e-HKD -
Charting the Next Steps

HONG KONG MONETARY AUTHORITY
香港金融管理局

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e-HKD – Charting the next steps

Introduction

The Hong Kong Monetary Authority (HKMA) announced in June 2021 its "Fintech 2025" strategy for driving the fintech development of Hong Kong, one strategic direction under which is to strengthen the HKMA's research work on Central Bank Digital Currency (CBDC) to future-proof Hong Kong in terms of CBDC readiness. Alongside our continued work with peer central banks on the application of wholesale CBDC (wCBDC) to cross-border payments, the HKMA has started a study to look at the prospect of issuing retail CBDC (rCBDC) in Hong Kong, i.e. e-HKD. This paper reports on the findings of the study, including the responses received to the earlier two rounds of market consultation on the subject, and provides the initial views of the HKMA on how to best prepare Hong Kong for future developments in the sphere of digital currency and payments.

HKMA's CBDC journey

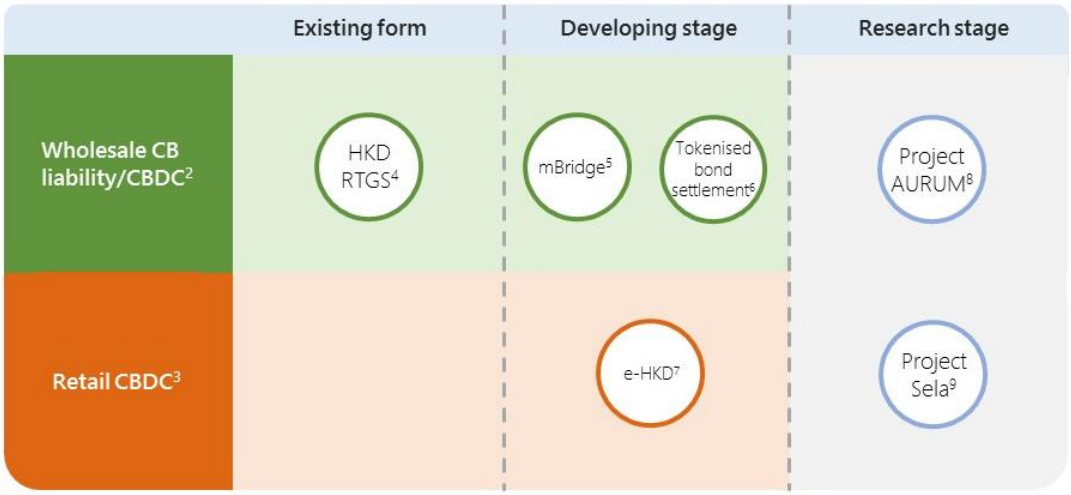
The HKMA started the exploration of CBDC back in 2017. At the time, in light of the well-developed and diversified retail payment landscape of Hong Kong, the HKMA accorded priority to exploring the application of CBDC at the wholesale level and embarked on **Project LionRock**[1] to study the application of wCBDC to large-value payments and delivery-versus-payment (DvP) settlements. In 2019, the HKMA started a collaboration with the Bank of Thailand on a joint research project, **Project Inthanon-LionRock**, to study the application of wCBDC to cross-border payments. The project was renamed **Project mBridge** in 2021 after two additional central banks, the Digital Currency Institute of the People's Bank of China (PBoC) and the Central Bank of the United Arab Emirates, as well as the Bank for International Settlements Innovation Hub (BISIH) Hong Kong Centre joined the project. This multilateral project has now entered a pilot phase and has been well recognised by the international financial community.

[1] Project LionRock was conducted by the HKMA in collaboration with the three note-issuing banks (The Hongkong and Shanghai Banking Corporation Limited, Bank of China (Hong Kong) Limited, and Standard Chartered Bank (Hong Kong) Limited) and Hong Kong Interbank Clearing Limited.

Against the backdrop of heightened international attention to enhancing cross-border payments and remittances, including through the use of CBDC, the HKMA started researching rCBDC in 2021. Together with the BISIH Hong Kong Centre, the HKMA embarked on **Project Aurum** to study the high-level technical design of rCBDC. Over the past couple of years, the pace of market digitalisation has significantly accelerated amidst the COVID pandemic and a rapid proliferation of crypto-market activities has been observed. The HKMA sees the need to take a deep dive into whether and how rCBDC can play a role in supporting and rationalising the relevant market developments. The HKMA therefore announced in June 2021, under the "Fintech 2025" strategy, that it would embark on an rCBDC project, **Project e-HKD**, with a near-term objective of formulating an initial view on the direction to pursue after identifying and considering the key issues involved.

The figure below provides a visual representation of the HKMA's work on the CBDC front, with respect to the nature (wholesale or retail) and level of development/maturity (existing form, developing stage and research stage) of the projects.

The HKMA's CBDC[1] work



1. **CBDC:** A central bank-issued digital money representing a direct claim on a central bank rather than the liability of a private financial institution. (source: BIS)
2. **Wholesale CBDC:** Intended for the settlement of large interbank payments or to provide central bank money to settle transactions of digital tokenised financial assets in new infrastructures. (source: BIS)
3. **Retail CBDC:** Also referred to as a "general purpose" CBDC; intended for use by the general public. (source: BIS) In Hong Kong's context, this can be the digital version of fiat currency, intended to circulate as currency, and can be accorded legal tender status.
4. **HKD RTGS:** Hong Kong dollar Real Time Gross Settlement system which enables settlement of interbank payments denominated in the Hong Kong dollar (HKD). (source: HKMA)
5. **mBridge:** A digital representation of HKD used on the mBridge platform by participating banks in a cross-border wholesale context.
6. **Tokenised bond settlement:** A digital representation of HKD used on a tokenised bond platform by participating banks in a local wholesale context.
7. **e-HKD:** A digital version of fiat currency intended to be circulated as currency and can be accorded legal tender status.
8. **Project Aurum:** Studied the benefits and challenges of tiered architectures for distributing retail CBDC through commercial banks and payment service providers.
9. **Project Sela:** Builds on the foundation laid by Project Aurum and studies cybersecurity issues in the context of retail CBDC.

Project e-HKD

Similar to the wCBDC projects undertaken by the HKMA, Project e-HKD has examined the potential of applying the latest technology to better address existing and evolving payment demands. Specifically, drawing reference from the experience in other jurisdictions, and the technical knowledge we acquired through Project Aurum, potential high-level architectures and design options for e-HKD leveraging Distributed Ledger Technology (DLT) have been identified.

On the other hand, just like its physical equivalents, rCBDC, if issued, is expected to play an important role in the economy and would have a broad interface with the public. Its implementation would therefore entail far-reaching implications on a wide range of issues relating to areas such as legal, regulatory, policy, financial stability, and interaction with existing payment methods. This view is also shared by the central banks of a number of advanced economies, which have indicated that it could take years of careful study before their version of rCBDC may come to fruition[2]. During our study, apart from reviewing the experience and considerations in other jurisdictions,

[2] In the US, the Federal Reserve has not made any decisions on CBDC issuance yet. In the UK, if the Bank of England ultimately conclude that issuing a CBDC is a good idea for the UK, then the earliest date for launch of a CBDC would be in the second half of the decade. In the EU, the investigation phase of the digital euro will conclude in October 2023.

we have also identified and examined key policy and design issues having regard to the case of Hong Kong. The HKMA is also mindful of the need to keep relevant stakeholders, including the industry and the public, well informed, and duly consider their views and comments. Two rounds of market consultation, one on high-level technical design and one on key policy and design issues, have been conducted during the study.

On the technical front, in October 2021, the HKMA published a **technical whitepaper** titled "e-HKD: A technical perspective"[3], which explored the potential architectures and design options for issuing and distributing e-HKD. It also identified a number of issues, summarised in seven problem statements, for further exploration. The industry, academia, and the community were invited to submit suggestions and feedback.

On the policy front, in April 2022, the HKMA published a **policy discussion paper** titled "e-HKD: A policy and design perspective"[4], which examined the key policy and design issues in introducing e-HKD, including the potential benefits and challenges, issuance mechanism, interoperability with other payment systems, privacy and data protection and legal considerations, as well as potential use cases. The issues were highlighted in the form of 12 discussion questions, and stakeholders and the public were invited to submit comments.

Responses received from market consultation

In total, **75 responses** were received (technical whitepaper: 36 responses; policy discussion paper: 39 responses) from stakeholders in various sectors, including academia, a central bank, consulting companies, financial institutions, fintech firms, individuals, industry bodies, non-bank professional organisations, public sector entities, and technology companies.

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[3] The technical whitepaper is available on the HKMA website: https://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/e-HKD_A_technical_perspective.pdf

[4] The discussion paper is available on the HKMA website: https://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/e-HKD_A_Policy_and_Design_Perspective.pdf

Overall, the feedback received indicates that respondents are supportive of the e-HKD initiative and believe that rCBDC has the potential to make payments more efficient while supporting the digital economy. This positive sentiment was observed across various sectors.

On the technical whitepaper, while respondents' views on use cases, areas of concern, and design choices for rCBDC varied, there were areas of significant agreement, namely: the design of an rCBDC should take a holistic approach, seek to protect user privacy while supporting legal and regulatory compliance, and achieve the highest level of cybersecurity to maintain public trust. Furthermore, an rCBDC should support interoperability with a wide range of payment means and different transaction systems. Last but not least, the rCBDC ecosystem should be open and inclusive to support a diverse set of participants and rCBDC wallet providers. A detailed summary of the feedback received is provided in Annex 1.

On the policy discussion paper, respondents generally agreed with the potential benefits and challenges discussed. Areas of considerable agreement included: adoption of a two-tier distribution model, preference for e-HKD to be unremunerated, and suggestions for e-HKD to support offline payment and cross-border payment (with some respondents highlighting the possibility of flexible conversion between e-HKD and e-CNY, the rCBDC currently under pilot by the PBoC, for cross-boundary use). Some of the feedback echoed that received in response to the technical whitepaper, including interoperability with existing payment systems, as well as the need to strike a balance between data privacy concerns and compliance with anti-money laundering and counter-financing of terrorism (AML/CFT) requirements (achieved possibly through adopting a "tiered-account" structure). A detailed summary of the feedback received is provided in Annex 2.

Charting the next steps

Based on the findings of our study and the comments received from the two rounds of market consultation, the HKMA considers it necessary to at least start paving the way for possible future implementation of e-HKD. While we will maintain an open mind in terms of the opportunities for the application of e-HKD to further enhance the existing retail payment landscape of Hong Kong, greater focus will be placed on getting ourselves prepared as best we can for use cases that may emerge out of the rapidly digitalising marketplace and the trend of increasing integration in the global payment landscape.

At the time of writing, around one-fifth of central banks worldwide are developing or testing an rCBDC[5], with only The Bahamas (Sand Dollar) and Nigeria (eNaira) having launched a live rCBDC, and Mainland China (e-CNY) and the Eastern Caribbean (DCash) having released a pilot version of their rCBDC. The launch and piloting of rCBDC in these four jurisdictions have primarily been driven by a number of considerations, including financial inclusion, competition, and operational resilience of payment systems. Such drivers appear to be less relevant in the context of Hong Kong. Digital payment services in Hong Kong are highly diversified, easily accessible, efficient, and resilient. That said, the HKMA is ready to explore with retail payment market participants whether and how e-HKD can fill any gaps that might be present in the existing market.

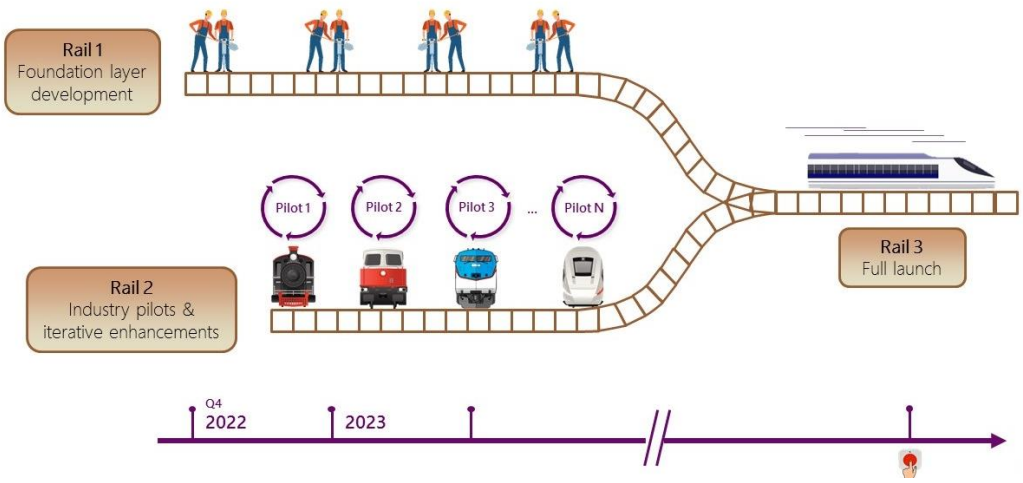
While it appears that e-HKD might not have an imminent role to play in the current retail payment market, we believe prospective use cases for e-HKD can emerge quickly out of the rapid evolution, or even revolution, in the digital economy. The search by the international financial community for more efficient cross-border payment and remittance solutions may eventually call for the enhancing of connectivity and interoperability between jurisdictional payment systems, and CBDC has the potential to become a common denominator in such arrangements. Similarly, there has also been discussion in the international financial community on the potential application

[5] Kosse, A and I Mattei (2022): "Gaining momentum – Results of the 2021 BIS survey on central bank digital currencies", BIS Papers, no 125, May. https://www.bis.org/publ/bppdf/bispap125.pdf

of CBDC to the crypto and decentralised finance (DeFi) space to provide an anchor of stability in the relevant markets, especially since the recent failures of several highly-visible private sector crypto-asset initiatives have demonstrated how private sector stablecoins, if not subject to robust regulation, are ill-suited as a means of payment.

The HKMA will therefore start work to lay the foundations for, and conduct in-depth studies and pilots on, the implementation and application of rCBDC. In doing so, due regard will be paid to maintaining a good level of flexibility so that the foundations laid and the components developed can be made as forward-compatible as possible to accommodate variations in future scenarios, and can be implemented reasonably swiftly. In gist, the HKMA would adopt a three-rail approach in preparing for any possible implementation of e-HKD in the future, as depicted in the following diagram.

Three-rail approach to preparing for possible e-HKD implementation



Rail 1 – Laying the foundations

Rail 1 aims to lay the technology and legal foundations for supporting the future implementation of e-HKD.

On the technology front, as the ultimate design of the layer for interfacing with retail end users (retail layer) in the two-tier structure discussed in the technical whitepaper may be significantly affected by a wide range of factors, some of which are yet to be fully articulated and deliberated, we would first proceed to develop the wholesale, interbank tier (wholesale layer). The target is to develop a technical foundation that can suit different design choices for the retail layer with relatively little modification further down the road. As a first step, we will in about nine months' time formulate a system development plan, including the project timeline, system design, and resources planning for establishing the wholesale layer. Subject to resources availability, it is expected that a wholesale layer of production grade may take at least two to three years to build.

On the legal front, the focus will be on enabling the issuance of a digital form of fiat currency, with legal tender status. Initial legal research suggests that existing legislation is not adequate to accommodate, with sufficient certainty, the issuance of a digital form of legal tender. As with physical currency, an unambiguous legal foundation for issuance is crucial to foster public confidence in the currency. This would also help ensure alignment in status between the digital form and the physical form of the local currency.

Together with the Government, the HKMA will first identify and examine the areas in which legislative amendment is required. The timeframe for completion of the legislative process to enact the required amendments will ultimately depend upon a variety of factors, including the complexity of the legislative proposals, the time at which a "slot" in the Government's legislative programme can be secured, and the time required for a bill to be considered by the Legislative Council.

Rail 2 – Deep-dive application research and pilots

Under Rail 2, which will run in parallel to Rail 1, we will take deep dives into use cases, and implementation and design issues relating to e-HKD, including deepening our research into application issues and gaining actual experience through conducting a series of pilots with various stakeholders, including banks and the industry.

Through this iterative process, the outcomes and insights gained from each pilot should help enrich our perspective and refine our approach to the implementation of e-HKD. In particular, they should allow us to make better informed decisions on the design choices for the retail layer of the e-HKD system, and the tools and devices developed may also be swiftly adapted for later, actual implementation of e-HKD. Below is a glimpse of the projects and tasks in the pipeline:

- Access to e-HKD via e-wallet app
- Project Sela[6] on cybersecurity
- Technical deep dives on privacy and performance
- DvP settlement of tokenised securities
- Industry engagements on rCBDC use cases and design choices
- Regulations prescribing the framework for the issuance and use of e-HKD
- Studying the pros and cons of using CBDC as the on- and off-ramp instrument for DeFi

Rail 3 – Rolling out e-HKD

Our work under the first two rails should help lay the foundations and put in place some essential building blocks for any future implementation of e-HKD. Rail 3 is concerned with launching e-HKD. Admittedly, it is difficult to project the timeline for rolling out e-HKD at this stage since it is subject to a wide range of factors, such as the actual progress of the work under Rail 1 and Rail 2, and the pace of relevant market development, both local and international. That said, we believe our work on the first two rails will put us in an advantageous position in terms of responsiveness to emerging market demands and enable us to set Rail 3 in motion reasonably expeditiously. In managing the timeline for rolling out e-HKD, the HKMA would pay particular attention to emerging market trends and international developments so that e-HKD can be made available in good time to address market demands and

[6] Jointly conducted by the HKMA, the Bank of Israel, and the BISIH Hong Kong Centre, Project Sela will study cybersecurity issues in the context of rCBDC. In particular, it will study the data security implications of a two-tier rCBDC architecture where the intermediaries will have no financial exposure. It will also pioneer methods to render the architecture more resilient to cyber attacks.

strengthen our competitiveness in the global payment arena.

Hong Kong Monetary Authority

September 2022

Annex 1

Responses to
“e-HKD: A technical perspective”

Section 1: Respondents at a glance

A total of 36 responses were received to the HKMA's whitepaper on "e-HKD: A technical perspective" (the whitepaper) from 37 respondents[7], sharing their views on a possible technology architecture for retail CBDC (rCBDC). These responses represented a geographic distribution over 12 jurisdictions, with views from different sectors including central banks/the public sector, academia/research institutes, non-bank professional organisations, industry bodies, financial institutions, technology companies, fintech firms, individuals and consulting companies.

Section 2: Overview of the feedback received

Respondents commented on various aspects of the whitepaper and offered a number of suggestions. They generally agreed that the whitepaper demonstrated a good understanding of the various technical considerations in an rCBDC implementation. Furthermore, respondents basically agreed that rCBDC had the potential to make payments more efficient and safe while supporting the digital economy. The majority of respondents were in favour of adopting a two-tier architecture for developing the distribution model. Also, almost all respondents agreed that privacy and cybersecurity were two key concern areas in rCBDC implementation. They also showed strong agreement on the openness principle set forth in the whitepaper as a necessary condition to support innovation and competition. The HKMA would like to thank all respondents for taking the time to provide constructive feedback on rCBDC. For details of the feedback received, please refer to Section 3.

[7] One response was a joint response from two respondents.

Section 3: Summary of feedback on the seven problem statements[8] and the HKMA's responses

Problem statement	Feedback received	HKMA's response
1. Privacy	(i) The majority of respondents stressed that privacy would need to take precedence over efficiency in CBDC design, and they also considered privacy-by-design as an appropriate approach for CBDC. (ii) Some respondents deemed it preferable to build privacy into the system, rather than relying on regulation; and many respondents stated that data protection should be carefully considered, including hardware, personal data management with third parties, visibility, traceability and security. (iii) Some respondents suggested using a zero-knowledge proof to protect privacy, and stated that end users should have an idea of what data would be held by central banks, banks and other actors.	The HKMA considers that privacy and data protection are key considerations of e-HKD and should be embedded in its system design and operation, while ensuring effective AML/CFT controls. With a view to maintaining public trust and assuring the integrity of the e-HKD system, the HKMA will make reference to the experience of other central banks when determining the most adequate privacy and data protection model for e-HKD.
2. Interoperability	(i) Some respondents agreed that interoperability is a crucial element of CBDC, which should be pursued at both the domestic and international levels.	The HKMA agrees that it is important to ensure that e-HKD should, so far as practicable, be fully interoperable with other payment systems so as to enable the general

[8] "e-HKD: A technical perspective" (Page 2-3): https://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/e-HKD_A_technical_perspective.pdf

Problem statement	Feedback received	HKMA's response
	(ii) Also, some respondents noted that the technology architecture under discussion could support interoperability through an appropriate adaptor/connector. They suggested that a detailed design of the cross-border flow should be shared with the private sector to support their innovation. (iii) A few respondents noted that standardisation of requirements and cooperation among different parties would be necessary to achieve interoperability.	public to make more efficient payments without impediment. Furthermore, connectivity and the possibility to adopt future innovations should also be taken into account to facilitate cross-platform payment and future development.
3. Performance and scalability	(i) There was broad agreement on the whitepaper's analysis on the token-based and account-based approaches for CBDC. Some respondents expressed concerns that there were potential limitations in both approaches and they highlighted the need to conduct more research and evaluation on the topic. (ii) Many respondents advocated that both DLT-based and non-DLT solutions should be explored for e-HKD, suggesting further work be done to compare the performance and scalability of the two proposed architectural models in the whitepaper. Some suggested a study to explore the assignment of roles in DLT-based solutions to avoid a bottleneck at certain participants, which may in turn affect the performance of the whole system.	In its CBDC exploration, the HKMA will carry out rigorous and in-depth evaluation of different distribution models, design architectures and technology choices, etc. to come up with a set of clear design requirements for the CBDC architecture. Further discussion with stakeholders will be undertaken.

Problem statement	Feedback received	HKMA's response
	(iii) Respondents generally held a range of views on the decentralisation of the validator infrastructure: a decentralised approach could provide benefits, in terms of service availability and ledger transparency and integrity, whereas, a more centralised approach would have performance and privacy advantages. A slight majority of respondents thought that the decentralised approach was more suitable for implementing the validator infrastructure.	
4. Cybersecurity	(i) The majority of respondents agreed that security needs to take precedence over efficiency for CBDC platforms. Ideally, a zero-trust approach should be adopted. A few respondents proposed the adoption of cryptographic key management to minimise cybersecurity risks. (ii) There was general consensus on the approach to achieve cyber resilience through the decoupling of the wholesale and retail layers. As intermediaries play an important role, some respondents noted that they must uphold a high level of standard in cybersecurity and other aspects so that relevant risks can be mitigated. In addition, these respondents highlighted that the intermediaries should maintain close communication with each other to ensure that new threats are mitigated as they arise.	The HKMA recognises that cyber resilience is a critical consideration in the CBDC system. It also notes that in-depth evaluation and research are key to any resilient infrastructure. The HKMA is committed to engaging widely and openly with stakeholders to understand their perspectives on design issues regarding cybersecurity and risk assessment.

Problem statement	Feedback received	HKMA's response
	(iii) Many respondents saw the need for a rigorous threat model for assessing the security of the technology architecture, which is critical to any robust and resilient design. (iv) Some respondents suggested that the development of a framework of cybersecurity controls should take a phased approach to test defence measures in a proof-of-concept environment before actual deployment. They also highlighted that an infrastructure for continuous monitoring of threats and incidents should be in place when deployed.	
5. Compliance	(i) Many respondents particularly highlighted the need to seek a balance between privacy, traceability and support of AML/CFT compliance. Some of them suggested that a tiered privacy approach, with full anonymity for small value transactions and traceability for high value transactions, could be adopted to implement risk-based compliance while protecting privacy to a certain degree. (ii) There was general agreement among respondents to use the e-HKD project as a valuable opportunity to introduce regulation-by-design. Many saw that CBDC would offer potential to improve the AML/CFT process.	The HKMA concurs that managing competing design principles, with due regard to regulatory and compliance standards, would be one of the critical aspects in the design architecture of CBDC. It also welcomes the involvement of stakeholders to understand their perspectives on various aspects of the CBDC system, such as use cases and AML/CFT issues.

Problem statement	Feedback received	HKMA's response
	(iii) Many also saw a need to further clarify the legal status and regulatory framework for CBDC, and they considered that clarity should be ensured in relation to: the legal rights of consumers against e-HKD issuers, obligations relating to consumer security and supervision obligations.	
6. Operational robustness and resilience	(i) Respondents commonly viewed redundancy and offline operations as basic resilience requirements for CBDC. In fact, many of them noted that a redundancy architecture, whether it is DLT-based or not, should be adopted to ensure a reasonable level of resilience and robustness for the CBDC system. (ii) 24/7 operation with real-time settlement were commonly seen as the baseline of a CBDC system. The need to assess the proposed technology architecture against the Principles for Financial Market Infrastructures (PFMI) after all the design choices are fixed, was also recognised by respondents. (iii) Offline-to-offline payment capability was generally seen as a key element to a resilient and robust CBDC system, particularly in the context of power/network outage.	The HKMA recognises that in order to construct a resilient and robust infrastructure, rigorous review must be conducted and contingency plans must be established and tested. Functional design and technology choices should be optimised after appropriate risk assessment and threat evaluation. The HKMA will continue to initiate dialogue with stakeholders to collaboratively explore practical solutions for related issues.

Problem statement	Feedback received	HKMA's response
7. Technology-enabled functional capabilities	(i) Among the range of suggestions, the most commonly cited applications of rCBDC were multi-currency wallets, offline payments, new compliance tools and programmable money. (ii) CBDC-generated data streams, smart contracts and programmable money were widely seen as the foundation for fostering other novel, innovative applications of CBDC. (iii) Many respondents pointed to the need to stipulate wallet features and requested that the wallet design should be made available, covering its technical design, structure, supervisory requirements, security features and commercial considerations. Some also suggested that a foreign exchange mechanism for multi-currency wallets should be added.	The HKMA will engage with stakeholders to discuss the costs and benefits of various technological functionalities and explore the feasibilities of including them in the CBDC system. It will also strive to foster innovative use cases relevant to the market and beneficial to the general public.

Annex 2

Responses to
“e-HKD: A Policy and Design Perspective”

Section 1: Respondents at a glance

A total of 39 responses were received to the HKMA's discussion paper "e-HKD: A Policy and Design Perspective" (the discussion paper), sharing views on the policy and design of retail CBDC (rCBDC). These responses consist of views from different sectors including the public sector, research institutes, non-bank professional organisations, industry bodies, financial institutions, technology companies, fintech firms, individuals and consulting companies.

Section 2: Overview of the feedback received

Respondents generally agreed with the potential benefits and challenges of e-HKD as listed in the discussion paper. On potential benefits, they generally noted that cross-border payment is an important use case for e-HKD. As for potential challenges, they acknowledged the risks of bank disintermediation, though they also believed that setting e-HKD as unremunerated with appropriate caps could provide useful mitigating measures. On distribution models, respondents generally were inclined to adopt a two-tiered distribution model for e-HKD. On design considerations, many respondents considered (i) supporting offline payment and (ii) settling cross-border payments as desirable features of e-HKD.

Separately, respondents noted that by making reference to practices elsewhere, e-HKD should come with a "tiered-account" structure, i.e. different levels of transaction/holding limits or functions depending on the level of KYC, to strike a balance between factors such as usability and privacy. From a technical/infrastructure perspective, e-HKD should also be interoperable with the existing payment systems (e.g. FPS, payment card systems etc.), which would help promote its adoption.

On AML/CFT, generally speaking, respondents appreciated the need to strike a balance between data privacy concerns and AML/CFT requirements with banks generally favouring adhering as closely as possible to existing frameworks under the Anti-Money Laundering and Counter-Terrorist Financing Ordinance (AMLO) and the Payment Systems and Stored Value Facilities Ordinance (PSSVFO), with anonymity for low-value wallets and more controls for wallets with higher transaction/holding limits. Technology companies and technology-oriented payments operators tend to favour implementation of pseudonymity through the use of cryptographic technologies so that access to consumer data will only be limited to wallet providers and merchants on a need-to-know basis. Respondents generally considered that a central banking institution should only have access to data appropriate to its monetary and other policy functions.

The HKMA would like to thank all respondents for taking the time to provide constructive feedback on the discussion paper. For details of the feedback received, please refer to Section 3.

Section 3: Summary of feedback on the 12 discussion questions and the HKMA's responses

Question	Feedback received	HKMA's response
1. Do you agree that e-HKD can bring potential benefits as described? Do you see other potential benefits?	(i) Respondents generally agreed with the potential benefits outlined by the HKMA, noting an important use case of e-HKD is to provide more efficient and secure cross-border payments. They also noted that it would be important to explore interoperability with e-CNY. (ii) While respondents generally agreed with the HKMA's stance to position Hong Kong for the challenges brought by stablecoins, some respondents also noted that e-HKD and stablecoins can co-exist, assuming there is a clear regulatory framework for stablecoins. (iii) Respondents agreed that e-HKD can facilitate innovation in a digital economy and a few noted that e-HKD can boost e-commerce.	The HKMA appreciates respondents' feedback. The HKMA recognises the potential benefits as mentioned by respondents, such as facilitating safe and efficient payments, promoting digitalisation of the economy and enhancing financial inclusion. We will take the feedback into account and continue to engage with stakeholders when exploring suitable features for e-HKD. During the process, we will take various factors into consideration, including use cases and the regulatory framework.

Question	Feedback received	HKMA's response
	(iv) As for the other benefits, respondents generally considered that it is worthwhile to explore the use of e-HKD as a means to enhance financial inclusion.	
2. How can e-HKD implement the suggested use cases better than the existing e-payment means? Apart from programmability, what other technologies would bring new use cases for e-HKD?	(i) Respondents in general supported the proposed two-tier distribution architecture and opined that it is more desirable for the private sector participants to interface with end-users and provide innovative payment solutions. (ii) The majority of respondents suggested that cross-border usage and interoperability with other platforms (such as FPS and electronic KYC systems) and CBDCs (such as e-CNY) would provide better user experiences and promote the adoption of e-HKD. Many also advised that e-HKD should be equipped with offline payment capabilities by integrating with digital wallets and smart devices such as cards, watches and other wearables	Generally speaking, the HKMA favours the adoption of a two-tier distribution structure. We will take note of the suggestions and will evaluate the various options in the course of our e-HKD research, taking into consideration various factors, such as policy objectives, use cases and other technical and non-technical matters.

Question	Feedback received	HKMA's response
	and they believed that this could help promote the use of e-HKD. Furthermore, some respondents saw the potential of e-HKD connecting fiat money to the emerging digital economies, such as decentralised finance (DeFi) and other blockchain-enabled applications. (iii) On the technology side, many respondents recommended the adoption of data standards and provision of open application programming interfaces (API). Some opined that delivery-versus-payment (DvP) and instant payment settlement offered opportunities for new use cases. Some also suggested adopting advanced user authentication, data protection and encryption technologies.	
3. How do you see the demand for e-HKD as a means of payment? What other design features would promote the use of e-HKD?	(i) Respondents in general noted that the demand for e-HKD will be highly dependent on the features of e-HKD, especially when there is already a range of diverse payment options available in the	The HKMA understands that use cases are driven by demand. We will take note of the suggestions proposed by respondents, continue to explore a variety of use cases, conduct pilot testing and draw reference from

Question	Feedback received	HKMA's response
	local retail payment landscape and they are in healthy competition. Furthermore, respondents generally noted that the ability to achieve various potential benefits outlined under Question 1 (e.g. cross-border payment, interoperability with existing payment options like FPS and e-CNY, programmability, offline payments, etc.) would help to boost the demand for e-HKD. (ii) Some respondents suggested that the Government should begin with some simple use cases to promote the usage of e-HKD, and then use e-HKD for distributing Government subsidies and payment of Government bills. In addition, involvement of existing financial intermediaries, e.g. banks and SVF operators, in the distribution and usage of e-HKD is generally considered to be positive in promoting the adoption of e-HKD.	other jurisdictions to refine the design features of e-HKD.

Question	Feedback received	HKMA's response
	(iii) Respondents generally agreed that using a "tiered-account" structure with different levels of transaction/holding limits or functions depending on the level of KYC would help promote the use of e-HKD. (iv) On design features, several respondents suggested that the HKMA should allow financial institutions to build their own wallet apps for their customers to access e-HKD functions, instead of developing an exclusive app for e-HKD. In other words, the role of the HKMA should focus on the issuance of e-HKD and setting of relevant standards. Some respondents also highlighted the importance of no/very low costs of doing transactions in e-HKD.	
4. Do you agree with the description of challenges brought by e-HKD? Do you see other challenges? Are there any other measures that can mitigate the adverse impacts of e-HKD? How would these	(i) Respondents generally agreed with the potential challenges laid out in the discussion paper. They agreed with the potential impacts on bank deposits when users of e-HKD switch funds from commercial bank deposits to e-HKD. A	The HKMA appreciates respondents' feedback. We will continue to explore and evaluate technically feasible solutions to help address these challenges. The HKMA also appreciates the feedback regarding the potential risk of bank disintermediation,

Question	Feedback received	HKMA's response
measures affect the attractiveness of e-HKD?	few respondents agreed that useful mitigating measures would include making e-HKD unremunerated (non-interest bearing), setting daily conversion and transaction limits, as well as setting a gradual transition period. (ii) Some respondents specifically noted that the HKMA should consider using the "CBDC-backed e-money model" which was one of the distribution models discussed in the e-HKD technical whitepaper. These respondents believed that this model would not bring any risk of shifting commercial deposits out of the banking system into e-HKD (unlike other forms of distribution models). (iii) Respondents agreed with the challenges arising from fraud with a few of them highlighting the difficulty of managing these risks across an rCBDC ecosystem given the huge number of transaction	whilst noting that such risk may exist for all kinds of CBDC distribution models, as one of the key features of e-HKD is that it is a central bank liability instead of a commercial bank liability.

Question	Feedback received	HKMA's response
	endpoints and hence potential points of vulnerability. (iv) A few respondents were concerned about the potential high cost to set up and run a secure and robust infrastructure, and noted the costs will need to be balanced with the potential benefits.	
5. How can e-HKD assist in the detection of illicit activities while preserving user privacy at the same time?	(i) Respondents generally recognised the need to strike a balance between data protection and AML/CFT controls. They advised that existing user privacy and data protection rules and regulations must be observed with clear guidance on protection and the use of data in relation to e-HKD. A few of them also felt that AML/CFT controls should apply to the same degree as to the existing forms of HKD and electronic payments. (ii) Some respondents noted that features of CBDCs, including the traceability of transactions and ability to link to AML/CFT	The HKMA broadly agrees that existing legal and regulatory requirements, including those under the AMLO and PSSVFO and the relevant Guidelines issued by the HKMA, should apply to transactions using e-HKD and traditional (or new) payment methods as far as possible in the same way, with intermediaries being responsible for meeting AML/CFT requirements. This is in line with the "same risk, same regulation" principle. Depending on the final design of e-HKD, consideration will be given to the need for additional requirements or guidance if necessary to

Question	Feedback received	HKMA's response
	systems, would aid in identifying illicit activities. Some respondents observed that consideration should be given to the use of public or private blockchains and where legal rights/responsibility for waiving anonymity should rest. Some also proposed connectivity with eKYC and AML systems to facilitate automated detection of illicit activities. (iii) Some respondents urged that consideration be given to ways to preserve anonymity via encryption using public/private keys and pseudonymous wallets. They agreed that the unspent transaction output (UTXO) model and pseudonym system with evolving public keys [9] can facilitate traceability while preserving user privacy. In fact, many	address any specific risks arising from the introduction of e-HKD in specific use cases. As with existing banking and other financial services currently, striking the correct balance between data privacy and AML/CFT and other financial crime risk management will be important. All in all, the HKMA takes note of the suggestions and will refer to the measures adopted by other jurisdictions and further explore technically feasible solutions on this subject matter.

[9] UTXO payment transactions contain no personal information of users. Users transact with their public keys (i.e. pseudonyms) only, and the mapping between public keys and real user identities is kept and known to the users' banks/payment service providers only. To further protect user privacy, a new public key can be used for each payment. Please refer to chapter 5.4 and 5.6 of *e-HKD: A technical perspective* for more details.

Question	Feedback received	HKMA's response
	opined that full anonymity is not desirable and recommended a tiered-wallet approach where a high level of anonymity is allowed for lower-tiered wallets with lower maximum holding and transaction limits. For higher-tiered wallets with a higher maximum holding and transaction limit, given the money laundering or terrorist financing risks involved are greater, the level of anonymity should be strictly controlled.	
6. What types of financial institutions should be responsible for distributing e-HKD? Should the functionalities of the e-HKD wallet be allowed to differ among the financial institutions?	(i) While some respondents considered that both banks and non-bank FinTech companies (e.g. SVF licensees) should be allowed to distribute e-HKD to encourage innovative developments for the industry, a few took the view that only banks should act as the sole distributors of e-HKD, believing that banks (i) could meet the stringent requirements in terms of financial stability, (ii) have the resources and experience in AML/CFT compliance, (iii) have more experience in customer	The HKMA notes the inclination of respondents towards facilitating innovative developments by the private sector. We will consider the proposed comments carefully and further engage with stakeholders to determine the preferable and practicable solutions.

Question	Feedback received	HKMA's response
	engagement, and (iv) possess relevant experience in distributing legal tender. (ii) On the functionalities of the e-HKD wallet, a few respondents added that certain basic functionalities should be standardised and made available in all e-wallets, and they generally agreed that wallets should be allowed to differ in order to encourage healthy competition among the private sector and stimulate further innovation, provided that this does not compromise interoperability.	
7. How should e-HKD be designed to achieve interoperability with existing payment systems? Are there any technological barriers that would prevent the acceptance of e-HKD?	(i) Respondents in general agreed with the HKMA's proposal that e-HKD should be interoperable with other payment systems and also to cater for future extension to support unseen innovative use cases. The majority of respondents proposed to embrace the concept of an open system design through adoption of common rules and protocols, and the provision of standardised APIs for ease of	The HKMA understands that the use case of e-HKD is driven by demand. We will remain open-minded and continue to engage the industry participants to conduct pilot programmes. Furthermore, we shall continue to consider and explore different options in search of viable solutions for refining the rCBDC design.

Question	Feedback received	HKMA's response
	integrating e-HKD into existing payment systems, such as e-banking, digital wallets, apps and point-of-sale systems. Many also opined that e-HKD, digital wallet balances and bank account balances, should be interchangeable with ease. Also, they advocated the importance of public-private partnerships and supported an open and inclusive e-HKD ecosystem. (ii) Some respondents considered technological barriers for e-HKD adoption include complexity of the system, scalability and performance limitations, cybersecurity risks, fragmented and inconsistent data standards, and limited support to large varieties of user devices.	
8. Should there be different types of e-HKD wallets based on the level of personal information required? If so, what should the corresponding transaction/holding limits for each type of wallet be?	(i) Respondents generally agreed that functionalities of e-HKD wallets should vary according to the level of personal information provided and the level of KYC/AML the providers have to comply	The HKMA welcomes respondents' feedback and is generally inclined to adopt a tiered wallet approach. We are also well aware of the importance of privacy and will draw reference from the existing regulatory

Question	Feedback received	HKMA's response
	with, and some respondents supported the adoption of a tiered wallet approach. (ii) On the transaction/holding limits, a few respondents suggested that the HKMA could consider adopting the existing industry practices for setting the transaction/holding limits. In particular, the HKMA could refer to the existing HKMA Guideline on Anti-Money Laundering and Counter-Financing of Terrorism when determining the applicable transaction/holding limits (e.g. a limit of HK$3,000 for anonymous transactions), to help reduce regulatory arbitrage. A few respondents further noted that the HKMA could draw useful lessons from other central banks on how to set different transaction and holding limits.	guidelines, including but not limited to the HKMA Guideline on Anti-Money Laundering and Counter-Financing of Terrorism and AMLO, in determining the corresponding transaction/holding limits for each type of wallet.
9. Are there more design considerations to be included in the e-HKD study? Would	(i) Many respondents considered that e-HKD should support offline payment functions. In addition, they generally considered that	Interoperability and convertibility of e-HKD are two key concern areas of respondents. The HKMA will conduct pilot testing to search

Question	Feedback received	HKMA's response
you be able to identify some trade-offs around such considerations?	it is important for e-HKD to be interoperable with existing payment systems. (ii) A few respondents suggested that it would be desirable for e-HKD to be made convertible to e-CNY, while many respondents considered that using e-HKD to settle cross-border payments has potential benefits.	for ways to address these issues accordingly. We will also initiate discussions with various stakeholders to further understand their concerns.
10. How could the private sector contribute to the e-HKD journey?	Respondents generally considered that the private sector could contribute on areas such as: (i) offering services in the areas of compliance and prevention of illicit activities (e.g. AML/CFT), (ii) promoting merchant acceptance and interoperability with existing payment systems, (iii) advising on e-HKD opportunities and functionalities, (iv) boosting innovation and competition, (v) sharing customer experience and expertise to enhance e-HKD features, and (vi) providing	The HKMA recognises the importance of the involvement and contribution of the private sector in the e-HKD project. We welcome the suggestions and comments proposed by respondents, which will help enhance the e-HKD development.

Question	Feedback received	HKMA's response
	cybersecurity control and risk management frameworks.	
11. Are there any other legal considerations, in addition to those discussed in this paper, which should be considered in designing a legally robust e-HKD?	(i) A few respondents mentioned the need to clarify the legal status and regulatory treatment of e-HKD, i.e. whether it is a digital form of fiat currency with identical classification and treatment as existing fiat HKD (and fungible with fiat currency), and some respondents briefly raised for deliberation whether e-HKD should be made legal tender. (ii) Some respondents mentioned the need to consider legal issues associated with cross-border transactions and interoperability with other CBDCs.	(i) The HKMA agrees that the legal mandate underpinning the status of any e-HKD, as essentially the digital version of Hong Kong dollar cash, should align with that of existing Hong Kong currency in the form of legal tender currency/bank notes (issued under the Legal Tender Notes Issue Ordinance) and coins (issued under the Coinage Ordinance). Introducing appropriate amendments to the law would ensure that the issuance of all forms of Hong Kong currency would be clearly prescribed by law in a consistent and coherent manner. The HKMA is also currently inclined to the view that the e-HKD should have legal tender status given it is intended to be the digital equivalent of existing HKD fiat currency. This status can be accorded via the legislative amendments referred to

Question	Feedback received	HKMA's response
		above. In essence, this would mean that, absent any contractual term to the contrary, e-HKD as legal tender, would by law be regarded as a valid and legal means of tendering payment for an incurred debt. (In commercial transactions however, the parties could (as now) contractually determine for themselves the terms upon which they will transact, including the means of payment they will accept. Accordingly, as is the case presently with currency/bank notes and coins, the law would not compel goods or service providers to accept e-HKD as payment, or prohibit a person from contractually refusing to accept e-HKD as payment.) (ii) The HKMA will keep cross-border/interoperability issues in view as it develops the framework and infrastructure for the e-HKD. Currency, including rCBDC, legally issued in one

Question	Feedback received	HKMA's response
		jurisdiction should normally be recognised in other jurisdictions and hence some of the legal issues associated with CBDC transfers should be similar to those encountered with existing cross-border transfers. However new issues may arise: if for example restrictions or limits are placed in some jurisdictions on holdings of CBDCs; if data protection laws differ markedly between jurisdictions or if governing law or "settlement finality" issues arise in respect of cross-border infrastructure. These and other issues which emerge as the market develops, will merit further consideration and where appropriate further consultation or discussion with stakeholders.
12. Are there any other policy considerations which are relevant to e-HKD but not covered in this discussion paper?	A few respondents opined that incentives may be required to motivate the private sector to participate, considering the significant costs involved (e.g. building new wallet solutions, integrating with new payment infrastructure),	The HKMA understands the views and concerns of different stakeholders in the e-HKD project. We will continue to explore possible ways to take forward the

Question	Feedback received	HKMA's response
	and the provision of consumer education may encourage the adoption of e-HKD.	development of e-HKD, with due regard to the key concern areas identified by respondents.