Programmable Payment and Investment: Cash Management for Low Balance Retail Investors

Retail Use Case Exploration for the e-HKD Pilot Programme

March 2024

Contents

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Executive Summary

The Hong Kong Monetary Authority ("HKMA") launched the e-HKD Pilot Programme in November 2022 and invited industry participants to submit potential use cases for an e-HKD. The e-HKD Pilot Programme is a key component of Rail 2 under the HKMA's three-rail approach in paving the way for the possible implementation of a retail central bank digital currency ("CBDC"). More significantly, this is a joint effort between the HKMA and the industry to explore and evaluate the commercial viability of potential use cases for an e-HKD.

This whitepaper is intended to share the key lessons learnt in one of the selected pilots on commercial use case applications and technology viability: "Cash Management for Low Balance Retail Investors". The pilot explored the viability of adopting an e-HKD in developing new retail financial services and products.

The key value proposition of our pilot allows for better financial inclusion, improved monetary rewards, and also unlocked value of small liquid balances.

In our testing, our pilot was able to streamline inter-intermediary operations through the use of smart-contract programmability. We were able to achieve a near-instant Delivery vs. Payment, shortening settlement cycles and reducing transaction costs. With integration of Investors' Verifiable Credentials ("VCs"), a straight-through integration across upstream and downstream financial intermediaries was also possible, reducing the current inefficiencies in conducting AML/KYC procedures and thus makeing it economically viable to provide services to users with only small balances.

Our pilot also saw improved transparency in several aspects, with investors able to receive near-instant confirmation of the executed order and better visibility on their investment's Net Asset Value ("NAV"). Fund Managers also receive proof that investors' relevant funds are escrowed in a smart contract vault that's ready for settlement allowing them to strike the NAV as soon as possible. The pilot also demonstrated that with the use of VCs, as and when their use is approved and made available for the public, certain potential burdens faced by regulated institutions can be alleviated when conducting AML and KYC processes as well as suitability assessments, whilst continuing to preserve investors' privacy.

Ultimately, the pilot showed that retail investors are able to reap the benefits of earning interest on their small cash balances and/or for short period investments. The improved settlement times also helps to earn more interest, especially for investments in tokenised bonds. The improved settlement time could also allow for new investment options that were previously prohibitive for investors with time constraints and the extra interest earned, albeit small individually, can translate into a decent return in the long term

It is worth noting that many of the findings from our pilot can also in principle be applied to other forms of digital money that the HKMA is currently exploring, such as stablecoins and tokenised deposits.

We hope to generate industry and public interests in further exploration on distributed-ledger-technology ("DLT") based financial services and infrastructure development. Leveraging the findings of our pilot to drive the foundation for further exploration, discussion, critics, and collaboration, we also look forward to feedback and insight from the industry to jointly explore use cases for potential implementation of an e-HKD.

Section 1

The Challenge

While access to bank deposits is ubiquitous in Hong Kong, retail investors generally earn less interest income from bank deposits than wholesale financial products such as money market funds or direct access to government bond bills.

Retail access to wholesale financial products is made complicated and inefficient by hurdles such as onerous and repetitive onboarding processes, minimum investment size, steep subscription fees, and long settlement periods. As such, these products become unfeasible for retail investors with low balances and/or for short-term investments. Improving financial inclusion and investment returns for retail investors were and are among the top priorities and objectives of the pilot.

High-level use case description

Our pilot was designed to study how a programmable e-HKD could enable investors to enjoy a faster turnaround and a closer to real-time market price when subscribing to investment funds.

As the HKMA has not reached a policy decision on whether or when to introduce an e-HKD, subsequent mentions of the e-HKD within this paper refers to a hypothetical version created by the ARTA-Emali team.

Figure 4-Fund Investment using e-HKD
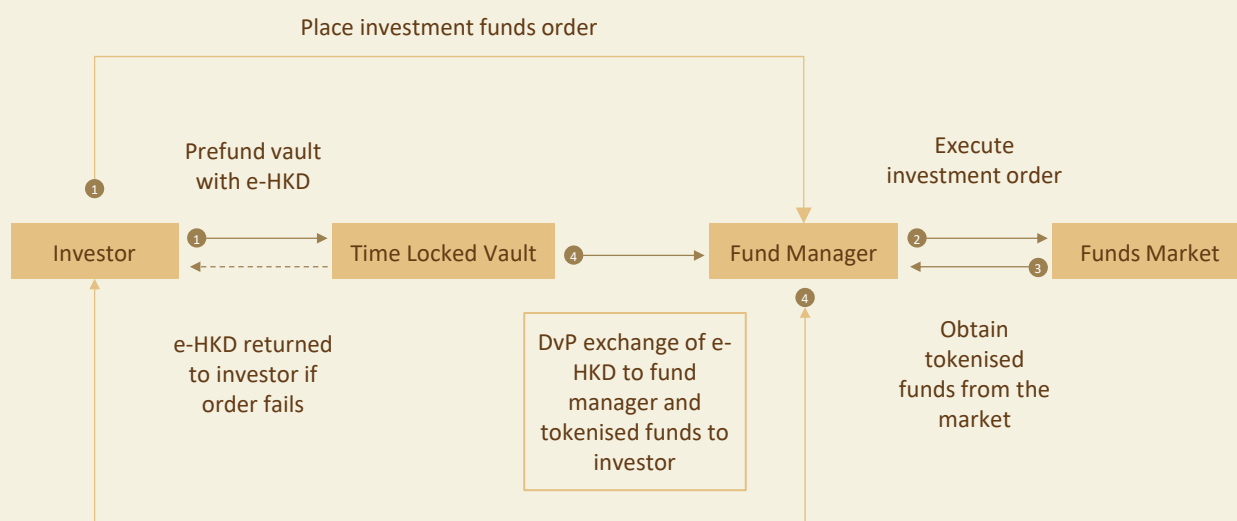
Specifically, our pilot examines the feasibility of atomic settlement for a fund order using e-HKD against tokenised funds, and the ability to integrate operational processes involving upstream and downstream investment intermediaries, including for example placing agents, fund managers, fund administrators, etc., in a straight-through manner through the use of smart contracts.

The pilot also explored the integration of investor's credentials with smart contracts using digital identities, with a view to streamline the onboarding processes prior to the fulfilment of an order.

Section 2

Pilot Solution

Purpose

1.   Improved access to wholesale financial services for retail investors

Wholesale financial products, such as money market funds or government short-term bills, generally generate higher investment returns than banks' short-term deposits.

Our pilot is designed to create a seamless and secure transaction flow using e-HKD, with smart contract as a foundational component. The purpose is to help retail investors generate market-competitive investment income. With lower frictional costs, a small balance can be invested for market-competitive yield income and for a short duration such as just for one day or few days.

2.   Reduced counterparty risks and improved operational efficiency

Our pilot also examined how an e-HKD-based system can reduce various risks associated with the provision of financial products, and assessed the benefits to financial intermediaries (including brokers (placing agents), fund managers, custodian(s) and transfer agents) arising from end-to-end improvement in transaction efficiency.

More importantly, the pilot examined whether the benefits and improved workflow is able to deliver sufficient cost savings to entertain retail investors' short-term, small-amount capital transfer and investment requests.

3.   Integration with digital identity systems

Our pilot sought to demonstrate how integrating a digital identity solution with e-HKD platform can help retail investors and financial institutions to efficiently comply with requirements relating to Know Your Client ("KYC"), Anti-Money Laundering/Countering the Financing of Terrorism ("AML/CFT") and investor suitability.

Specifically, our pilot examined the feasibility of improving the efficiency of KYC/AML/suitability process while protecting the privacy of investors' personal information, allowing retail investors securely and efficiently access financial products from service providers without the need to enter personal data into different providers' platforms separately and repetitively.

Design Considerations

In developing the e-HKD pilot use case, its surrounding ecosystem and the system to support the fund investments, we had the following design considerations.

Dynamic Anonymity

The system would be capable of supporting various policy models and use cases, from fully anonymous to fully transparent. This enables the system to be more open and more flexible in system design for future development, and allows users to choose whether to associate their e-HKD holdings with specific identity attributes while preserving their privacy.

Further, users have the choice to hold e-HKD in an anonymous or pseudonymous manner, respecting user privacy and allowing different users to use e-HKD according to their own privacy requirements.

Technology Agnostic

Whilst we have designed our system using Distributed Ledger ("DLT"), the system design is also technology and vendor agnostic, ensuring that the system's functionality is not tethered to any specific technology stack or service provider. By embracing a technology neutral approach, the ecosystem remains versatile, adaptable, and future proof, enabling seamless integration with diverse technologies and facilitating the incorporation of emerging innovations.

Ease of Access

Accessibility is a priority for the use case implementation and the system is designed to reduce technological barriers to the minimum possible level. Apart from reducing reliance on a specific technology, the design also enables users to hold and transact with e-HKD using a smart mobile device, ensuring a low barrier to entry and widespread accessibility for users.

> **Flexible Governance Layer**
>
> The pilot system is designed to support various governance models that may emerge in the future. Flexibility within the governance layer through role segregation ensures that the ecosystem can evolve to meet changing regulatory and governance requirements as finally determined by the HKMA.

Assumptions

The HKMA has yet to conclude on the form of the e-HKD, as such the proposed solution for the pilot is based on a number of fundamental assumptions as relate to the hypothetical e-HKD we have created, specifically:

- It will be a sovereign currency and a digital form of the physical Hong Kong Dollars.

- It will also be a bearer instrument; it is non-interest-bearing and risk-free.

- Same level of dependability and stability as physical HKD.

- A fixed 1-to-1 convertibility with physical HKD.

- Freely convertible into and from bank deposits in Hong Kong.

A major assumption in the subject pilot is that our e-HKD is DLT-based. It is however important to highlight that this assumption may not necessarily be the technology of choice for the future e-HKD.

Other assumptions relating to tokenised securities include:

- Licensed placing agent (broker) conducts third-party fund distribution.

- Licensed fund manager offers tokenised fund products.

- Fund administrator issues official NAV with frequency from daily to hourly.

- Transfer agent carries out share transfer and registry services.

The above assumptions form the foundation of the use case in this pilot and drive all design and implementation decisions.

Section 3

Solution Architecture

Key design features

The pilot system is designed and developed with a number of key features. It is important to note that these features are only relevant to our pilot, and should not in any way be taken to represent the design of the e-HKD, which will ultimately be determined by the HKMA. The rationale of the design considerations for these features is discussed below:

Adoption of a Self-Custody Model

- The first consideration was whether the pilot system should employ a self-custody model or an intermediary-custody model. The key consideration surrounding this decision is that users give up control and privacy for greater convenience when using an intermediary-custody model compared to a self-custody model. Further, a self-custody model may also be more flexible, as it allows for subsystems that facilitate intermediary custody when required. The concept of self-custody is similar to the operation of physical safe deposit boxes, where assets placed in the safe deposit provider's infrastructure do not entail a direct liability of the user's assets on the safe deposit provider.

- Adopting a self-custody approach means that e-HKD is held by the user themselves in a device, typically a wallet. Wallet providers would facilitate the recording of transactions, such as to update a global ledger within the e-HKD infrastructure.

- A self-custody model also enables greater consumer choice, minimizing the proliferation of individual wallets across service providers, reducing reliance on the creditworthiness of intermediaries, and allowing individuals to act with autonomy and anonymity, as with physical cash.

Adoption of a Vault Model

- Another key feature of the system, given the focus on short-term interest earning investments, is to determine whether the deposit function should be based on a vault model or a Direct Token model.

- A vault model functions similarly to a traditional time deposit. For example, a distinct time-locked vault is established every day at 12:01 am. Users deposit their e-HKD into these daily vaults and receive a corresponding amount of 'lockXX' tokens, denoting the lock-in duration (e.g., lock7 for 7 days). As the day ends at 11:59 pm, the smart contract automatically moves e-HKD from all active vaults into a designated wallet controlled by the fund manager. On the specified maturity day, the fund manager deposits the principal amount along with the earned interest back into the vaults. The vaults then automatically return the accumulated amount to the respective users on a pro-rata basis depending on the user's share of 'lockXX' tokens provided by the vault.

- A vault model offers the advantage of not relying on real-time price data or external oracles for calculating both subscription and redemption values, ensuring simplicity and security in the process.

Investor   **Fund Manager**
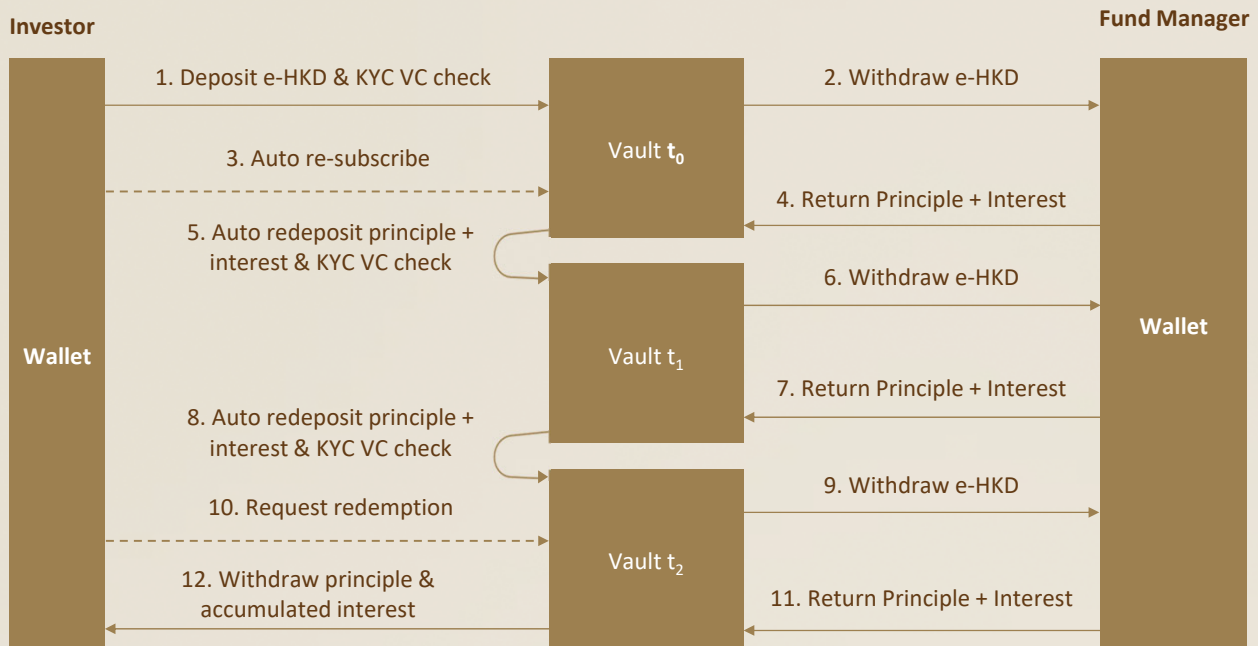

Fig. X : The process flow of the vault model

The vault model also provides the fund manager immediate confidence of payment delivery against fund delivery as e-HKD locked in the vault is effectively 'escrowed' collateral. Investors also gain from increased transparency as historical vault returns can be recorded and, if the fund manager fails to return the principal to a respective vault, a circuit breaker may be introduced to prevent new subscriptions.

The vault model could be structured similarly to a collective investment scheme, a lending pool or even a term deposit product. Depending on how liabilities are defined between the fund manager and investors, the vault model may be a more flexible model of offering simple savings-like products for retail.

The Direct Token model, on the other hand, is when users directly purchase tokens representing ownership in a certain fund. Each user will purchase a token based on the real time price of a fund where price information is provided by a trusted oracle. Alternatively, the price can be algorithmically calculated to reflect the short-term compound interest rate of the underlying security. The token will then be locked and will automatically be sold at its market value at expiration to the fund manager.

While a token model has the benefit of price flexibility and return transparency, the disadvantage is that it relies on pricing data from an oracle, which risks introducing errors or having the price feed compromised.
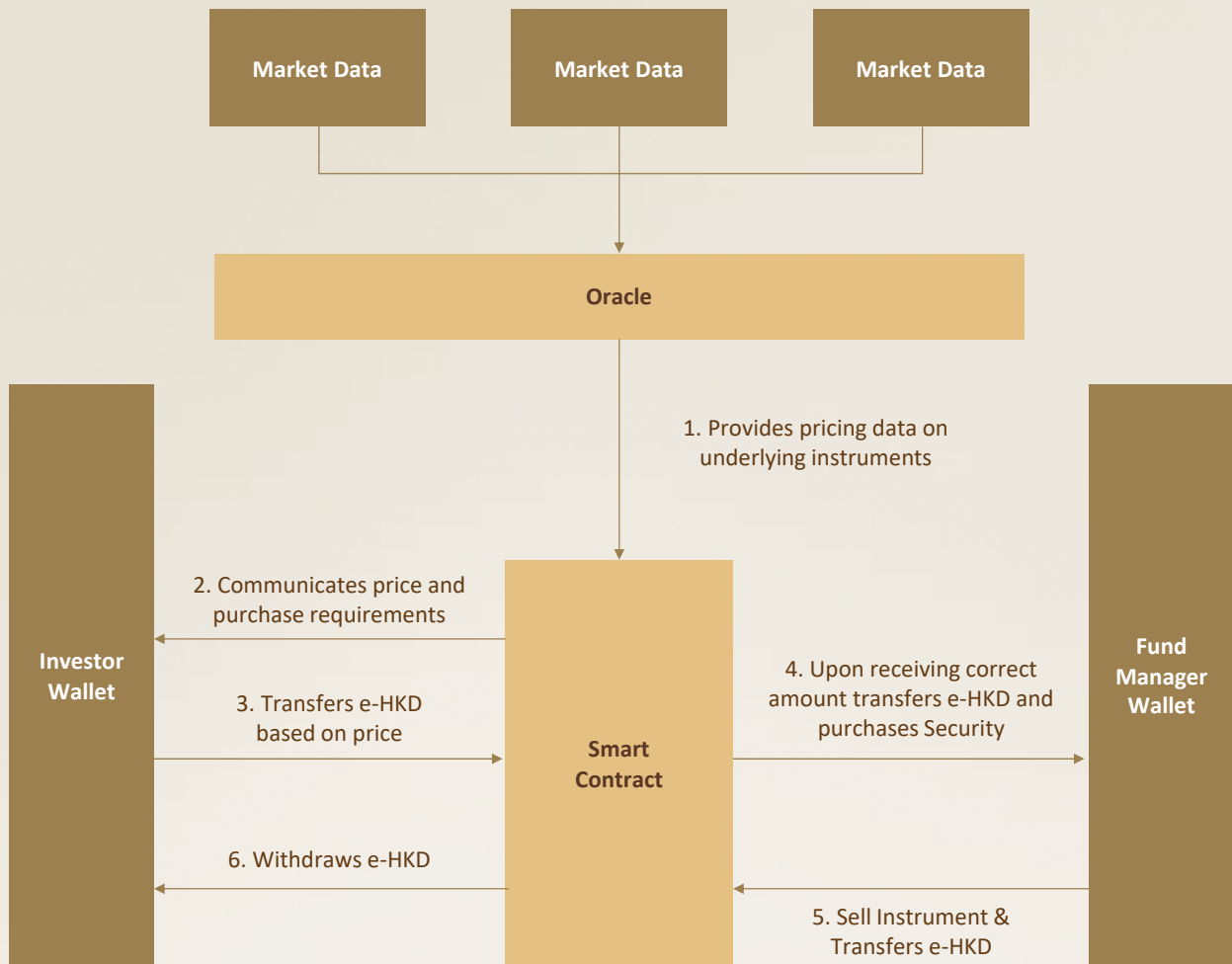
Fig. X : The flow of Direct Tokens

The final decision was to adopt the vault model as it is much more reliable (no need to rely on accurate pricing data), and does not require a market-making function where tokens can immediately be bought and sold by a user at any given time. It is also conceptually similar to traditional time deposits, which would be easier for retail investors to understand and utilize.

Adoption of a Tiered KYC Model

e-HKD, like cash, will need to operate as a generalized payment settlement instrument. While in most retail use cases, identifying information of the payee is typically not required, some transactions, such as purchases of financial products, or large purchases require some identification model.

As such, one important decision is whether to implement a tiered, or non-tiered KYC system. The major differentiating factor is that tiered KYC introduces a lot more flexibility in how users participate within the system, while a non-tiered system reduces overall complexity and thus has fewer risks. However, it also results in a significant reduction in privacy.

Ultimately, a tiered KYC system is a more robust choice that facilitates a wide variety of users' needs. The implications of this system are that any user has the discretion to choose their level of privacy by deciding at which level they participate in the system. For example, if a user is holding low balances and only making small transfers or payments, they can act in relative anonymity. On the other hand, if they want to invest their money into digital securities they would have to divulge more personal information to meet KYC requirements. This means that users have greater control over what information they disseminate and, as a result, can enjoy significantly more privacy compared to a non-tiered KYC system.

A tiered KYC model also allows more flexibility on the service provider's side: different service providers will have different information requirements to perform their KYC checks, using a dynamic KYC system allows each service provider to implement their KYC policy to their own standards. Furthermore, when a service provider performs a KYC check, they will issue a credential to the client which can be transferable to other service providers and can be accepted or rejected by those other service providers based on their own requirements. This dynamic system is able to cater to the diverse requirements of investors but also the different requirements of service providers.

Adoption of Off-Chain Credentials

An equally important decision revolves around the choice between on-chain and off-chain credentials for user identity verification. This choice significantly impacts the system's efficiency, security, and user experience.

On-chain credentials involve storing user identity and verification data directly on the blockchain. While this approach offers inherent transparency and immutability, it introduces challenges related to scalability, privacy, and regulatory compliance. The accumulation of vast amounts of personal data on-chain can strain the network and hinder scalability. Additionally, maintaining privacy becomes intricate, due to the public and permanent nature of the blockchain, and even though the information will be encrypted, certain client information can be gleaned from knowing which wallets are holding tokens and where those tokens are from. For example, if a company issues KYC NFTs to their clients, an observer - while unable to find out specific KYC data - would be able to understand how many clients a service provider has, among other extrapolations. This can be seen as sensitive information and as a result presents a serious privacy concern.

Choosing off-chain credentials is the natural decision for the system. As with off-chain credentials, user identity and verification data remain outside the blockchain's public domain, where only DID information will be accessible on-chain. Instead, credentials and information will be stored in a wallet and, by cross-checking local VCs with the DID information on the blockchain, a verifier will be able to entirely verify the credential. This approach addresses scalability concerns by reducing the burden on the blockchain, enabling smoother operations even as user numbers increase. Off-chain credentials also safeguard user privacy, as personal data remains within a controlled and secure environment either on the user's device or on the cloud. This information is not accessible to unauthorized entities and remains as trustworthy and verifiable as on-chain credentials.

Ultimately, the adoption of off-chain credentials in the pilot e-HKD system underscores an approach to identity verification which prioritizes user privacy, system efficiency, and compliance.

Section 4

Workflow Design

The pilot solution is intended to enable retail investors to make better use of their surplus cash (by converting to e-HKD and investing in new tokenised products) to generate returns while retaining a minimal amount to support their day-to-day spending needs. In addition to improving financial accessibility and inclusivity for retail investors, this solution also improves operational efficiency of fund product issuance and reporting for financial intermediaries.

This section outlines the user journey within the proposed e-HKD Cash Management pilot ecosystem, highlighting key features and considerations from both the investor's and fund manager's perspectives.

Overall Workflow

Charging the e-HKD Wallet

Investors are able to convert the deposit balance in their bank accounts into e-HKD and keep custody of e-HKD in their "wallet(s)".

Identity Confirmation

Investor's digital identities provides as much information about the investor to the placing agent and/or fund manager for KYC, AML, and for investors' suitability assessment. Once completed, the investor can choose between a variety of service providers offering different types of investment products based on their needs.

Fund Subscription

The investor moves their e-HKD to subscribe a money-market fund out of their wallet, which essentially "locks up" their cash for pre-determined period of time and at pre-determined interest income target. Efficient access to competitive money market products will likely generate a higher rate of return than bank deposit.

Funds Escrow

- Once an investor initiates a fund investment order, their e-HKD is escrowed in a smart contract-based vault. The e-HKD is only released to the fund manager when the fund manager delivers the tokenised funds to the investor. Under this delivery versus payment (DvP) model, the fund manager is exposed to less risk as they have the knowledge and confidence that the investor has already prefunded their order. The fund manager also has an incentive to obtain the market price and satisfy the order as quickly as possible to receive the investor's funds. This mode of straight-through atomic settlement can significantly reduce operational overhead.

- Investors in turn can enjoy faster order execution and a timelier entry to the market, allowing them to potentially benefit from an extra day of interest income, say with the purchase of a tokenised bond. This smart-contract based solution enables retail investors to invest e-HKD into yield-generating financial products.

User Journey: Investor's Perspective

Any individual can create a e-HKD wallet if they have access to a smartphone. After creating a wallet, the investor can convert all or part withdraw cash from their bank account, con and deposit into the digital wallet or top up their wallet using other means, such as bank transfers or cash deposits.

With funds in their digital wallet, investors can explore various fund management products offered by different financial providers within the marketplace connected via their digital wallet. These products could include fixed-term savings plans, investment funds, or other yield-generating options. Ultimately, there will be an open-ended marketplace of financial products and services that the investor can access and use through their digital wallet, using e-HKD as the settlement mechanism.
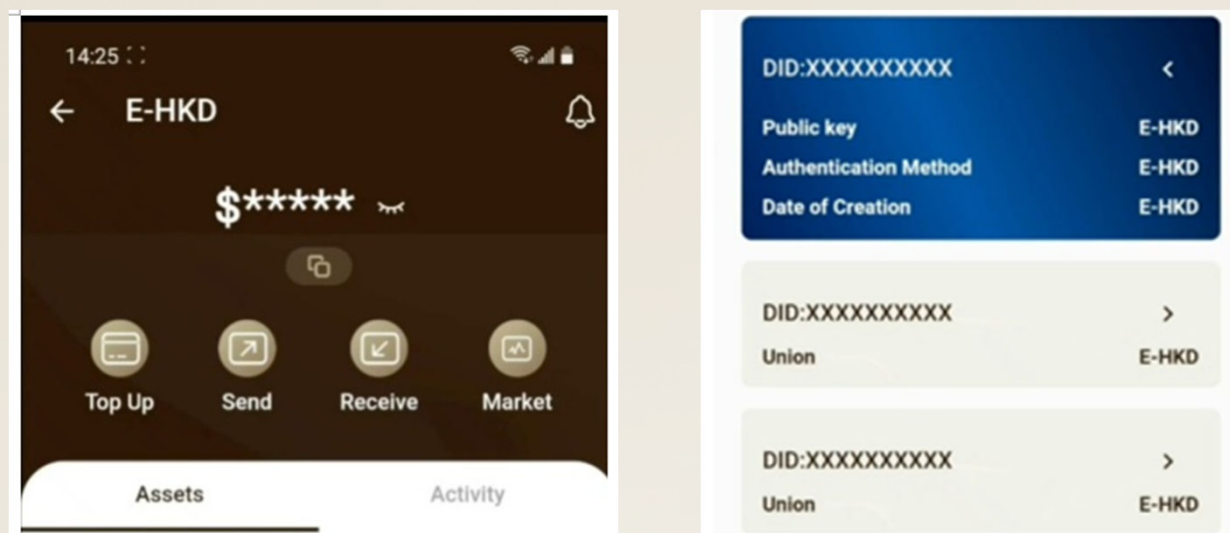

Fig X : Screenshots from Arta-Emali system

As different financial transactions require different levels of data and identification disclosure, the system will function on a tiered KYC system with compartmentalised information disclosure to different parties. This means that the investor will be able to create a wallet, upload funds and browse products by providing a minimum amount of personal identification information. Investors would still need to complete certain KYC checks by third-party financial institutions to invest their funds or to transfer large sums of money. Such KYC checks can be more robust for larger investments or for higher risk investment products.

The financial institutions will complete a series of checks to ensure the validity of the investor's participation. The investor will be required to provide the necessary information to comply with the financial institution's KYC policy. This will all happen cryptographically in a manner designed to protect and authenticate the investor's confidential information. This is significantly more efficient for the investor and the financial institution than current KYC processes. The financial services provider will verify these credentials in accordance with their onboarding policies and issue a cryptographically secured verifiable credential (VC) to the investor. These VCs are portable and can be presented by the investor to other institutions to prove certain attributes of their identities. These can be as simple as proving account ownership at a certain bank or demonstrating income.

Once investors completed their KYC and suitability requirement assessment, they can subscribe to the chosen products. After selecting the product with the relevant amount of e-HKD, investors will not be able to further access or withdraw these funds within a predetermined period per the terms of the product. This allows the investor to earn potential returns on their funds. This investment process can differ depending on the nature of the chosen product, but the fundamental idea is the same.

After the set period elapses, the principal amount, along with any generated interest or yield, is returned to the investor's digital wallet in the form of e-HKD. This returned amount can be either transferred out of the wallet or reinvested into another product. With the terms fixed by an agreement directly with one party, the amount of counterparty risk can also be reduced.

User Journey: Fund Manager's Perspective

Once investors completed all the checks and subscribed for investment products, the funds are locked from the investor's perspective and accessible to respective fund managers for the subscribed products.

Fund managers can then withdraw the e-HKD from the vault and look to generate returns on this amount within the specified time frame. The fund manager will follow one of two investment flows, depending on the market structure and the available technology of the respective trading and settlement marketplaces. Regardless of investment flows, the fund manager, supported by the fund administrator, will issue the tokenised fund to the investor's wallet upon striking the fund NAV.
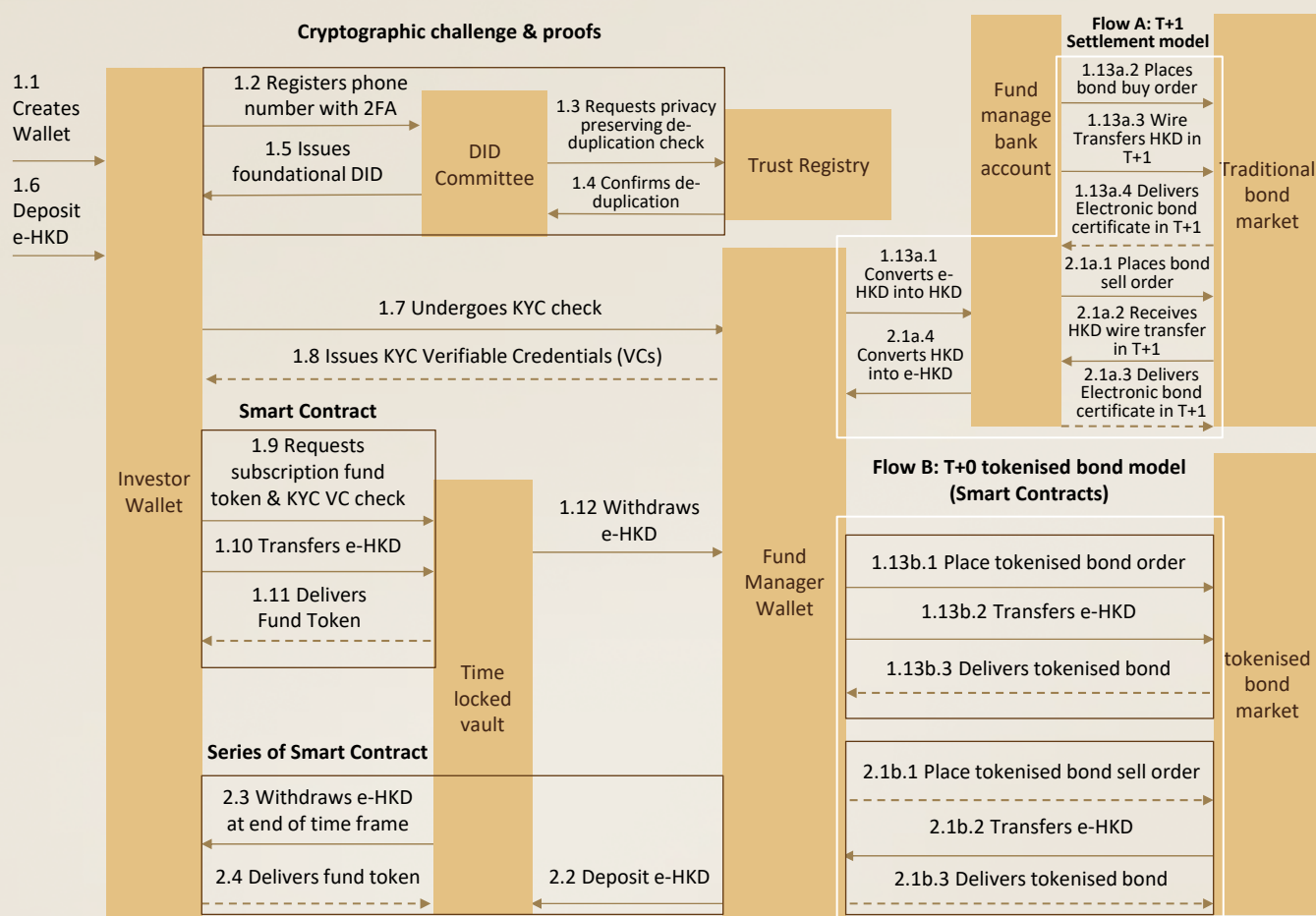

Fig. X : The process flow for investors and fund managers, with two separate branches in the flow representing a tokenised bond model and a T+1 traditional bond market model

The first flow represents fund products that follow current convention of T+1 settlement (such as US Treasury bills, notes, and bonds with DTCC). The fund manager will buy the bonds in the traditional bond market with T+1 settlement. e-HKD will seamlessly converted into traditional HKD though the process, and transparent to investors. It is important to note that T+1 settlement cycle would not affect NAV striking by the fund manager at the point of tokenised fund issuance.

The second flow requires an assumption that tokenised government bonds can be traded and settled on a T+0 basis. If tokenised bonds are made available, fund managers can directly settle the investment with e-HKD. This settlement process follows a T+0 model and atomic settlement given instantaneous execution of smart contracts. In this case, fund managers can generate an additional day's worth of interest for investor within 24 hours.

tokenised bonds allow for significantly improved efficiency for the pilot use case; future development of smart-contract based trading and settlement systems would enable interest income to be earned or charged on a more frequent basis, e.g. minute by minute basis instead of daily.

Section 5

Benefits and Summary

The e-HKD based "cash management for low retail balance" pilot is able to demonstrate significant benefits to participants in the ecosystem.

Operational efficiency

The e-HKD designed in our pilot allows for atomic settlement and given its programmable nature of embedding smart contract. The lead time of the overall settlement process is significantly shortened. This concept can easily be extended to other similar transaction and settlement processes. For example, processes like contract note issuance and investment executions can also be made near-instant.

Increased market efficiency

The pilot system facilitates an 'open curated garden model' which allows for a wide variety of products from different vendors to be available to investors all on one platform. Investors are not locked onto a single wallet operator and can choose any wallet operator to interface with the e-HKD system. The variety of wallet operators, an open technology platform and the variety of products offered reduces transaction and switching costs whilst increasing competition between service providers. Investor can switch between different vendors with ease, thus allowing them to find the right investment opportunities more effectively for their needs. Furthermore, lower vendor costs will allow more products to be made available on the market. This wider accessibility, combined with an expanded product pool, will benefit investors, and improve the efficiency of the market.

Integration with Digital Identity Solutions

Through integration of digital identity solutions and VCs, the pilot solution allows for increased operational efficiency for both investors and institutions. Similar to the Corporate Data Interchange platform operating in Hong Kong, the inclusion of Digital Identity and VCs form a base layer that facilitates many of the other benefits of e-HKD, as they enable instant verification of information within the system and reduce settlement times for monetary and information transactions.

Reduced Counterparty Risks

The pilot system significantly reduced counterparty risk during the settlement process. Investors can comfortably make investments and send money to service providers without the risk of their e-HKD being used for unintended purposes. Fund managers can also benefit from settlement certainty and efficiency.

Improved operational efficiency and user journey for investors

The pilot DLT platform is compared with the fund subscription and payment process of an established licensed financial institution. Increased efficiency for investors is assessed through quantifiable and measurable benefits in the end-to-end processes covering subscription, confirmation, reporting, and redemption, analysed based on four key metrics:

- the number of interfaces visited by investors.

- the number of (repetitive) manual entries by investors

- the number of hours for process completion

- the number of parties involved in process completion.

The pilot solution clearly demonstrated significant improved efficiency across all the above metrics.

Investors with existing accounts

Item	Quantitative Analysis	Current	DLT
1	Number of interfaces visited by investor	2	1
2	Number of (repetitive) manual entries by investors	30	10
3	Number of hours for process completion	24	0.5
4	Number of parties involved in process completion	4	2

Investors that need to set up new accounts

Item	Quantitative Analysis	Current	DLT
1	Number of interfaces visited by investor	5	1
2	Number of (repetitive) manual entries by investors	60	10
3	Number of hours for process completion	48	0.5
4	Number of parties involved in process completion	5	2

Section 6

Assumptions, Prerequisites and Next Steps

Through the pilot, several critical areas were identified that merit deeper exploration as part of the development of the e-HKD ecosystem, so as to fully utilize the power of digital fiat currencies and paves the foundation to make the pilot a reality. These areas include e-HKD technology infrastructure; cross-border transactions; cross-chain interoperability; and suitable financial products and services.

Transparency level within the system

There needs to be a good understanding of what the level of transparency will be within the system. Understanding who can access data and who cannot are critical for stakeholders. As an extension of this idea, there is the important design consideration of how public the DLT implementation will be, which parties will be allowed to be a node on the chain, and what information access rights the nodes have.

Stranded balance

An important question is how balances for dormant accounts will be handled. An account could become dormant due to a phone number being lost, or due to it being a tourist's account, there needs to be a system developed so that the stranded funds are handled in a fair manner in the case that the account owner ever comes back to retrieve the funds. As an extension of this idea, there will need to be a system for individuals with low KYC levels to recover their account if they lose their phone number.

Exploration with Hong Kong regulators and the private sector

Collaboration with regulatory bodies, fund managers, brokers, and issuers remain integral. Exploratory discussions with regulators and industry stakeholders to assess the issuance of diverse fund tokens under private placement or Collective Investment Schemes will no doubt augment the financial landscape's vibrancy. Increasing the number of collaborators with regulators and the private sector will add value to the e-HKD ecosystem, as the true value of the system will be found in its scale and participants. These activities will help steer the industry in the direction to identify the appropriate issuer (e.g. Government or private sector issued) and investment product type suitable for the market for investors with small balances.

Enhanced Regulatory Frameworks

Additionally, an appropriate regulatory framework is crucial to support the different aspects of this use case (E.g. whether the AML/KYC requirements will eventually allow the use of transferrable credentials). Legality of smart contracts and suitable cryptographic techniques also need to be ascertained. Finally, regulators may need to consider whether the current Securities and Future Ordinance is already sufficient to cover the investment of tokenised securities by retail investors. These are important foundations for the new financial infrastructure and will require immense support from the regulators.

Section 7

Conclusion

The current use case exploration has been a valuable experience for the Arta and Emali team and we are delighted to be part of Phase 1 of HKMA's e-HKD Pilot Programme. PwC is also delighted to be invited to help to provide comments and edit this report.

This pilot solution was developed after careful considerations to be innovative and customer centric and also includes infrastructures that foster compliance. In our pilots, we were able to leverage the potential attributes of an e-HKD and we have designed our system to be flexible, technology agnostic to allow interoperability for any model the HKMA ultimately decides on.

Despite this, we believe further research and support from the industry will be needed to inform HKMA's decision on the potential implementation of an e-HKD. We look forward to seeing the results from other participants and we welcome any dialogue to collaborate or explore use cases of an e-HKD.

We remain committed to innovation, collaboration, and seamless user experiences. We hope lessons in testing our pilot use case and our pilot solution helps support the HKMA in realising the full potential of an e-HKD should it be launched and help position it as a cornerstone of digital finance in Hong Kong and globally.

Appendix

Appendix 1: The team

ARTA
TechFin

ARTA TechFin, a financial services technology company, and Emali, a technology company, have partnered to develop a e-HKD use case and smart contract-based platform for the purpose of the HKMA's e-HKD Pilot Programme.

Arta TechFin Corporation Limited (HKSE: 0279) is a hybrid financial (HyFi) platform bridging traditional finance with DLT-based financial system via technology innovations. Our regulated one-stop solution enables corporates, financial institutions, and family offices to access traditional assets and digital assets. Arta TechFin, through its various subsidiaries, are licensed under Hong Kong Securities and Futures Commission. Other licenses include Hong Kong Stock Exchange participant, insurance brokerage license, trustee license and money lending license in Hong Kong.

Contributions from:

Eddie Lau	Ayishah Ma	Andrew Wong
Pamela Yeung		

EMALI

Emali is an enterprise technology company specializing in the development of Web3 solutions for enterprises using its proprietary Trust Solutions technology stack. The company has developed and deployed multiple distributed systems for government agencies, financial institutions, and large corporations.

Contributions from:

Cynthia Cheung	Matthew Betty	Keat Lai
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pwc

PwC Hong Kong supports the development of digital assets and financial innovation in Hong Kong. PwC previously supported the HKMA's mCBDC Bridge and were invited to edit the associated report. At PwC, our purpose is to build trust in society and solve important problems. PwC is a network of firms in 152 countries with nearly 328,000 people who are committed to delivering quality in assurance, advisory and tax services.

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