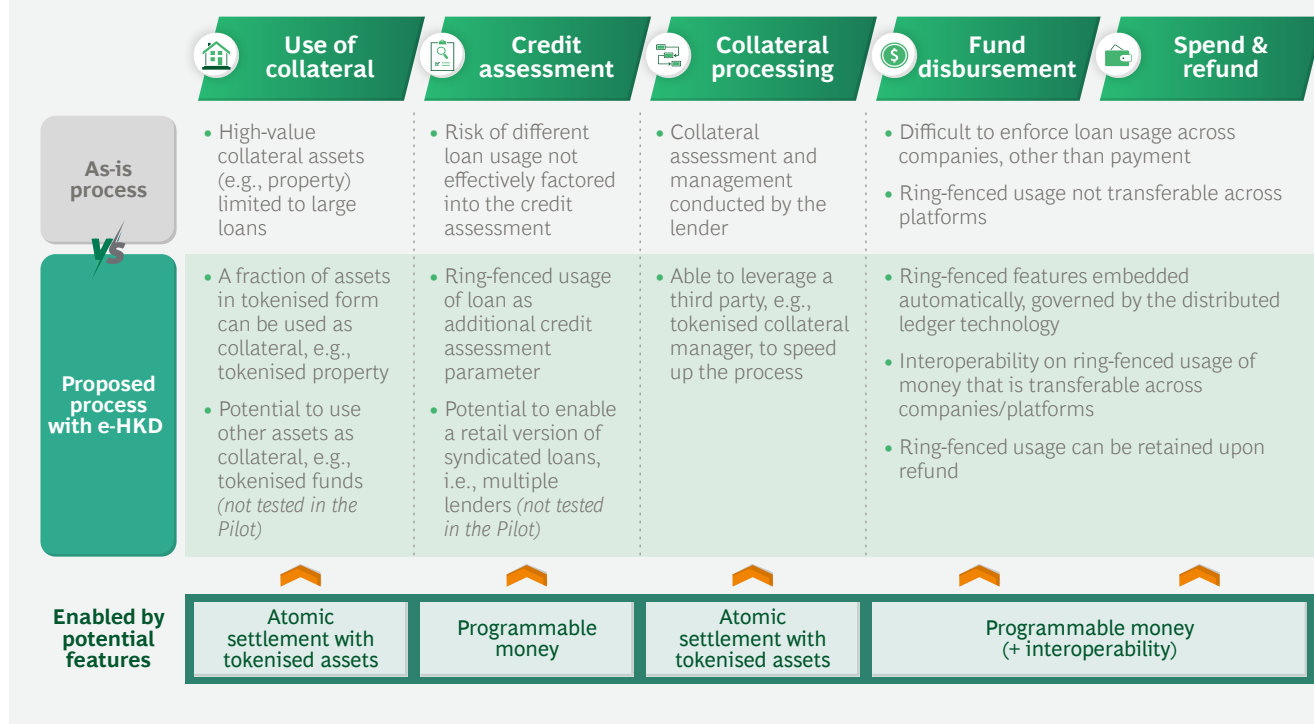
Source: BCG analysis.

- **VSFG** provided asset tokenisation technology in the pilot use case, creating real-world asset token(s) linked to the user's underlying real-world assets (such as residential property). In addition, VSFG played the role as the tokenised collateral manager, providing custody of the user's real-world asset tokens, and acting as an independent party to support operations of the tokens and assets.
- **ZA Bank** provided secured lending services that supported users with real-world asset token(s) as collateral and loan disbursement in hypothetical e-HKD subject to ring-fenced usage.
- **HKT Payment Limited** provided a digital wallet for ring-fenced hypothetical e-HKD usage, and managed refunds between the pilot's participants.
- **paywith.glass** provided technical advisory and support for the pilot use case design.
- **BCG** advised on and facilitated the pilot use case design.
- **DLA Piper** provided legal advisory support.

3.1.3 As-is versus proposed process flows

Compared to the as-is secured lending process, the pilot solution primarily leveraged two potential features of hypothetical e-HKD, to enhance the process flow. (See Exhibit 15.)

EXHIBIT 15 | “As-is” versus “proposed” process flows of our pilot solution



- **Atomic settlement with tokenised assets.** With this feature, hypothetical e-HKD could be transferred immediately once pre-defined conditions are met. This gives lenders and borrowers more efficient and trusted processing, potentially reducing operational costs and processing time.
- **Programmable money with interoperability.** e-HKD could be programmed for specific usage, e.g., medical expenses. This is enforced across platforms via smart contracts, instead of a single platform only. This means lenders now have a new function to better manage credit risk, and thus potentially offer preferential financing rates for different loan usages.

3.1.4 e-HKD’s benefits demonstrated in the pilot

In October 2023, the co-authors conducted a pilot trial of the use case which overall received positive feedback from all trial participants. Some highlights of the trial participants’ feedback include:

- **Trial borrower:**

“I actually want to use it in the future – the personalised rate and flexibility are attractive if e-HKD has programmability features. I’m happy to define a purpose for the loan, in exchange for a more personalised financing rate, as I already know that I’m spending the loan for a specific purpose.”

- **Trial merchant:**

“The pilot solution made payment and refund much more efficient, enabling us to better manage our finances and serve our customers.”

These benefits are enabled by the added efficiency provided by distributed ledger technology (DLT), as well as the inclusion of ring-fenced usage as part of the credit assessment processing. For example, from a lender’s perspective, the pilot use case could potentially result in faster processing time and lower interest costs for secured lending, thereby translating into benefits for customers.

The other three features of new mediums of exchange, namely near-instant payment, operations via transparent protocols and connection with virtual assets/Web3 economy, were also explored during the pilot. (See Exhibit 16.)

EXHIBIT 16 | Our pilot solution’s benefits for users and service providers

Typical features and opportunities of e-HKD						
		Focus of the pilot				
Features		Near-instant payment	Atomic settlement with tokenised assets	Programmable money	Operations via transparent protocols	Connection with virtual assets/Web3 economy
Used in our pilot?		Yes	Yes	Yes	Yes	Yes
Preliminary findings	Benefit for users	Similar process as online consumer-to-merchant payment today	- Use of new asset types as collateral Ability to take out smaller loans with fractionalisation	Potentially more competitive interest rate with ring-fenced loan features	Faster and more efficient loan processing using on-chain assets as collateral	No longer required to undergo on/off ramp process
	Benefit for service providers	Potential to reduce the payment settlement time for merchants from T+1/2 to same-day	Potential to streamline collateral management process for lender, as collateral has been pre-validated by tokenisation agent	Ability to lock in loan usage during application and track usage post disbursement—easier for banks to manage risk	New revenue streams by unlocking use of new asset types as collateral (e.g., virtual assets, tokenised securities, tokenised funds)	Creation of new virtual asset services (e.g., virtual asset exchange)

Source: Pilot findings; BCG analysis.

3.2 Requirements to Capitalise on the Benefits of e-HKD

The premise of benefit realisation of the e-HKD is built on three requirements: 1) creating new value through opportunities for disruptors and innovators to challenge the status quo; 2) providing a trusted medium of exchange by ensuring controls around cybersecurity and “singleness” of money; and 3) building a clear legal and regulatory framework for new mediums of exchange and virtual assets. We believe these requirements do not only apply to retail CBDC if introduced, but to tokenised deposits and stablecoins as well.

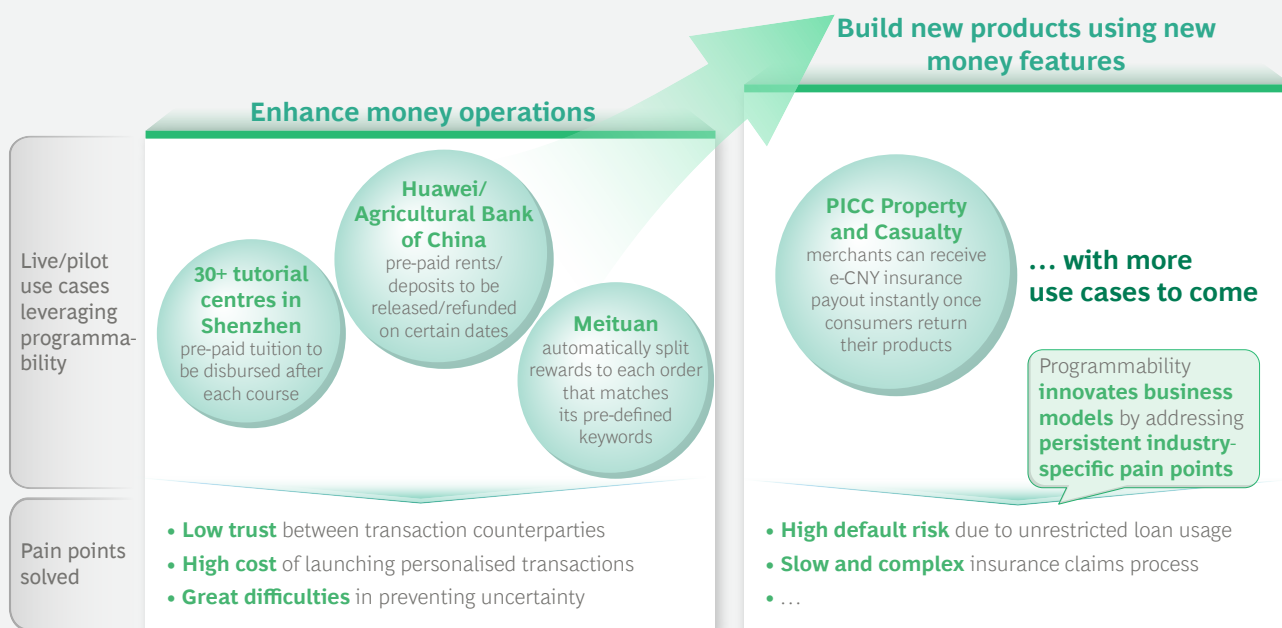
3.2.1 Creating new value

• Programmability

Enhanced programmability is a key value-add of retail CBDC. From the consumer survey, almost 50% of respondents find this feature helpful in scenarios such as transferring money to dependents; in addition, 57% of respondents find loans with ring-fenced usage attractive (if offered a lower interest rate versus loans without pre-defined conditions). Aside from potential applications in payments, programmability can also be applied to other financial and non-financial use cases, as observed in other retail CBDC, such as e-CNY. (See Exhibit 17.)

EXHIBIT 17 | Programmability as a key value-add for retail CBDC

Illustrative



Source: Literature research; BCG analysis.

• On-chain transactions and settlement

There has been a growing market interest in asset tokenisation, with an increasing number of use cases or pilots to explore tokenisation of different asset types. As time progresses, assets and operations could increasingly move on-chain, which would shorten the time spent in settlement and asset delivery as well as bring in innovation to business and operating models. (See Exhibit 18.)

EXHIBIT 18 | Illustrative scenarios of transaction and settlement



Source: BCG analysis.

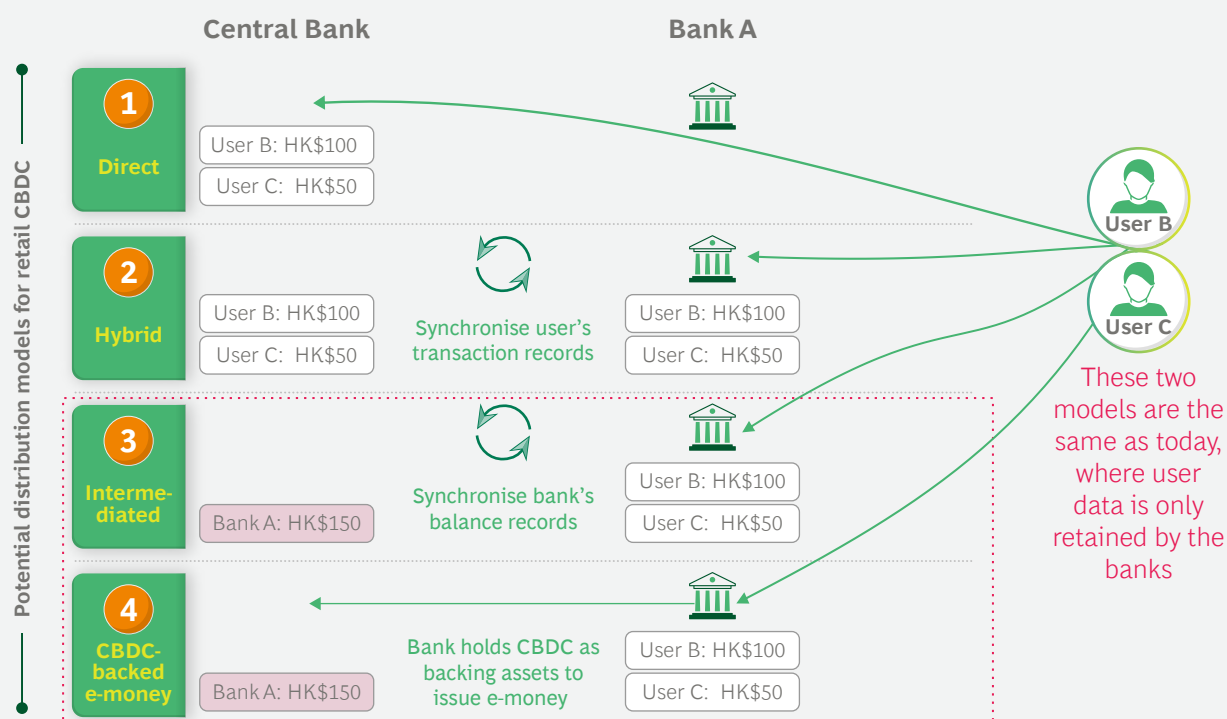
3.2.2 Providing a trusted medium of exchange

• Data privacy

Data privacy was highlighted as a key concern by 71% of consumer survey respondents and was often the first question asked by industry practitioners when we discussed a potential future issuance of retail CBDC.

If retail CBDC is rolled out, potential data privacy risks can be managed by carefully designing how retail CBDC is distributed. As highlighted in the HKMA whitepaper “e-HKD: A Technical Perspective”, there could be four potential distribution models of retail CBDC, two of which (intermediated, CBDC-backed e-money) do not directly expose the central bank to individual users’ transaction records. (See Exhibit 19.)

EXHIBIT 19 | Potential distribution models of retail CBDC

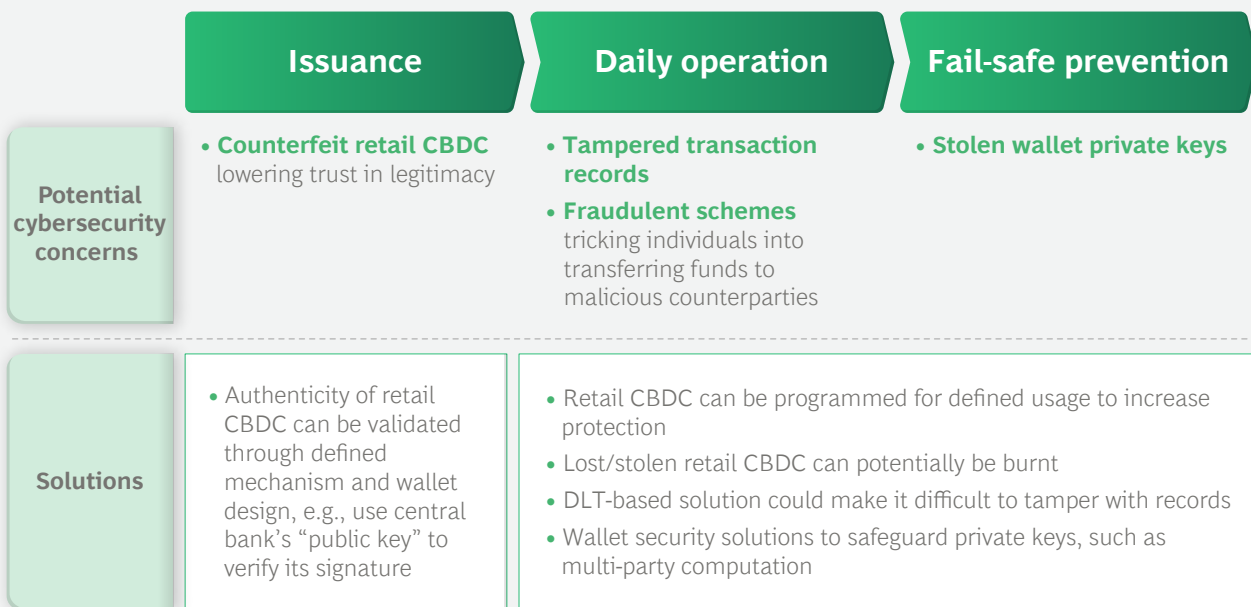


Source: HKMA whitepaper “e-HKD: A technical perspective”; BCG analysis.

• Cybersecurity

Similar to data privacy, cybersecurity was ranked by the majority of respondents (70%) as a key concern. To mitigate cybersecurity risks, a range of technology solutions can be leveraged and incorporated into the design of a future retail CBDC. (See Exhibit 20.)

EXHIBIT 20 | Potential solutions to address cybersecurity concerns



Source: BCG analysis.

• “Singleness” of money

In the consumer survey, 61% of respondents find “backed by the central bank” as an important criterion in considering whether to use retail CBDC in everyday scenarios. As such, it is important that “singleness” of money is retained if retail CBDC is to be introduced. In other words, one unit of retail CBDC provably carries an equivalent value to one unit of other existing forms of legal tender (e.g., banknotes and coins), and that this condition always remains true.

• Interoperability

With the potential introduction of retail CBDC as a new means of payment, interoperability with existing payment rails will be important to ensure a smooth user-merchant experience, as well as to minimise potential disruptions to existing clearing and settlement systems. (See Exhibit 21.) Interoperability applies to technical standards (such as messaging standards, data infrastructures), access controls, clearing and settlement obligations, and fail-safe mechanism across all payment rails.

EXHIBIT 21 | Retail CBDC should be interoperable with domestic and cross-border payment rails

Interoperability enables money to flow seamlessly across different payments rails



Specific benefits include ...

- **Payment flexibility:** Universal payment acceptance could help merchants increase customer reach and retain customers
- **Increased efficiency in payment processing:** Integration reduces communications among financial/payment service providers, lowering operational costs and empowering faster payment for end users

Source: BCG analysis.

3.2.3 Building a clear legal and regulatory framework for new mediums of exchange and virtual assets

• Legal and regulatory challenges

In designing and completing our pilot, we explored various legal and regulatory issues arising from the use of new mediums of exchange and virtual assets (e.g., RWA tokens). For financial and technological services providers navigating these issues, complex legal engineering and detailed consultation with regulators are often required, which significantly impact costs and go-to-market timelines. This, in turn, reduces the commercial feasibility of service offerings seeking to leverage unique benefits of new mediums of exchange. As for consumers, unfamiliarity with the underlying technology of new mediums of exchange and other concerns as highlighted in the consumer survey (e.g., data privacy, cybersecurity, the “backing” of new mediums of exchange) may be contributing factors to general apprehensiveness towards using new mediums of exchange in everyday transactions.

Addressing the above issues would help accelerate the acceptance of new mediums of exchange and virtual assets by both businesses and consumers. To do so, in our view, there is ample room for law reform and regulatory guidance, in order to provide the market with sufficient clarity and confidence to roll out innovative offerings involving new mediums of exchange and virtual assets.

- **Potential areas for law reform and regulatory guidance**

From our pilot experience, the following issues are potential areas for law reform and regulatory guidance for the development of new mediums of exchange:

- **Legal tender status.** In Hong Kong, the legal tender status of currency notes, banknotes and coins is recognised under the Legal Tender Notes Issue Ordinance and the Coinage Ordinance. If e-HKD or another form of CBDC were to be implemented, amendments of relevant statutes or enactment of a new statute specific to new mediums of exchange would help clarify their legal tender status.
- **Tokenisation (and fractionalisation) of real-world assets.** A key issue relevant to creating on-chain real-world assets (RWAs) is how a legal right external to a cryptographic token can be “linked” or “stapled” to the token. This is an issue faced by every issuer of an RWA token, and its complexity would also vary across different RWAs (e.g., residential homes, debt securities). The legal status of such a link is also untested in courts, and the strength of which would depend on various factors, such as the type of RWA, the legal right(s) involved, and what the RWA token is used for (e.g., fundraising, used as collateral). In the case of our pilot, this issue translates into how property rights to a residential home can be fractionalised and represented by ERC-1155 tokens. While technically possible, various statutory requirements relating to the registration of land interests and proof of title represent one of the challenges to the industry to fully harness technological advantages presented by tokenisation and fractionalisation of RWAs.

In particular, for real estate to be tokenised and fractionalised in a meaningful manner and RWA tokens to act as a bearer asset which grants rights to the underlying RWAs, the following challenges presented under Hong Kong’s current land law regime would have to be overcome:

- (i) Potential co-ownership issues may arise in relation to a fractionalised real estate in the form of RWA tokens, since there would be no documents in place to govern the relationship between the fractionalised RWA token holders. A digital form of a deed of mutual covenant for a single property will be required to represent each RWA token holder’s portion of the property ownership interest.
- (ii) Each transfer of the fractionalised RWA tokens would trigger an assignment of a part of the property registered with the Hong Kong Land Registry, which means every token transfer will need to be registered with the Hong Kong Land Registry in order to be legally effective. In other words, even though the RWA tokens can be transferred quickly, these transfers are not sufficient for the underlying property interest to legally change

hands. As such, unless the law recognises token transfers as a way to effect property transactions, the increased transfer efficiency enabled by tokenisation would be nullified by the lack of legal effect.

- (iii) Unless RWA token holders are able to produce title deeds to a property, lenders may not be satisfied that they have good title. Again, existing statutory requirements prevent RWA tokens from being used or seen as an instrument that confers legal rights to the underlying asset.

As above, these challenges stem from statutory requirements relating to property rights. Unless the law evolves to accommodate tokenised real estate, tokenisation would add an additional layer of complexity to property transactions, rather than serve its intended role of bringing efficiency and interoperability to paper-heavy processes.

- **Regulatory compliance.** To accommodate virtual assets activities, the Hong Kong regulatory framework has undergone significant development in the past 12 months. Examples include regulatory regime of virtual asset trading platforms and regulatory guidance on tokenised securities-related activities; in addition, the Financial Services and the Treasury Bureau (FSTB) and the HKMA jointly released a public consultation paper in December 2023, which proposes legislative measures to implement a regulatory framework for stablecoin issuers in Hong Kong, inviting feedback from the public and stakeholders.

That said, many activities involving new mediums of exchange and virtual assets (e.g., providing custody services, issuing or creating virtual assets) generally remain unregulated. Timely guidance on regulatory compliance requirements and expectations of regulators would help businesses formulate their Web3 strategies more efficiently.

3.3 Technical Considerations

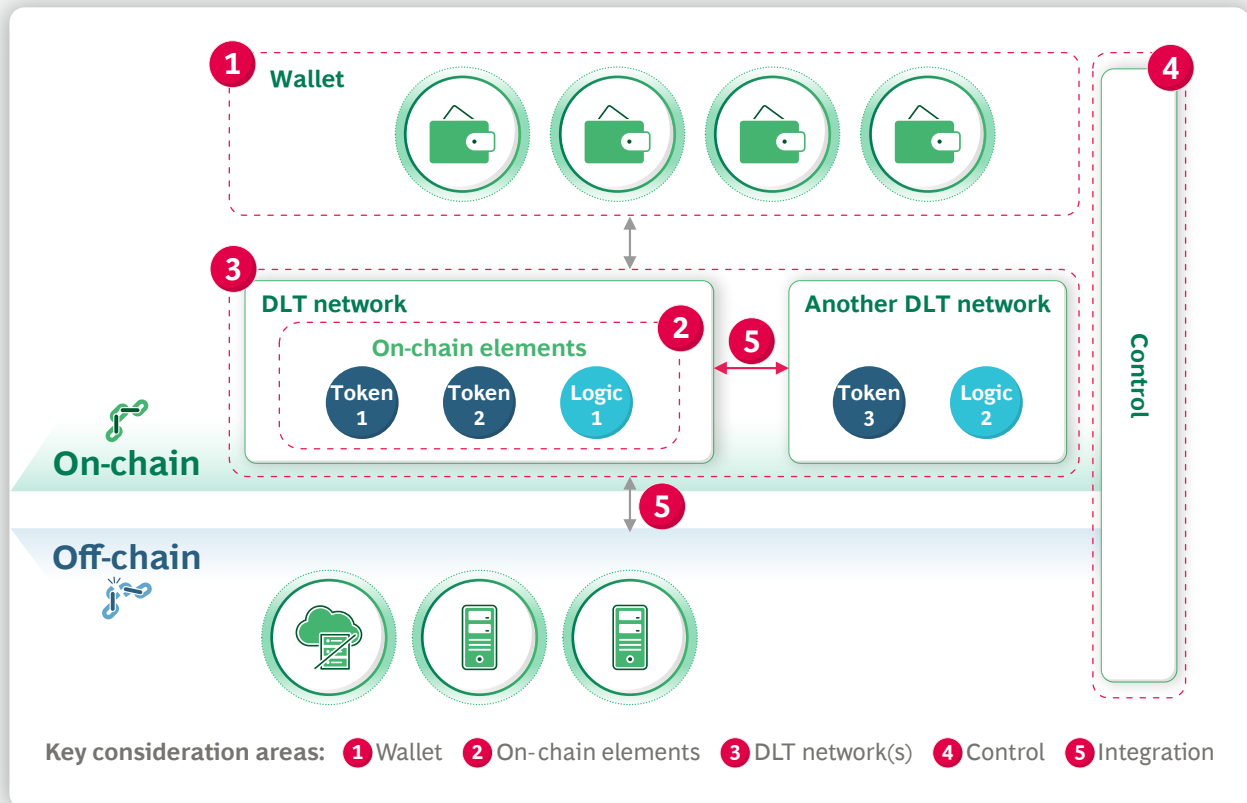
With new mediums of exchange, we see the potential of using distributed ledger technology (DLT) to better deliver business value. During the pilot, DLT such as blockchain enabled us to develop solutions faster and introduce new features enabled by smart contract, such as programmability and atomic settlement with tokenised assets.

The full benefits of new mediums of exchange can only be realised with proper technical design and use case application. In this section, we will discuss: 1) the design framework: what are the fundamental questions to ask when designing a new mediums of exchange technical solution? 2) our pilot solution: what are the design choices we have made for our pilot product and what are the underlying rationales? 3) lessons learnt: what are the key takeaways from our pilot and what are the key areas worth further improvements?

3.3.1 Technical framework for using new mediums of exchange

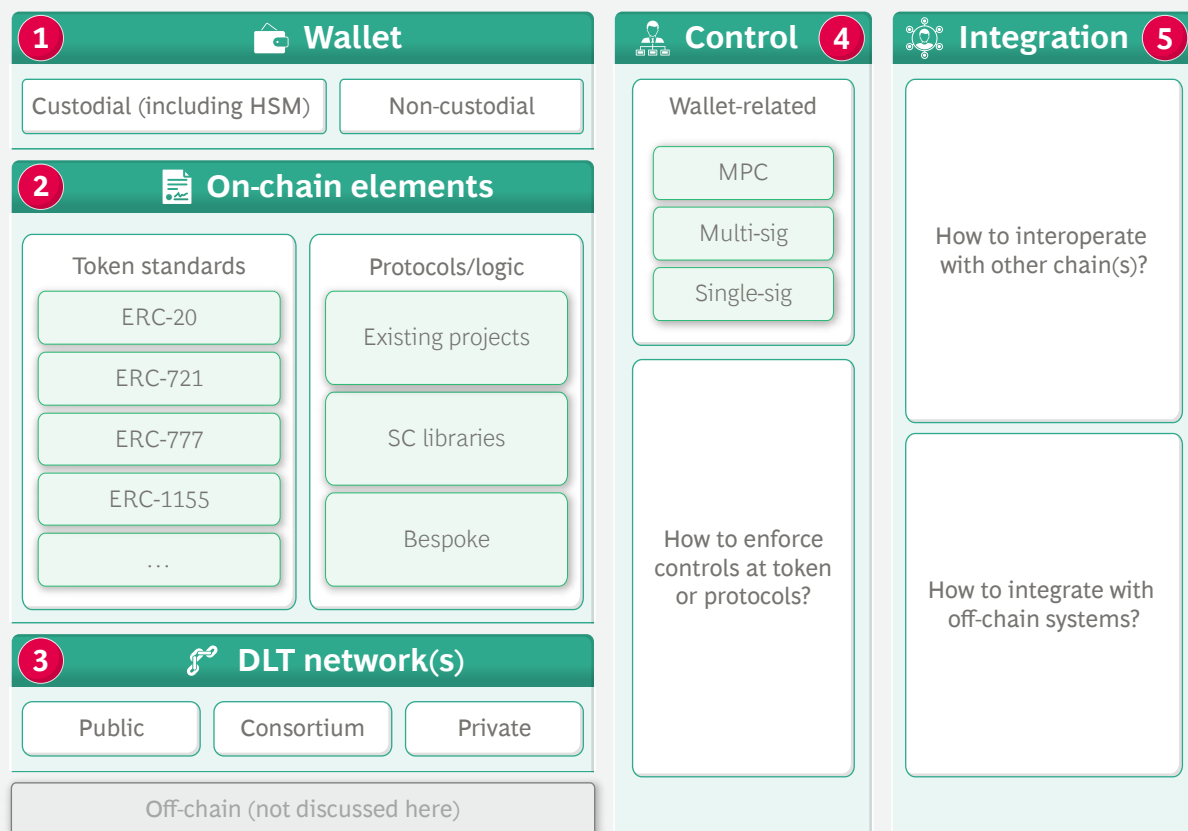
What is meaningful to be hosted on-chain? This question encompasses three elements: data (including token and asset data), automation, and product logic. A solution can have one of three potential technical designs: a fully on-chain solution, an entirely off-chain solution, or a hybrid solution of the two. (See Exhibits 22 and 23.)

EXHIBIT 22 | Key technical elements of a hybrid DLT-based solution



Source: BCG analysis.

EXHIBIT 23 | Hybrid-DLT technical design framework



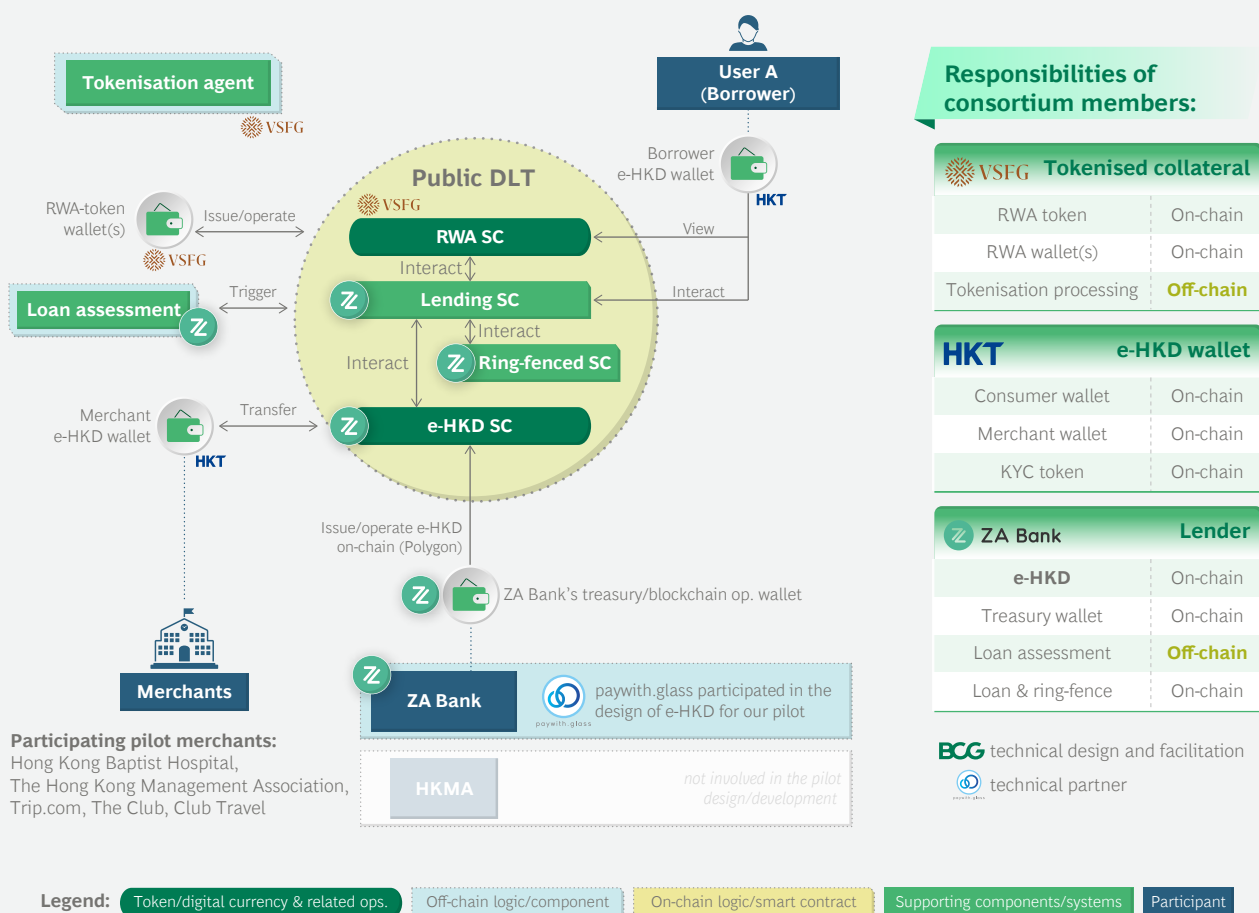
Source: BCG analysis.

3.3.2 Technical design for the e-HKD pilot use case

• High-level technical design

We decided to leverage a hybrid-DLT model to have a subset of data (such as token information) and automation (enabled by smart contracts) hosted on-chain, while business logic such as credit assessment for loans is processed off-chain. (See Exhibit 24.) This is to ensure that confidential data and business logic are processed safely. Real-world asset (RWA) tokens were created on-chain as a transferable documentation proof. In addition, cross-entity process automation was handled on-chain for trusted operations, for example, setting ring-fenced usage for the hypothetical e-HKD and disbursement of hypothetical e-HKD to borrowers.

EXHIBIT 24 | Technology design of our pilot solution



Source: BCG analysis.

Note: Five merchants participated in two rounds of testing for the pilot use case. These merchants primarily tested the ring-fenced payment and refund function. e-HKD employed in the pilot is hypothetical.

• Specific technical design details

Referencing back to [Exhibit 24](#), our technical design and corresponding rationales are outlined below:

Category	Technical design	Rationale
Blockchain	Public chain	For its developer-friendly environment; Polygon was chosen for our pilot, considering its support for EVM-compatible chains
Smart contract	Bespoke design	Leveraging existing library to build the product logic required in our pilot
Wallet	Custodial wallet	For compliance and user protection (e.g., access recovery) purposes, leveraging third parties with a hardware security module to manage the private key of KYC'ed parties
Tokens	ERC-721 for KYC token	An NFT with non-transferable support to indicate whether a wallet address has been validated
	ERC-777 for hypothetical e-HKD	Widely accepted (as compatible as ERC-20), with advanced flexibility to implement controls on repayment logic required in our pilot and future logics
	ERC-1155 for RWA token	Enabled issuance and management of many individually fungible asset tokens
Interoperability	APIs (e.g., restful APIs with authorisation)	Pre-defined and agreed between the interfacing parties on Day 0 to facilitate modularised design
Control/security	MPC + TEE solution (by Safeheron)	To reinforce security, recover control key and for its potential to support multi-party signatures in future
	Control on hypothetical e-HKD	To allow the ring-fenced usage feature of hypothetical e-HKD. Authorised parties can control the spending conditions (e.g., purpose); this may be expanded to cover timing restrictions in future

3.3.3 Lessons learnt on technical design from our pilot

- **Best practices of hybrid-DLT model**

We have concluded four key best practices that have been incorporated into our hybrid-DLT solution:

- Leverage existing technical standards and DLT-native programmability (smart contracts)
- Modularise smart contracts with data exchange format and interface specifications agreed in design
- Smart contract requires each party to review (e.g., smart contract audit) to ensure smooth operation
- Apply wallet-level non-transferable digital identity tokens, to distinguish wallets that have met regulatory KYC standards from other wallets

- **Areas for improvement**

Looking ahead, we see room for further improvements to DLT. Such improvements include but are not limited to:

- Common smart contract standard across DLT platforms to simplify migration and allow uniform business logic
- Easier and safer cross-chain interoperability for more developer-friendly solutions
- Better and configurable privacy controls to ease users' concerns given blockchain's transparent nature
- Better transaction performance to increase scalability and applicability of DLT

Design choices should be made to fit the use case. Our pilot solution is only one way to utilise the innovative features of smart contract and new mediums of exchange, and we look forward to more developments from the industry.

4. Actions for the Path Forward

Earlier sections of this report highlighted the potential benefits and considerations of e-HKD and other forms of new mediums of exchange. The remaining questions to solve are: how should we seize the opportunities created by e-HKD, tokenised deposits and stablecoins? What are the roles of different parties in this ecosystem?

In this chapter, we will cover the shifting role of financial institutions, the ecosystem required to support the development of new mediums of exchange, and recommendations for public-private collaboration moving forward.

Evolving Role of Financial Institutions

Financial institutions (FIs) have an opportunity to be at the forefront of driving innovation using new mediums of exchange. Traditionally, financial institutions have played an important role in facilitating the exchange of goods and services, helping customers safeguard assets and manage risks, and providing individuals and businesses with access to financing. With the emergence of new mediums of exchange, we see the first-mover advantage for those who actively explore its potential features and develop cutting-edge products and services. Applications of new mediums of exchange should also be considered in conjunction with other fintech areas such as open banking, embedded finance and more.

Operating Model and Ecosystem

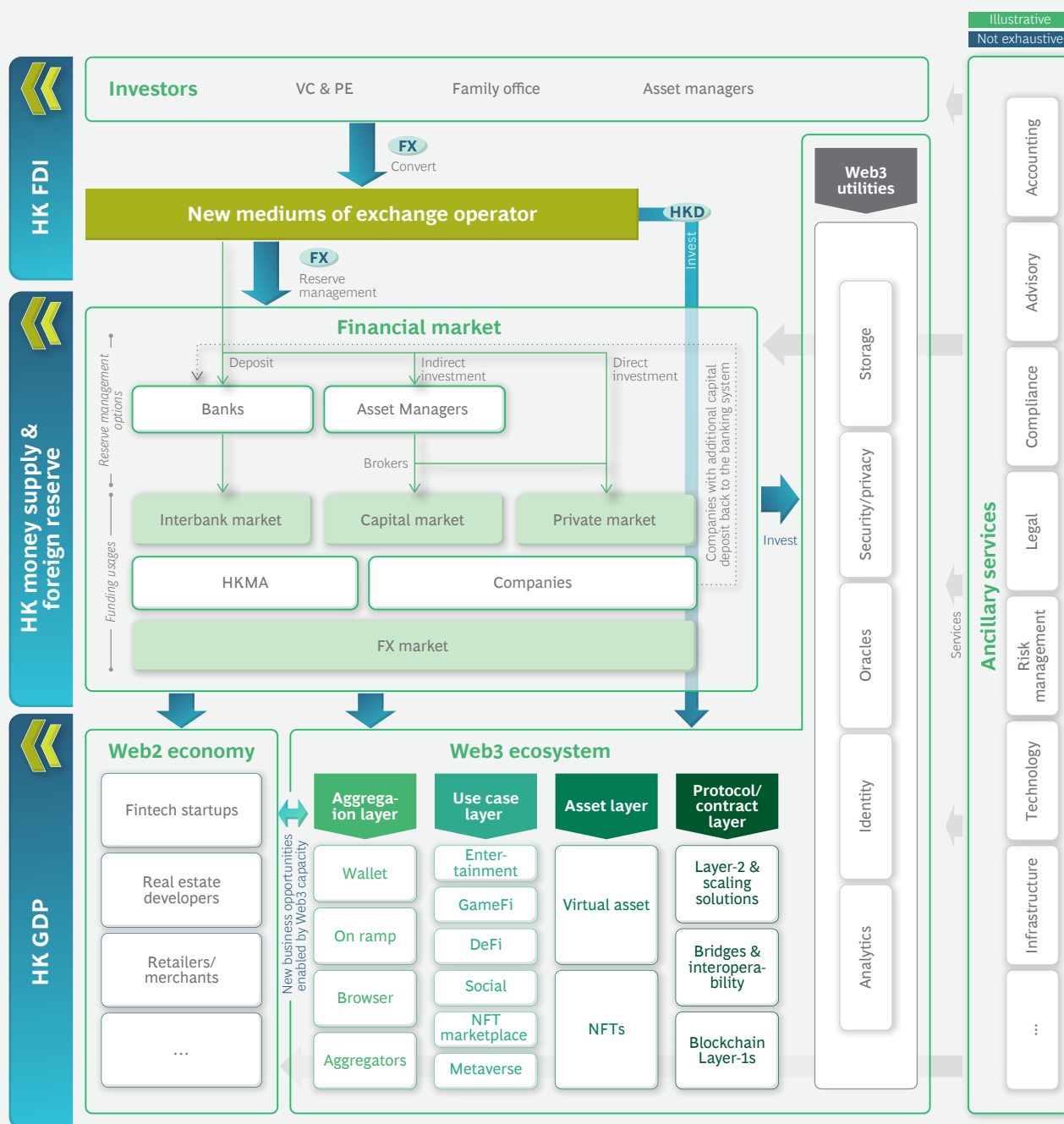
To drive the adoption of new mediums of exchange, different stakeholders need to come together with each playing a different role. These stakeholders include:

- Investors, such as private equity (PE), venture capital (VC), family office, and asset managers
- Financial market participants, such as banks, asset managers, broker-dealers, and regulators
- Corporates and businesses, such as retailers and real asset developers
- Web3-focused companies (e.g., wallet providers, GameFi developers, virtual asset exchanges, blockchain providers)

- Web3 utilities and ancillary service providers (e.g., oracles, digital identity, legal, accounting)

Ultimately, the fully-fledged operating model could accelerate the economy growth and act as a springboard for Hong Kong to become a prominent international fintech centre. (See Exhibit 25.)

EXHIBIT 25 | Potential operating model for new mediums of exchange



Source: BCG analysis.

Public-Private Collaboration

To achieve the transformative growth empowered by new mediums of exchange, both public and private sector participants should come together and define a clear framework for collaboration. To mark the end of our research and pilot, we have distilled our experiences into four areas of collaboration to be considered by the public and private sectors. (See Exhibit 26.)

EXHIBIT 26 | Four key areas for public-private collaboration

	Public sector	Private sector (FIs and non-FIs)
Build digital mediums of exchange/on-chain ecosystem 	Public-private sector collaboration to build on-chain ecosystem (e.g., on-chain assets, CBDC, tokenised deposits and stablecoins, and on-chain operations), to support future development of digital mediums of exchange and related use cases, as well as facilitate mass adoption	
Align regulations and industry standards 	Accelerate regulatory development on CBDC, tokenised deposits and stablecoins, and other digital assets	Develop industry standards to promote interoperability of CBDC, tokenised deposits and stablecoins, and other digital assets (e.g., token standards)
Reduce adoption hurdles 	Government support (incubator, grants) to drive related technology development	Industrywide utility to support adoption of CBDC, tokenised deposits and stablecoins, and other digital assets
Educate and build talent foundation 	Raise public awareness of potential benefits and risks associated with the use of CBDC, tokenised deposits and stablecoins Attract new businesses and talent to bring latest skillsets to Hong Kong	Develop CBDC, tokenised deposits and stablecoins/digital asset talent in Hong Kong through training and education

Source: BCG analysis.

Conclusion

C BDC, tokenised deposits and stablecoins are no longer a niche topic. This report has shown that public and private sectors can come together and seize this opportunity to shape the evolution of money for the benefit of all.

Whilst a key focus of this report is to share co-authors' key findings and learnings from the e-HKD pilot use case, it is important to note that the HKMA has not made a decision on whether or when to introduce the e-HKD. The ability to realise the potential benefits at scale is subject to further research and testing. In addition, the decision to launch e-HKD should be considered in conjunction with market development on stablecoins and tokenised deposits.

The adoption of new mediums of exchange, regardless of their stage of development, does not come without challenges. Nevertheless, understanding the core features of new mediums of exchange and the potential disruptions and innovations they could bring is imperative for leaders across the public and private sectors. With both public and private sectors working together, we can reimagine the future by unlocking the potential of new mediums of exchange.

Appendix

Hong Kong Consumer Survey on CBDC, Tokenised Deposits and Stablecoins and Property-Backed Secured Lending

Objective



Understand **general perception** of Hong Kong consumers towards CBDC, tokenised deposits and stablecoins



Understand **potential demand for CBDC, tokenised deposits and stablecoins** use cases, such as property-backed secured lending



Scale and duration

- Received a total of 1,840 effective responses from 15 to 25 August 2023



Content

Survey questions were divided into four sections to understand:

- 1 Demographics:** whether demographic features (e.g., age group) have any correlation with perceptions of CBDC, tokenised deposits and stablecoins
- 2 Perceptions and behaviours of digital mediums of exchange:** general perceptions of CBDC, tokenised deposits and stablecoins in Hong Kong
- 3 Preferences over features for digital mediums of exchange:** whether there are consumer preferences for specific features for CBDC, tokenised deposits and stablecoins under a set of hypothetical scenarios
- 4 Property-backed secured lending experiences:** user pain points during the secured lending process and views on potential innovation to be enabled by CBDC, tokenised deposits and stablecoins (e.g., programmability)

Source: Hong Kong Consumer Survey on CBDC, Tokenised Deposits and Stablecoins and Property-Backed Secured Lending, conducted by BCG, HKT Payment Limited, VSFG and ZA Bank in August 2023.

References

Bank for International Settlements (BIS), “CBDCs in emerging market economies”, April 2022, <https://www.bis.org/publ/bppdf/bispap123.pdf>.

Bank for International Settlements (BIS), “Making headway – Results of the 2022 BIS survey on central bank digital currencies and crypto”, July 2023, <https://www.bis.org/publ/bppdf/bispap136.pdf>.

Coindesk, “Nodes on Bitcoin’s Lightning Network Double in 3 Months”, July 2021, <https://www.coindesk.com/tech/2021/07/14/nodes-on-bitcoins-lightning-network-double-in-3-months/>.

Cryptoslate, “25 important stats about the DeFi industry from 2022”, January 2023, <https://cryptoslate.com/25-stats-about-the-defi-industry-from-2022/>.

DefiLlama, total stablecoins market cap, extracted on 26 February 2024, <https://defillama.com/stablecoins>.

Financial Services and the Treasury Bureau, “Replies to initial questions raised by Legislative Council Members in examining the Estimates of Expenditure 2023-24”, https://www.legco.gov.hk/yr2023/english/fc/fc/w_q/fstb-tsy-e.pdf.

HKSAR Government, “HK set to tap Web3 potential”, August 2023, https://www.news.gov.hk/eng/2023/08/20230825/20230825_124937_227.html.

HKSAR Government, speech for the 2023-2024 budget, February 2023, https://www.budget.gov.hk/2023/eng/pdf/e_budget_speech_2023-24.pdf.

Hong Kong Consumer Survey on CBDC, Tokenised Deposits and Stablecoins and Property-Backed Secured Lending, conducted by BCG, HKT Payment Limited, VSFG and ZA Bank in August 2023.

Hong Kong Monetary Authority, “Commencement of the e-HKD Pilot Programme”, May 2023, <https://www.hkma.gov.hk/eng/news-and-media/press-releases/2023/05/20230518-4/>.

Hong Kong Monetary Authority, “e-HKD: A Policy and Design Perspective”, April 2022, https://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/e-HKD_A_Policy_and_Design_Perspective.pdf.

Hong Kong Monetary Authority, “e-HKD: A Technical Perspective”, June 2021, https://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/e-HKD_A_technical_perspective.pdf.

About the Authors

Boston Consulting Group (BCG)

Tjun Tang, Managing Director and Senior Partner

Saurabh Tripathi, Managing Director and Senior Partner

David Chan, Managing Director and Partner

Yue Hong Zhang, Managing Director and Partner

Kunal Jhanji, Managing Director and Partner

Kaj Burchardi, Platinion Managing Director

Teddy Hung, Project Leader

Bihao Song, Principal IT Architect

DLA Piper

Kristi Swartz, Partner and Technology Sector Lead (Asia)

Kenneth Lee, Senior Associate (real estate)

Jen Lee, Associate (intellectual property and technology)

HKT Payment Limited

Monita Leung, Chief Executive Officer at HKT Digital Ventures and Chief Executive of HKT Payment Limited

Felix Tsui, Chief Strategy Officer at HKT Digital Ventures

paywith.glass

Paul Sisnett, Chief Executive Officer

Venture Smart Financial Holdings Limited (VSFG)

Lawrence Chu, Chairman

Christopher Cheung, Chief Technology Officer

ZA Bank

Ronald Iu, Chief Executive Officer and Executive Director

Devon Sin, Alternate Chief Executive and General Manager of Business Banking and Lending

Kenneth Tsoi, Senior Manager (product and ecosystem)

The authors wish to thank BCG colleagues Allison Xu, Daniel Hartschenko, David Lee, Florence Lee, Jiaqi Lan, Johnny Kao, Jolene Ho, Nikolai Pomortsev, Sheila Hsu, Stefan Wang and Xiaoqing Xu for their support and contributions in the preparation of this report.

We also thank the many stakeholders for their open and supportive contributions towards the e-HKD pilot use case and this report. On the e-HKD pilot use case, we acknowledge the technical support provided by Safeheron and Polygon, as well as merchants' participation in the pilot. Our hybrid-DLT solution is built on Polygon's blockchain and Safeheron provided the wallet technology solutions for ZA Bank and VSFG to facilitate the secured handling of RWA tokens and hypothetical e-HKD. We also acknowledge our participating merchants in the e-HKD pilot, including Hong Kong Baptist Hospital, Trip.com, The Hong Kong Management Association, The Club and Club Travel.

About Boston Consulting Group

Boston Consulting Group partners with leaders in business and society to tackle their most important challenges and capture their greatest opportunities. BCG was the pioneer in business strategy when it was founded in 1963. Today, we work closely with clients to embrace a transformational approach aimed at benefiting all stakeholders—empowering organizations to grow, build sustainable competitive advantage, and drive positive societal impact.

Our diverse, global teams bring deep industry and functional expertise and a range of perspectives that question the status quo and spark change. BCG delivers solutions through leading-edge management consulting, technology, and design, and corporate and digital ventures. We work in a uniquely collaborative model across the firm and throughout all levels of the client organization, fueled by the goal of helping our clients thrive and enabling them to make the world a better place.

About DLA Piper

DLA Piper is a global law firm with lawyers located in more than 40 countries with over 90 offices and 5,000 lawyers across Asia Pacific, Europe, Africa, the Middle East, and the Americas. We have extensive experience gained from working within every area of law. We are one of the largest international law firms in the region, providing clients with a comprehensive range of legal services through our practice groups: Corporate; Intellectual Property and Technology; Tax; Finance and Projects; Litigation and Regulatory; Restructuring; Employment and Real Estate.

At DLA Piper, we believe great businesses can make a better world. That's why, every day, we help our clients succeed. Bold thinking and trusting relationships are at the heart of our work, helping clients embrace change and seize opportunities. Together, we can make business better.

About HKT Payment Limited (Stored Value Facilities Licence Number: SVF0002)

HKT Payment Limited, a wholly-owned HKT Limited subsidiary, was granted the stored value facilities license by the Hong Kong Monetary Authority in 2016, and provides mobile payment service in Hong Kong under the Tap & Go brand.

Tap & Go is the first mobile wallet in Hong Kong incorporating Mastercard, UnionPay, FPS and Tap & Go closed-loop payment, allowing users to make payments seamlessly and reliably over a secured app as the city moves fast towards a cashless society. With its extensive local merchant network, users can enjoy spending at more than 100,000 points of sale including physical stores and online platforms. Tap & Go users can also enjoy the convenience of seamless payment in China including transportation and flexible conversion between HKD and RMB anytime, anywhere.

About paywith.glass

paywith.glass is Digital Asset/Real-Time Payment (DA/RTP) infrastructure which seamlessly blends the speed of real-time payments with Satoshi Nakamoto's peer-to-peer electronic cash vision. It addresses existing system limitations by introducing robust privacy constructs, security measures and anti-exploitation features, while preserving scalability.

This asset-agnostic infrastructure embodies a user-centric, privacy-focused and globally scalable multi-Central Bank Digital Currency (mCBDC) architecture. With native support for tokenised asset minting and burning, real-time compliance, a self-sovereign digital identity model and support for self-custody, the paywith.glass architecture meets the demands of today's instant world and those of tomorrow's digitally native generation.

Through its native support for the coexistence of multiple digital assets including Central Bank Digital Currencies (CBDCs) and cryptocurrencies and along with a focus on addressing cash flow constraints and financial inclusion issues, paywith.glass is an ideal choice for forward-thinking governments and innovative businesses. It combines user-centric mobile payment features with real-time settlement, security, accessibility and global scalability, surpassing the capabilities of legacy payments networks and the DLT-only systems already on the market. Notably, paywith.glass already provides the supporting infrastructure to power the Digital Sterling pilot via the Digital FMI Consortium in the UK.

About Venture Smart Financial Holdings (VSFG)

Venture Smart Financial Holdings Limited (VSFG) is a global financial services platform headquartered in Hong Kong, striving to integrate traditional wealth management with the future of finance, while supporting Hong Kong as an international virtual asset centre.

In June 2020, VSFG became the first virtual asset manager in Hong Kong approved by Securities and Futures Commission (SFC) to manage portfolios that may invest up to 100% in crypto assets, and within this space launched Hong Kong's first SFC-regulated Bitcoin Tracker fund, followed by a cryptocurrency hedge fund.

VSFG is dedicated to the research and development of products and services that can integrate traditional and virtual assets under a compliant regulatory framework, helping family offices and institutions to allocate their assets in an orderly manner in both traditional and virtual worlds. By combining Web3 and blockchain technologies to financial services, we have formed a dedicated team and new business called IDA to spearhead Hong Kong's efforts in developing Finance 2.0 globally.

About ZA Bank

ZA Bank Limited (ZA Bank), licensed by the Hong Kong Monetary Authority on 27 March 2019, is one of the first batch of virtual banks in Hong Kong. On 24 March 2020, ZA Bank officially launched its services to the public, making it the first fully operating virtual bank in Hong Kong. On 22 March 2021, ZA Bank officially launched Business Banking to deliver an innovative banking experience to local small and medium-sized enterprises. ZA Bank was established by ZhongAn Technologies International Group Limited (ZA International). With its “Community-Driven” approach, ZA Bank encourages users to directly contribute to its product development and design processes, helping the bank create innovative services that better serve the needs of Hong Kong customers.

Based on market data as of 30 June 2023, ZA Bank has gained the support of 700,000 users, becoming the largest virtual bank in Hong Kong in terms of user base with a leading position in the virtual banking industry in terms of customer deposits and assets. The bank was named Virtual Bank of the Year – Consumer (Hong Kong) in The Asset Triple A Digital Awards 2023.

ZA International was established in Hong Kong in December 2017, by ZhongAn Online P&C Insurance Co., Ltd., an online-only insurtech company in mainland China, to explore international business development, collaboration, and investment opportunities in the area of fintech and insurtech in overseas markets.

