

Digital Assets

Asian & ASEAN
Central Banks
Intensify CBDC Pilots



CONTENT

This report serves as an update to highlight the rapid pace and widespread variety of key CBDC experimentations and pilots across various Asian and ASEAN countries (in alphabetical order).

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EXECUTIVE SUMMARY

Prior to Covid-19, Singapore's Monetary Authority of Singapore (MAS) was taking the lead with its multi-year multi-phased CBDC experimentation under Project Ubin from 2016 to 2020. By 2019, Thailand's Bank of Thailand (BOT) and Hong Kong's Hong Kong Monetary Authority (HKMA) teamed up with their cross border CBDC study under the expanded Project Lionrock + Inthanon.

In China of course, the People's Bank of China (PBoC) had pushed ahead with local retail pilots of the e-CNY, expanding vastly the scope and frequency across multiple cities in China.

After Covid-19 hit, by early 2021 almost all major Asian central banks had regrouped and reprioritized their respective CBDC initiatives. In line with the ramp up in interests in the private sector on the application of Distributed Ledger Technology (DLT) and smart contracts in financial and real world applications, Asian central banks have also jump started and re-intensified their CBDC experimentations. Quite a few have now progressed from Proof of Concept (PoC) studies to official Pilot programmes.

Retail vs Wholesale CBDC

It is worth noting that amidst this flourish in CBDC pilots across Asia, the debate is still raging as to which CBDC is a priority, whether it is Retail CBDC for the masses or Wholesale CBDC for financial institutions. E.g. Thailand's Bank of Thailand (BOT) has prioritized for retail CBDC by launching a pilot in Aug 2022. Similarly, Japan's Bank of Japan (BOJ) has launched its Retail CBDC pilot in Apr 2023 under what it calls General Purpose CBDC. And most recently in May 2023, Hong Kong's HKMA launched its e-HKD pilot, which is a cumulation of Retail CBDC studies across 2021 and 2022 in collaboration with Bank of International Settlements (BIS) under Project Aurum.

"It is worth noting that amidst this flourish in CBDC pilots across Asia, the debate is still raging as to which CBDC is a priority, whether it is Retail CBDC for the masses or Wholesale CBDC for financial institutions."

Mr Heng Koon How
Head of Markets Strategy

Other Asian central banks pushed forth with their Wholesale CBDC studies instead, or adopted variations of twin pronged or concurrent Wholesale and Retail CBDC studies. Philippines' BSP went ahead with its Wholesale CBDC pilot CBDCPh. Indonesia's Bank Indonesia has a 3 staged CBDC pilot for its Digital Rupiah and that starts with Wholesale CBDC studies before progressing to Retail CBDC. India's Reserve Bank of India (RBI) launched concurrent CBDC-R and CBDC-W pilots in late 2022. Singapore's MAS expanded its Wholesale CBDC studies under Project Ubin+ and also launched its Retail CBDC pilot under Project Orchid focusing on Purpose Bound Money.

CBDC in Cross Border Trade

Whether it is Retail CBDC or Wholesale CBDCs, the holy grail of Asian central bank CBDC experimentation is in the area of cross border payment and settlement. This is generally seen as pivotal in changing the benefits of Wholesale CBDC. The experiments are mostly in collaboration with the BIS looking into how to enable various CBDCs interact with each other. Interoperability of CBDC platform is the desired end state. To that end, two major studies have been conducted, namely Project Dunbar and Project m-Bridge.

It is heartening to see the multitude of Asian central banks pushing forth with their respective CBDC pilots. Strictly speaking this is not just an Asian phenomena. Based on the Atlantic Council's Central Bank Digital Currency Tracker, as of December 2022, 114 countries, representing over 95% of global GDP are exploring a CBDC with 60 countries in an advanced phase of exploration (development, pilot, or launch).



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Based on the Atlantic Council's Central Bank Digital Currency Tracker, as of December 2022

Key Considerations and Implications for CBDCs

As to when we will actually see a CBDC being implemented and issued on a widespread level across an Asian country, the ultimate timeline remains uncertain. Quite a few Asian central banks have also warned of the various uncertainties and risks. Some highlighted that no decision has been made on if and when to launch its respective CBDC. The MAS has also said clearly that given the strong digital banking penetration, there is no urgency for issuing a Retail CBDC for Singapore.

On the flip side, India with its vast population and relatively large amount of cash usage will benefit from financial inclusion and cost savings from a Retail CBDC. But Reserve Bank of India also warned that there are many considerations to fine tune across user anonymity, monetary policy implications and legal issues just to name a few.

There are many motivators to explore CBDC such as to reduce settlement risk, improve liquidity and payment efficiencies and enable new capabilities such as programmability of money. At the same time, there are as many if not more challenges to be addressed. A few worth mentioning includes balancing between privacy concerns and prevention of money laundering and terrorist financing; interoperability with traditional Financial Market Infrastructure (FMI) and across jurisdictions; technological stability and scalability; and last but not least choosing the suitable CBDC design and operating model. Hence, depending on each jurisdiction's policy goals for CBDC which is unique to each jurisdiction's economic situation, both benefits and challenges need to be carefully considered before launching a CBDC.

As part of preparations for issuance of CBDC, there are two additional aspects that should be comprehensively investigated and evaluated. Firstly, as most existing legal framework were enacted pre-digital age, clarity on whether central banks have the mandate to issue CBDC and what status CBDC would have; are important in guiding whether law reform is necessary before CBDC could be issued. Secondly, currently there is insufficient data to undertake empirical analysis on the monetary policy implication of CBDC, assessments thus far are largely conceptual. As different CBDC design choices may have different impact, a multifaceted strategy may be needed to comprehensively identify the macroeconomic and financial market risks. While CBDCs are being widely explored, let's also keep an eye on tokenized bank liabilities or sometimes referred to as tokenized deposit and its potential in complementing CBDC.

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Ms Lyselle Tan Lip Cheak
SVP, Blockchain & Digital Assets

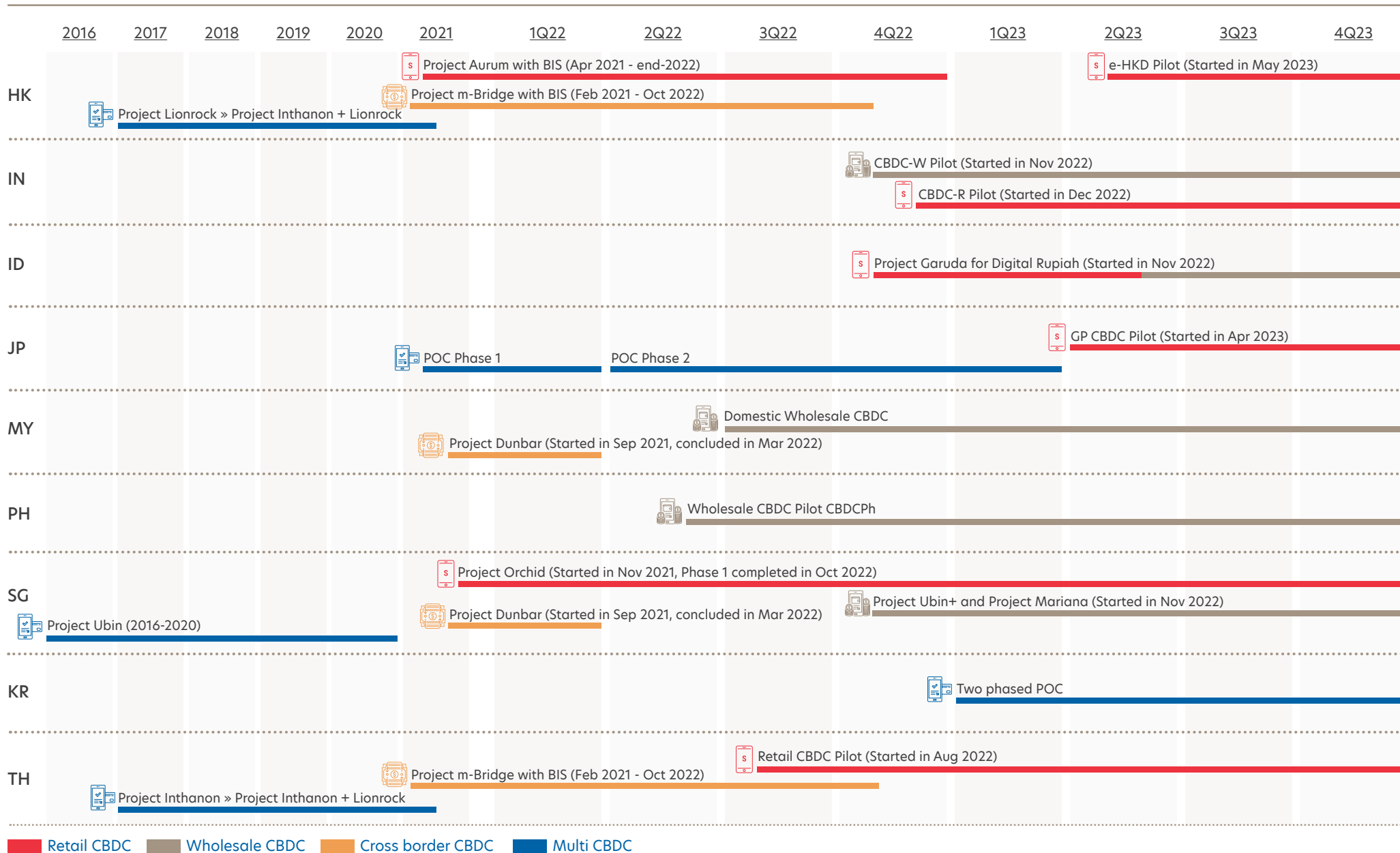
In summary, while there is rapid progression in CBDC exploration across the board, the actual launch and eventual uptake of CBDCs still remain uncertain. Overall, there are many permutations with regards to the design and technology to be adopted for the respective CBDCs. There is no "one size fit" all approach as each Asian country's priority and needs are different.

Beyond prioritizing whether the focus should be on retail CBDC or wholesale CBDC and finding the most impactful use cases; there are many technical considerations like whether the CBDC should be token or account based? what is the level of anonymity to be accorded? Which architecture is more suitable - decentralised or centralised? Should CBDC be remunerated or unremunerated? etc.

In the meantime, many central banks maintain a high-level consultation and collaboration with local banks, the finance industry and private sector. Specifically, it is noted that many of the use cases in the various pilots involve experimentations with banks and various private blockchain and fintech firms. This provides the industry with opportunity to help craft practical and useful solutions that solve real world challenges.

This report serves as an update to highlight the rapid pace and widespread variety of key CBDC experimentations and pilots across various Asian and ASEAN countries. China's E-CNY is an extensive endeavor in itself and will be discussed in more detail in a separate report.

TIMELINE FOR ASIAN AND ASEAN CBDC EXPERIMENTATION



Source: Respective Asian central bank, UOB Global Economics & Markets Research

Summary of e-HKD Pilot Programme

In May 2023, the Hong Kong Monetary Authority (HKMA) announced the start of the e-HKD Pilot Programme. In this e-HKD Pilot, the HKMA will collaborate with 16 local banks and firms from a diverse range of financial, payment and technology sectors. HKMA notes that this Pilot Programme include 14 specific pilots conducting "deep dives into potential use cases in six categories, including full-fledged payments, programmable payments, offline payments, tokenised deposits, settlement of Web3 transactions and settlement of tokenised assets."

The pilots involving tokenized assets are particularly interesting as these include settlement and inter-operability of various types of tokenized assets; demonstrating the critical role of digital currency in enhancing the benefits of tokenized assets. One such tokenized asset focused pilot aims to focus on the inter-operability of deposit tokens between banks. Another tokenized asset focused pilot aims to test real estate tokenization as a potential use case for e-HKD. [More details](#)

Details of e-HKD Three Rail Approach

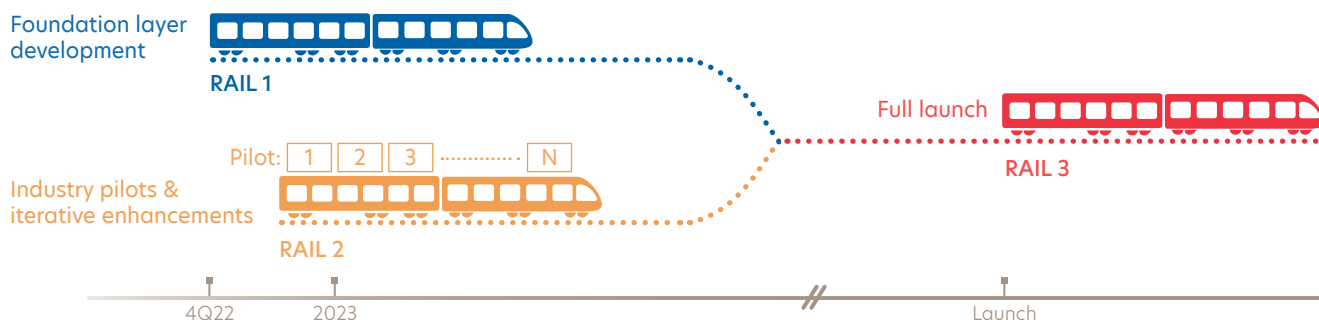
In Sep 2022, after various rounds of research and consultation, there were significant agreements that the design of a retail CBDC should take a holistic approach, adopt a two-tier distribution model, preference for e-HKD to be unremunerated, support offline payment and cross-border payment, protect user privacy while supporting legal and regulatory compliance requirements such as anti-money laundering and counter-financing of terrorism (AML/CFT) and achieve the highest level of cybersecurity to maintain public trust. Furthermore, a retail CBDC should support interoperability with a wide range of payment transaction systems and should be open and inclusive to support a diverse set of participants and retail CBDC wallet providers.

The HKMA issued a policy paper titled "e-HKD: Charting the Next Steps", outlining its policy stance and development steps for its proposed retail CBDC, also known as the e-HKD. Accordingly, the HKMA has adopted a three-rail approach for the development of the e-HKD.

According to the HKMA paper, Rail 1 "aims to lay the technology and legal foundations for supporting the implementation of e-HKD. Specifically, a plan will be formulated for developing the wholesale layer of the two-tier e-HKD system". Concurrently, Rail 2 "runs in parallel to Rail 1, taking deep dives into use cases as well as application, implementation, and design issues relating to e-HKD. It will also conduct a series of pilots in close collaboration with various stakeholders to gain actual experience". Finally Rail 3 "will consolidate the outcomes of Rail 1 and Rail 2 for more thorough implementation planning and will set the timeline for launching e-HKD".

The current e-HKD Pilot Programme is a key component of Rail 2 of the abovementioned three-rail approach, to collaborate with various industry stakeholders to gain actual experience.

THREE-RAIL APPROACH TO PREPARING FOR POSSIBLE e-HKD IMPLEMENTATION



Source: HKMA, UOB Global Economics & Markets Research

Useful links:

[Press releases: HKMA's policy stance on e-HKD](#)

[e-HKD: Charting the Next Steps](#)

[e-HKD: A Policy and Design Perspective](#)

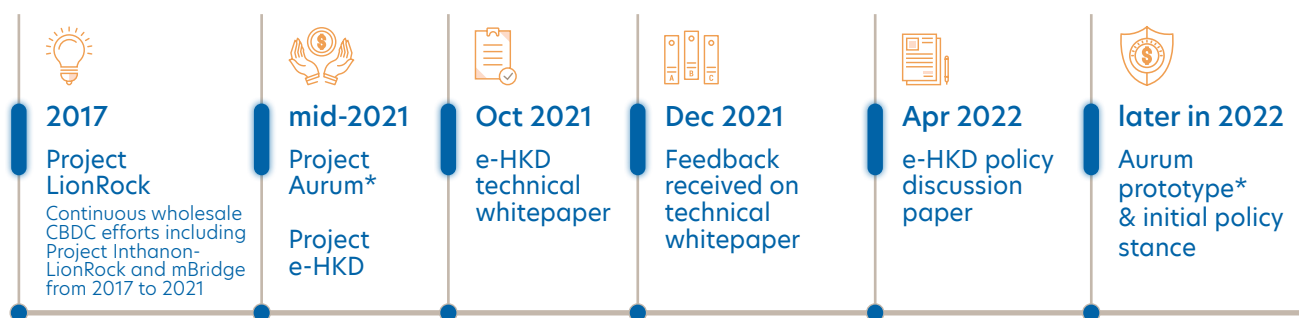
[HKMA: Central Bank Digital Currency \(CBDC\)](#)

HKMA's CBDC Journey

The HKMA's CBDC journey started in 2017 with its study of Wholesale CBDC under Project Lionrock for large value payment and settlement. This then progressed into cross border Wholesale CBDC study in 2019 under the expanded collaboration with Bank of Thailand (BOT) via Project Inthanon – Lionrock. Thereafter, the cross border collaboration with BOT was further expanded in 2021 with the addition of People's Bank of China (PBoC) and the Central Bank of the United Arab Emirates, under the BIS's Project mBridge which experimented with cross border payment and exchange of multiple CBDCs.

The HKMA also experimented with Retail CBDC from Jun 2021 with the start of Project e-HKD. There was a concurrent Retail CBDC study together with BIS, under Project Aurum which studied high level technical design of Retail CBDC. Various rounds of technical papers and industry consultation then resulted in the above mentioned policy paper on e-HKD in Sep 2022 and the start of the Pilot Programme in May 2023.

THE CBDC JOURNEY OF THE HKMA



* Together with BIS Innovation Hub Hong Kong Centre

Source: HKMA, UOB Global Economics & Markets Research

Key Takeaway

Mr Eddie Yue, the Chief Executive of the HKMA, noted that "While the HKMA has not yet made a decision on whether and when to introduce e-HKD, we are excited to kick-start the e-HKD Pilot Programme, which serves as a tremendous opportunity for the HKMA to collaborate with the industry in exploring innovative use cases and maximizing our readiness for a potential e-HKD. We appreciate the industry's active participation in the pilots and look forward to the results. We are also pleased to have many experts in the academia joining forces with us on this CBDC journey. By fostering government-industry-academia collaboration in CBDC research, we aim to ensure the relevance of our research and development efforts, and enable the translation of such outcomes into viable business opportunities."



Summary of CBDC Concept Note

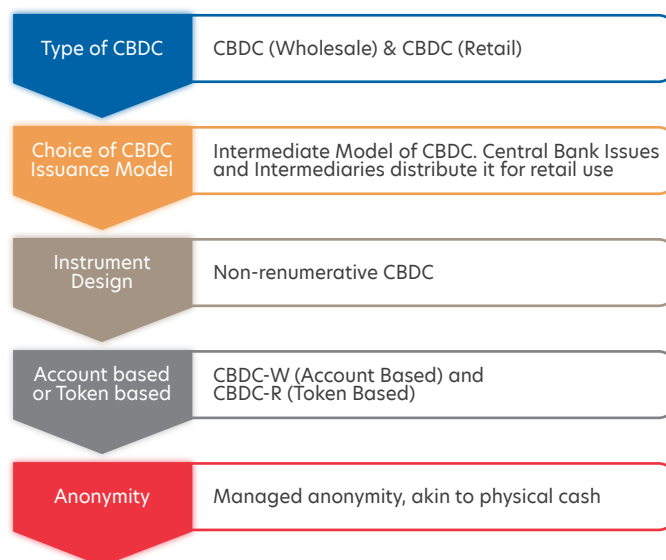
In Oct 2022, Reserve Bank of India (RBI) issued a "Concept Note on Central Bank Digital Currency". The RBI's CBDC concept note highlighted that "This Concept Note explains the objectives, choices, benefits and risks of issuing a CBDC in India, referred to as e₹ (digital Rupee)" and that "The Reserve Bank will soon commence limited pilot launches of e₹ for specific use cases." [More details](#)

Given India's existing efforts to move the large cash using population to digital payment, the RBI's CBDC Concept Note made effort to explain the motivation by the central bank to explore CBDCs. These included:

- Reduction in cost associated with physical cash management
- To further the cause of digitisation to achieve a less cash economy.
- Supporting competition, efficiency and innovation in payments
- To explore the use of CBDC for improvement in cross-border transactions
- Support financial inclusion
- Safeguard the trust of the common man in the national currency vis-à-vis proliferation of crypto assets

There was also detailed discussion on the various constructs for CBDCs. Whether the CBDC should be account based or token based? How the CBDC will be distributed, whether it will be the Single Tier "Direct CBDC Model", or the Two-Tier "Intermediate CBDC Model" or the "Hybrid Model" with the private sector messaging layer. In addition, questions were being asked as to whether CBDCs should be interest bearing and how that affects monetary policy, i.e. remunerated CBDC or non-remunerated CBDC and whether a token based CBDC or account based CBDC is more efficient. Overall, the RBI's CBDC Concept Note defined in detailed the various design considerations.

DESIGN CHOICES SNAPSHOT



Source: RBI, UOB Global Economics & Markets Research

Details of CBDC-W and CBDC-R Pilots

Following the publishing of the CBDC concept note, RBI proceeded to announce two concurrent CBDC pilots. First was a Wholesale CBDC Pilot (CBDC-W), announced on 31 Oct 2022 with local banks. The CBDC-W pilot focuses on experimenting with inter-bank payments with banks and financial institutions. The RBI statement noted that 9 local banks have signed up the CBDC-W trials and that "use case for this pilot is settlement of secondary market transactions in government securities". [More details](#)

Second was a Retail CBDC Pilot (CBDC-R) which was announced on 29 Nov 2022 in various cities across India. The CBDC-R pilot will be token based and focus on individual retail payments. The RBI statement noted that "the pilot will test the robustness of the entire process of digital rupee creation, distribution and retail usage in real time. Different features and applications of the e₹-R token and architecture will be tested in future pilots, based on the learnings from this pilot." The statement noted that "Eight banks have been identified for phase-wise participation in this pilot" with more banks, users and location to be added as needed. [More details](#)

Key Takeaway

RBI Governor Shaktikanta Das was quoted by local media as highlighting that CBDCs are "central bank money", while various existing forms of digital payment are still "bank's money" and that CBDCs will have all the advantages of physical money but without the associated risks of money laundering and counterfeiting. He added that another basic feature of CBDCs is maintaining anonymity for the end user, with RBI maintaining the transaction ledger.

In his latest update in Feb 2023, RBI Deputy Governor T Rabi Sankar was quoted as saying that R-CBDC trials are proceeding well with about 700,000 transactions done between 50,000 end users and 5,000 merchants and that eight banks are participating across five cities with more banks and cities planned to be added in due course. Latest news reports claim that the RBI is targeting 1,000,000 users for its CBDC-R pilot by the end of this year and that the pilot will be extended to as many as 15 cities.



Summary

In November 2022, Bank Indonesia (BI) announced a 3 stage CBDC project, called the Project Garuda with the focus for “exploring the optimal design for Indonesian CBDC, or Digital Rupiah.” Concurrently, BI published an initial whitepaper on the high-level design of the Digital Rupiah.

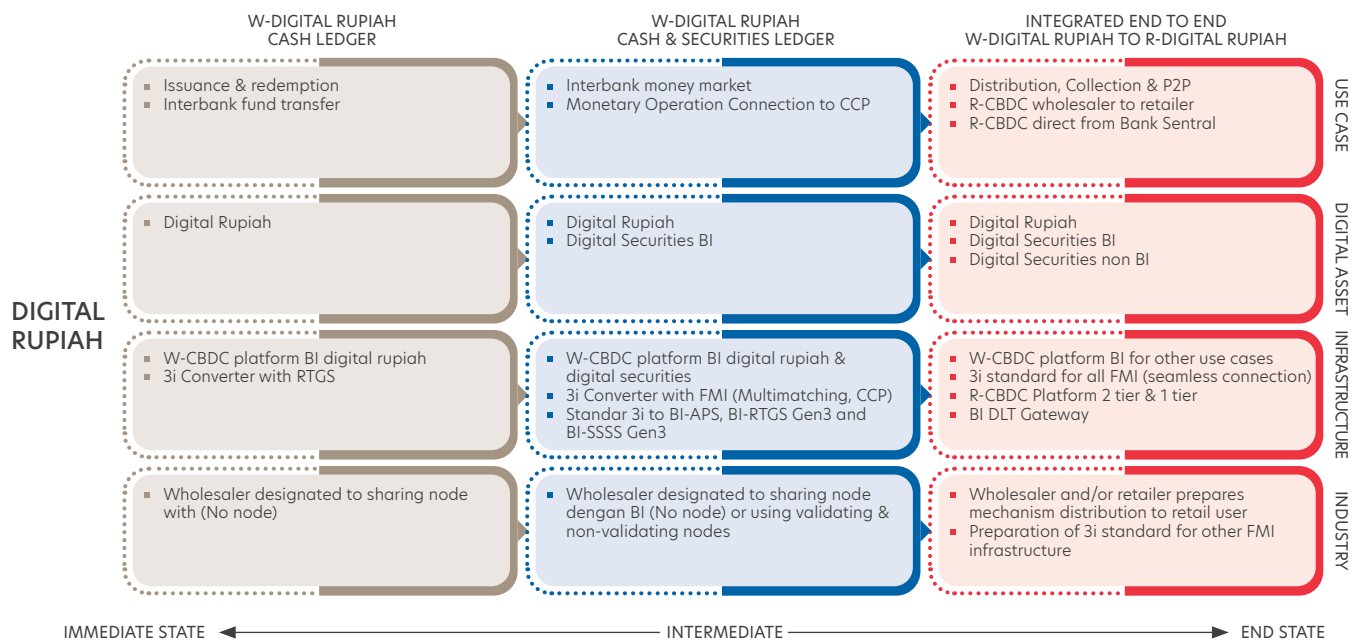
Details of Project Garuda

According to the white paper, there are 3 development phases to the Digital Rupiah: Immediate Phase, Intermediate Phase and End Phase. The Immediate Phase involves a Wholesale Digital Rupiah study for the issuance and redemption of interbank fund transfer, integrating with the existing Real Time Gross Settlement (RTGS) payment system. The Intermediate Phase expands the Wholesale Digital Rupiah study from interbank money markets to include cash and securities ledger, potentially experimenting with tokenization of securities.

The End Phase opens up the Wholesale Digital Rupiah to an end-to-end Retail Digital Rupiah. Interestingly, the White Paper teased that entities designated as Wholesalers (including non-commercial banks) can help distribute the Retail Digital Rupiah while BI focus on the operation for Wholesale Digital Rupiah.

As of Feb 2023, BI has initiated the public consultation for Phase 1 of Project Garuda. [More details](#)

DIGITAL RUPIAH ROAD MAP



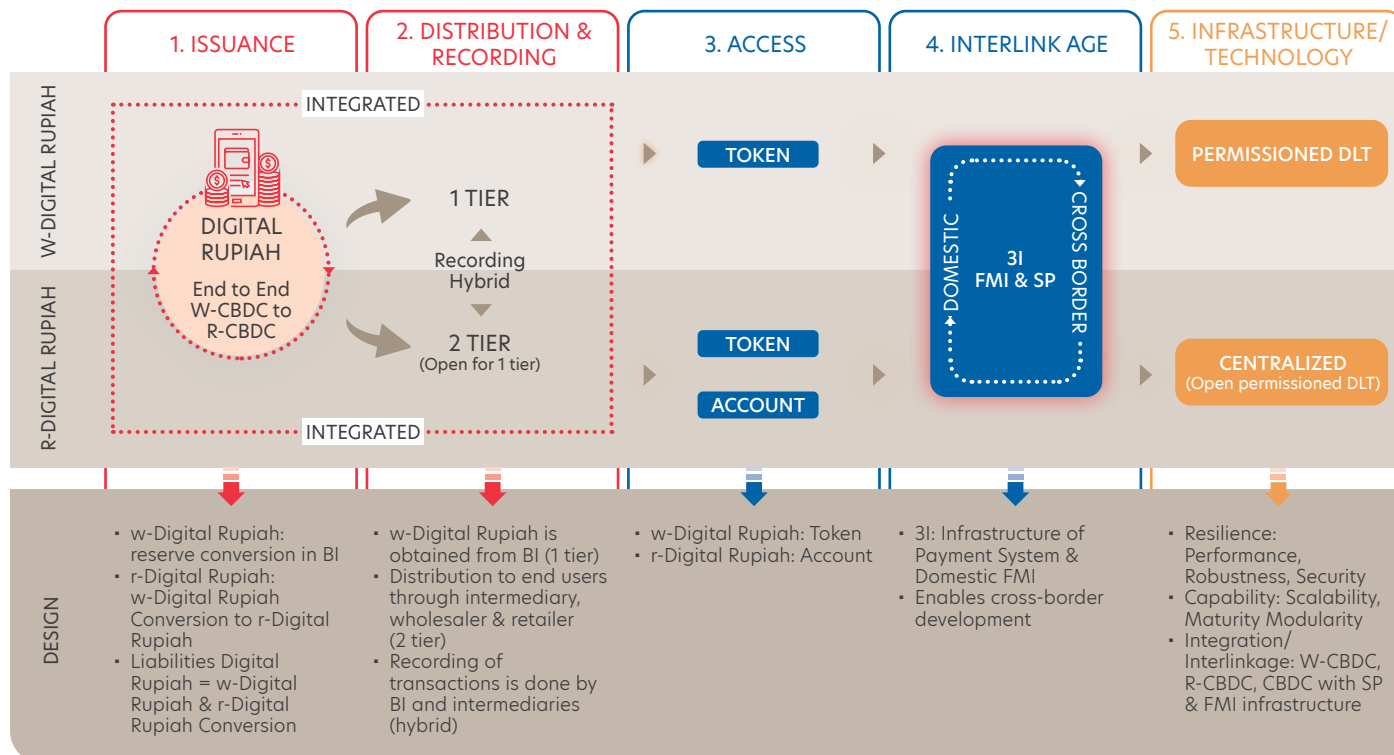
Source: BI, UOB Global Economics & Markets Research

The Digital Rupiah tech architecture will consist of 3 layers to realize the business model - tech platform, digital assets and use cases. As it is paramount for the Digital Rupiah platform to exchange information and perform transactions with existing and future traditional infrastructure, a 3i connectivity bridge is envisioned to link Digital Rupiah platform with other Financial Market Infrastructures.

For Wholesale Digital Rupiah, permissioned-based Distributed Ledger Technology (DLT) accessed via token-based verification is identified as a suitable choice for its one-tier distribution model in view of its potential to tackle single point of failure problem, improve financial integrity and promote higher efficiency.

On the other hand, a centralized system allowing access via both account-based and token-based verification is envisioned as a more suitable choice for Retail Digital Rupiah in view of its scalability, ability to mimic banknotes and coins for small value transactions and fulfil AML/CTF compliance requirement for high value transaction.

DESIGN CONFIGURATION OF THE DIGITAL RUPIAH



Source: BI, UOB Global Economics & Markets Research

Key Takeaway

BI believes that "Digital Rupiah has the potential to preserve the sovereignty of Rupiah in the digital era, including supporting integrated digital economy and finance as well as creating the opportunities for more equitable and sustainable financial inclusion".

However, BI also warned that "most central banks are still mindful before taking a decision to issue a CBDC for the public. There are stages of further experimentations and discussions required" and that "There is no one-size-fits-all solution in the development of CBDC as each country has its own unique characteristics and specific policy contexts."

In the consultation paper for Phase 1 - Project Garuda, BI avails 3 options - validating node, non-validating node or no node to both wholesaler and non-wholesaler. Validating node participants has the rights to validate transactions and controls the custody of their w-Digital Rupiah token while non-validating nodes participants only have rights to the later. If a participant chooses no node option, participants could only hold w-Digital Rupiah token custodised with BI as the ledger operator. For interested participants, it may be worthwhile to evaluate these roles against existing business model and desired state as each option has implications on investments and operations.

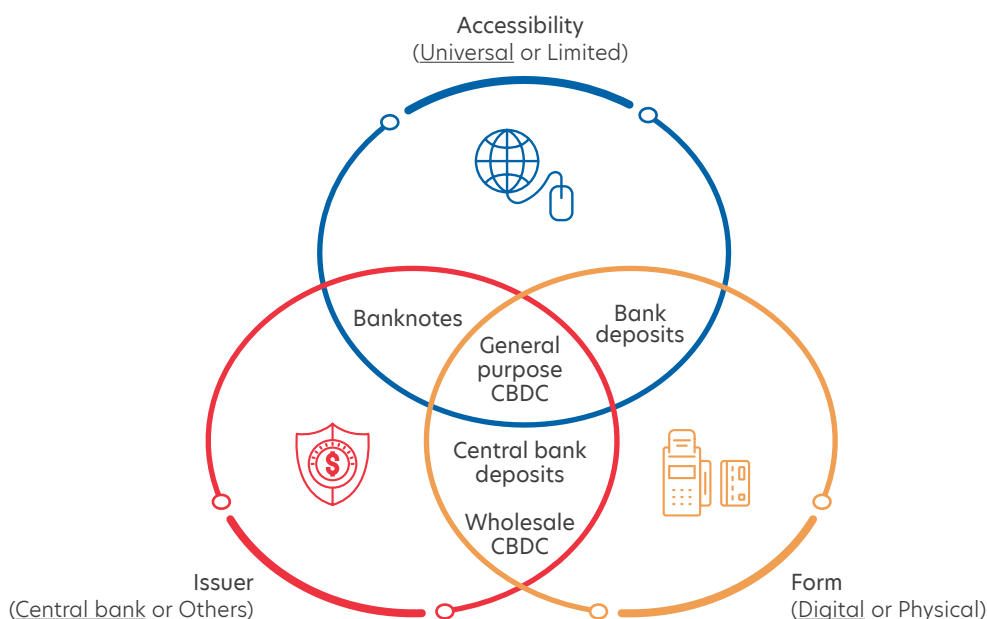
Summary of BOJ's Approach to Central Bank Digital Currency

The Bank of Japan's (BOJ) CBDC journey started in Oct 2020 when the BOJ published its CBDC white paper titled "The Bank of Japan's Approach to Central Bank Digital Currency". According to the BOJ, their view is that there are two main variants of CBDCs, namely Wholesale CBDC and General Purpose CBDC.

As per their definition, Wholesale CBDC is the first variant of CBDC in which "a central bank provides to limited counterparties mainly for large-value payments among financial institutions" and that it is similar to current account deposits held by banks at central banks, available to a limited group of entities.

The BOJ's focus is on the second variant of CBDC, which they termed "General Purpose CBDC". In this case, General Purpose CBDC "is intended for a wide range of end users, including individuals and firms" and "would have similar functions as cash (i.e., banknotes and coins), enabling the end users to make daily purchases with currencies issued by a central bank". This is similar to the broader mainstream concept of Retail CBDC.

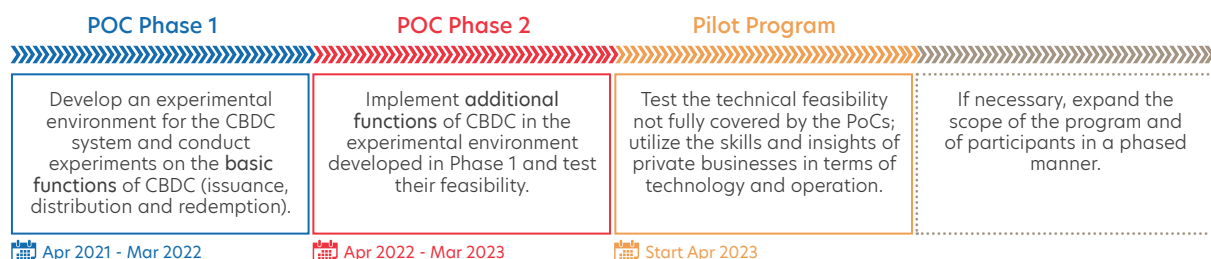
CLASSIFICATION OF CURRENCY



Source: BOJ, UOB Global Economics & Markets Research

The BOJ reiterated that "The Bank will explore General Purpose CBDC in a more concrete and practical way by conducting experiments, rather than confining itself to conceptual research as before". To that end, the BOJ has conducted two Proof of Concepts (PoCs) "to test the technical feasibility of the core functions and features required for a CBDC". PoC Phase 1 was conducted from Apr 2021 to Mar 2022 and PoC Phase 2 was conducted from Apr 2022 to Mar 2023. Thereafter, the BOJ announced that after taking into account the learnings from both PoCs, the BOJ will proceed with the start of the Pilot Program in Apr 2023.

BOJ'S PROOF OF CONCEPTS (PoCs)



Source: BOJ, UOB Global Economics & Markets Research

Speech: Taking the Next Step

[The Release of "The Bank of Japan's Approach to Central Bank Digital Currency"](#)

[The Bank's Approach to CBDC](#)

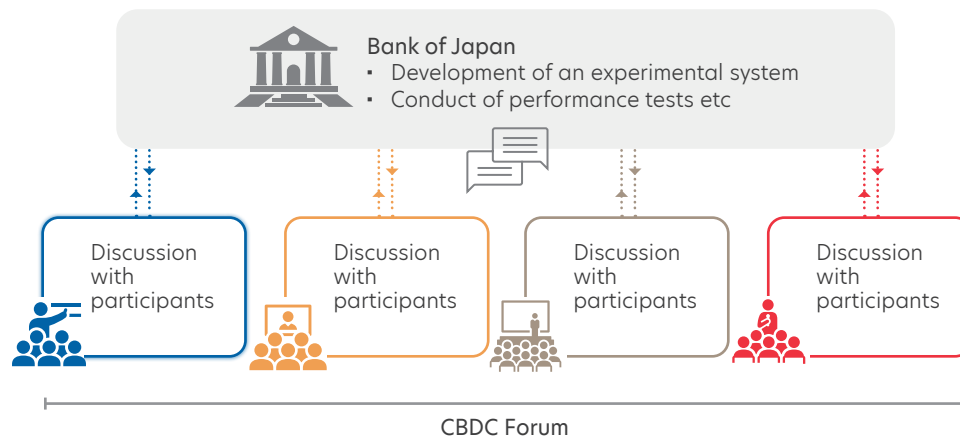
Details of Pilot Program

The BOJ noted that the Pilot Program two main objectives: "First, to test the technical feasibility not fully covered by the PoCs, and second, to utilize the skills and insights of private businesses in terms of technology and operation for designing a CBDC ecosystem in the possible event of social implementation."

In doing so, Pilot Program will expand the experiments from focusing on central system and intermediary network system in POC to include multi-layered intermediary system and endpoint devices for consumers and retailers to be configured in an integrated manner to explore the measures and potential challenges for connecting the CBDC system with external systems.

The BOJ added that the Pilot Program aims "to test the end-to-end process flow and outline the measures and potential challenges for connecting the experimental system with external ones." To that end, the BOJ "will establish a CBDC Forum and invite private businesses engaged in retail payments or in related technologies to participate".

THE PILOT PROGRAM



[Commencement of Central Bank Digital Currency Experiments: Pilot Program](#)
[Liaison and Coordination Committee on Central Bank Digital Currency](#)

Source: BOJ, UOB Global Economics & Markets Research

Throughout both phases of POC, BOJ had built the experimental environment in the public cloud centered around "CBDC ledger" as the foundation of a CBDC system. A total of 4 CBDC ledger designs were experimented of which 2 were account-based and 2 were token-based.

Both phases of POC explored technical feasibility and processing performance towards achieving a production ready system. Processing performance of each design were measured based on throughput, latency and resource utilization. Additionally, functional aspects of reliability and ease of extension were also evaluated. While BOJ has not made any decision on the ledger system to adopt, these POCs had demonstrated that no one design stand out significantly, hence research on alternative data model in comparison with account-based data model will continue in pilot:

1. Performance: While account-based design was affected by record locking, token-based design required more resources.
2. Functional: No significant differences were observed from different designs in terms of reliability and availability. On fault tolerance, each design has its challenges.
3. Ease of extension: Each design has its distinct qualities

Key Takeaway

The BOJ noted that "If a CBDC were to be issued in the future, exploring its framework in such phased manner and engaging in highly transparent communication with the private sector are necessary steps to take for adoption in society. Similar approaches have been taken by other advanced economies."

The BOJ added on a cautious note that any potential CBDC will be "affecting all fronts -- business conditions of financial institutions and of firms, and end users' daily lives. It is therefore essential to develop institutional arrangements that would satisfy all parties involved and proceed in line with this".



Summary

In its Financial Sector Blueprint 2022 to 2026, Bank Negara Malaysia (BNM) sets development priorities for the financial sector over the abovementioned five years, centering on 5 Strategic Thrusts. Experimentation with CBDCs are included in the 3rd Strategic Thrust, which is to "Advance Digitization of The Financial Sector", noting that Digital Currencies "Are A New Frontier". [More details](#)

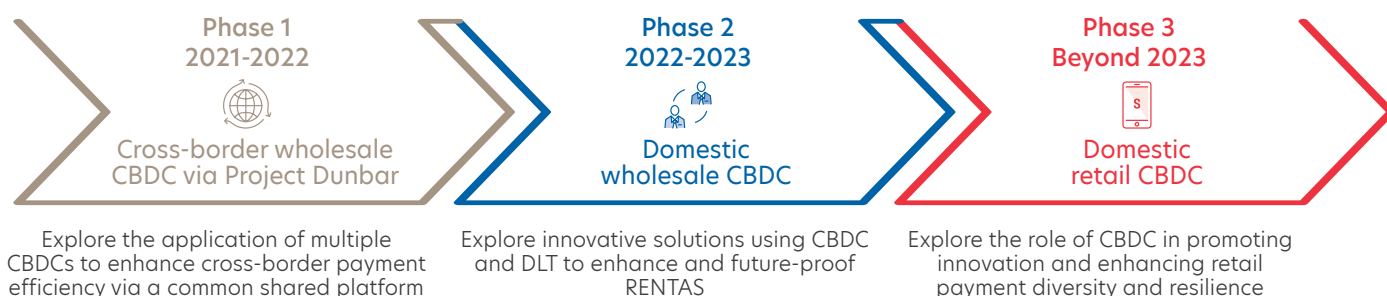
Details

According to BNM, Malaysia's CBDC roadmap is "a multi-year exploration to assess the potential of CBDC to address gaps in the financial sector and to achieve public policy objectives". The CBDC roadmap consists of three phases.

First Phase from 2021 to 2022, is to participate in Project Dunbar to explore the application of multiple cross border CBDCs to enhance cross-border payment efficiency via a common shared platform. Second Phase from 2022 to 2023, is to explore innovative solutions using wholesale CBDC and DLT to enhance and future-proof the existing domestic wholesale payment system RENTAS. Third Phase, beyond 2023, moves onto Retail CBDCs to explore the role of CBDC in promoting innovation and enhancing retail payment diversity and resilience. [More details](#)

MALAYSIA'S CBDC PROOF-OF-CONCEPT ROADMAP

A multi-year exploration to assess the potential of CBDC to address gaps in the financial sector and achieve public policy objectives



Source: BNM, UOB Global Economics & Markets Research

Key Takeaway

BNM notes that "irrespective of our decision on the issuance of CBDC, the developments in the broader digital currency space, particularly foreign CBDC, stablecoins, and other digital assets, may pose other challenges and risks".

BNM added that "beyond assessing the opportunities and risks associated with CBDC issuance by the Bank via the CBDC POC, we will also undertake a holistic assessment of the implications of foreign CBDC, stablecoins and other digital assets to monetary and financial stability, with the aim to develop appropriate policy responses and strategies."



Summary

In May 2022, Bangko Sentral ng Pilipinas (BSP) announced a pilot CBDC initiative called "Project CBDCPh". This is essentially a wholesale CBDC project aiming to "promote stability in the country's payment system" and to "test the use of CBDCs for large value transactions on a 24/7 basis across a limited number of financial institutions".

Details

According to the BSP, Project CBDCPh includes "policy and regulatory considerations, technological infrastructure, governance and organizational requirements, legal matters, payment and settlement models, reconciliation procedures, and risk management". BSP added that the pilot will generate learnings that will be "critical in constructing the BSP's medium- to long-term roadmap for more advanced wholesale CBDC projects that shall further strengthen the Philippine payment system".

The BSP took extra effort to highlight the focus on Wholesale CBDC instead of a Retail CBDC. The BSP noted that "In contrast to general purpose or retail CBDC intended for use of the general public, a wholesale CBDC is restricted mainly to banks and other financial institutions" and that "a wholesale CBDC may contribute to addressing frictions on large cross-border foreign currency transfers, settlement risk exposure from using commercial bank money in equities and operating an intraday liquidity facility."

The BSP added that Wholesale CBDC "can yield the greatest value-adding benefits to the payment system." BSP Governor Benjamin Diokno has said that the BSP "would go into digital currency maybe at some point in the near future but this will be wholesale rather than retail."

[Press Releases - Project CBDCPh to Further Strengthen PH Payment System](#)

[Speeches - Opening Remarks of Governor Benjamin E. Diokno](#)

Key Takeaway

BSP Governor Benjamin Diokno acknowledged that "CBDC issuance does not necessarily address the root causes of financial exclusion. Barriers to financial inclusion are multi-dimensional, involving infrastructure, socio-economic, cultural, and behavioral factors that require cost-cutting and well-coordinated policy interventions" and that in addition "CBDC could bring in some legal issues", particularly the "issuance of retail CBDCs may require legislation, particularly if it involves BSP directly distributing CBDC to the public, which is not contemplated in the existing BSP charter."



Summary

The Monetary Authority of Singapore (MAS) has had extensive multi-year experimentation with the entire range of CBDCs across the entire range of wholesale, retail and cross border CBDCs. The experimentation started with Project Ubin in 2016, which aims to use Distributed Ledger Technology (DLT) for the clearing and settlement of payment and securities. Phase 4 of Project Ubin in 2019 saw MAS collaborating with Bank of Canada (BOC) under Project Jasper to explore cross border payments using CBDCs.

Thereafter, there was a flurry of collaborative cross border and wholesale CBDC projects. These include Project Dunbar in 2021 which explores multiple CBDC settlements and Project Ubin+ and Project Mariana in 2022 which study cross border wholesale CBDCs. Together with the Federal Reserve Bank of New York (FRB NY), the MAS also studied using wholesale CBDCs to transact and settle less liquid currencies under Project Cedar x Ubin+ in 2023.

In the retail CBDC space, the MAS has launched Project Orchid in 2022 as well to explore the various design and technical aspects of a retail CBDC, although noting in an earlier whitepaper in 2021 that there is no urgent need for a retail CBDC in Singapore at this stage. The focus in this case is on Purpose Bound Money (PBM) which is essentially a type of programmable money which specifies conditions attached to the use of the Digital SGD.

Key CBDC Projects

1 Project Cedar x Ubin+ Started in Nov 2022 and successfully completed in May 2023

The MAS and Federal Reserve Bank of New York (FRBNY) announced the results of a joint Project Cedar (FRBNY) and Project Ubin+ (MAS) examining the use of distributed ledger technology (DLT) to improve the efficiency of cross-border wholesale payments and settlements involving multiple less liquid currencies with hypothetical payments using simulated Wholesale CBDCs. [More details](#)

3 Project Orchid, Retail CBDCs and Purpose Bound Money Started Nov 2021 with Phase 1 completed in Oct 2022

The MAS launched Project Orchid in Nov 2021 as a multi-year, multi-phase exploratory project examining the various design and technical aspects pertinent to a retail CBDC system for Singapore, from its functionalities to its interaction with existing payment infrastructures. The objectives for Project Orchid are twin fold: First is to develop technology to issue a retail CBDC, second is to explore potential use cases for Programmable Money. The MAS did note that their assessment at that juncture is "there is no urgent need for a retail CBDC in Singapore" and that studies are to advance on-going learning.

[Project Orchid](#)

[Project Orchid Whitepaper](#)

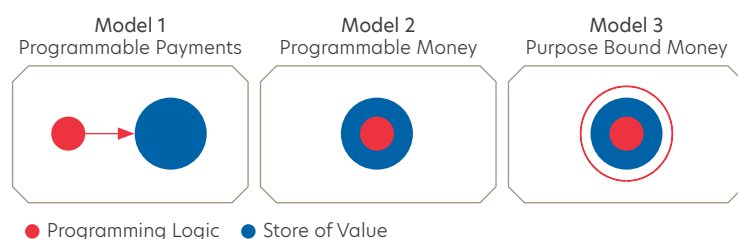
[A Retail CBDC: Economic Considerations in the Singapore Context](#)

2 Project Ubin+ and Project Mariana Started Nov 2022

This is a Wholesale CBDC project by the Monetary Authority of Singapore (MAS) that involves an expanded collaboration with various international partners on cross-border foreign exchange (FX) settlement, studying the business models, governance, technical standards for cross border FX connectivity, inter-operability, atomic settlement of currency transactions using Distributed Ledger Technology (DLT).

Ubin+ also includes Project Mariana, which is a collaboration between MAS, Banque de France, Swiss National Bank (SNB) and the Bank for International Settlements (BIS) that explores the exchange and settlement of CHF, EUR and SGD wholesale CBDCs. [More details](#)

POSSIBLE MODELS OF PROGRAMMABLE DIGITAL CURRENCY



Source: MAS, UOB Global Economics & Markets Research

Specifically, Phase 1 of Project Orchid completed in Oct 2022 introduced the concept of Purpose Bound Money (PBM) which builds upon the concept of programmable payment and programmable money. PBM refers to a protocol that specifies the conditions upon which an underlying digital SGD can be used across different platforms and systems. Multiple case studies undertaken in 2022 and planned for 2023 aims to refine product features and optimize user experience. [More details](#)

4 Project Dunbar m-CBDC

Started in Sep 2021 and successfully concluded Mar 2022

The cross border multi-CBDC project, termed Project Dunbar was successfully completed in Mar 2022. The project involves the MAS, Reserve Bank of Australia (RBA), Bank Negara Malaysia (BNM), South African Reserve Bank (SARB) and the International Settlements (BIS).

The project studied the transaction of respective multiple CBDCs issued by participating central banks with each other on a shared platform, so as to advance the efficiency of cross border payment with the potential to cut cost and increase speed.

[Experimental Multi-CBDC Platform for International Settlements Project Dunbar](#)

5 Project Ubin

Multi-year Project involving 5 key phases from 2016 to 2020

This maiden project is a very expansive multi-year effort by MAS, collaborating with the industry to explore using Distributed Ledger Technology (DLT) for the clearing and settlement of payment and securities. Project Ubin encompasses a wide range of activity beyond just CBDC and is divided into 5 key phases.

Phase 1 in 2016 explored the use of Tokenized SGD for interbank payment. Phase 2 in 2017 studied various models for decentralized interbank payment and re-imagines the RTGS. Phase 3 in 2018 aimed to develop Delivery versus Payment (DvP) capabilities for settlement of tokenized assets across different blockchain platforms. Phase 4 in late 2018 saw the MAS collaborating with the Bank of Canada (BoC) and Bank of England (BoE) to jointly explore cross border payments using CBDCs. Finally Phase 5 in 2020 had the MAS collaborating with Temasek to use a blockchain-based multi-currency payments network prototype to enable broad ecosystem collaboration. [More details](#)

Key Takeaway

MAS sees the Digital Currency System as a new companion monetary system that must mirror the structure of existing monetary system from security and resilience point of view. Today, about 10% of money in circulation takes the form of Central Bank Money (e.g. notes, coins, central bank reserve). This could be in the form of CBDC which will provide the anchor and trust in the system. The remainder 90% of money comes in the form of Commercial Bank Money (e.g. bank deposits). Tokenized Deposit where bank can choose to tokenize a part of deposits may fill this role as it has the potential to play a bigger role and opens up possibilities to do many things that cannot be done today. Thirdly, there is a possibility of a new form of money which is Non-Bank Stablecoin but it is essential to ensure that it has qualities of money i.e. provided it is fully secured and backed.

Specifically, Digital Currency will provide Programmability, Composability, Instantaneous settlement that current system lacks. The following key design features is critical as the exploration continues:

1. Singleness of money is key and must hold in digital currency.
2. Open participation and payment rails.
3. Interoperability rules/ protocol setup up front to maximise benefits.
4. Security is critical as new infrastructure and design feature may bring about new sets of risk.

For a better understanding of MAS' broader philosophy of digital currency, CBDCs, programmable money and how that integrates with existing fintech landscape, kindly refer to the [landmark speech by MAS MD Ravi Menon](#) at the Singapore Fintech Festival, Nov 2022.

SOUTH KOREA



Central Bank
Bank of Korea (BOK)



Current Focus
On-going POC Experiments on Various CBDC Use Cases

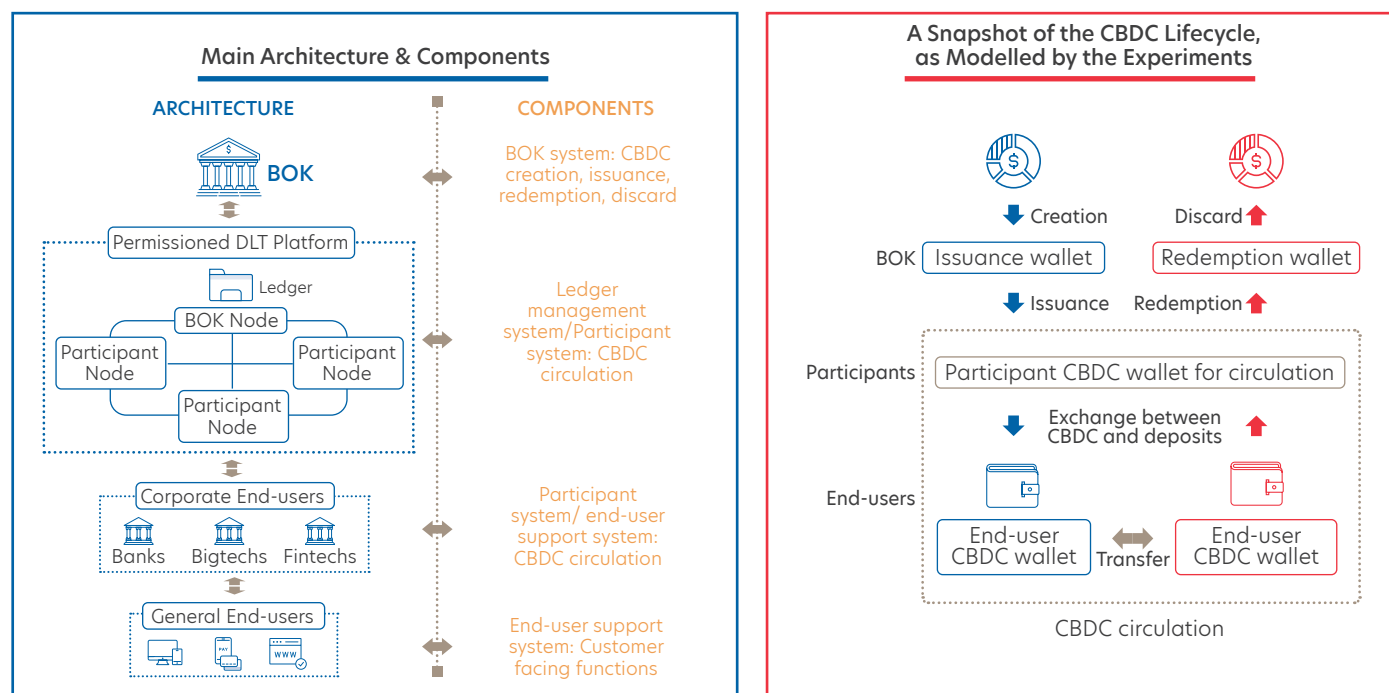
Summary

BOK launched a dedicated CBDC unit in early 2020 that researched on CBDC-related systems and run a proof of concept (POC) test on feasibility of distributed ledger technology (DLT) to serve as the technological foundation of CBDC. In Nov 2022, Bank of Korea (BOK) issued the findings of its two phases of Proof of Concept (PoC) experiments with CBDC. BOK will continue to collaborate closely with local banks and industry to experiment with various use cases for CBDC.

Details of PoC Experiments

From Aug 2021 to Jun 2022, the Bank of Korea (BOK) built its CBDC test system on a hybrid model featuring a two-tier structure where the BOK manages the CBDC lifecycle while participant nodes support CBDC circulation and provide end user services as part of a series of proof-of-concept (PoC) experiments. The primary goal of testing the technical feasibility of a CBDC on a DLT based platform. Specially, the PoC experiments guided by two key objectives. First is to validate technical and institutional design features of a CBDC in a simulated virtual space. Second is to test the feasibility and reliability of DLT in supporting baseline functions ranging from CBDC lifecycle management up to P2P, offline, and cross-border payments.

BOK'S CBDC TEST SYSTEM - ARCHITECTURE & MAIN COMPONENTS



Source: BOK, UOB Global Economics & Markets Research

Phase 1 experiments were conducted from Aug 2021 to Dec 2021 and were mainly dedicated to testing the operational feasibility of CBDC lifecycle management and of P2P transfer. Phase 2 experiments were undertaken from December 2021 to June 2022 and focused mainly on testing additional CBDC functions in the context of exploring potential use cases, as well as assessing performance enhancement measures and end user anonymity enhancement measures on the DLT platform.

Phase 2 experiments focused on various potential use cases. These included:

- offline payments testing end CBDC user apps using Near Field Communication (NFC) technology,
- digital asset transaction between a CBDC and a digital asset token, specifically using CBDC to buy a NFT
- cross border payment between KRW CBDC and a USD intermediary,
- testing the scalability, performance capacity, speed of DLT platforms
- testing of Zero Knowledge Proof (ZKP) concept to reinforce the anonymity of CBDC payments without the need to reveal the identify of the end user.

While “the two rounds of POC experiments suggest that circulating CBDC on a permissioned DLT platform is technically feasible with a reasonable degree of stability and reliability”, it also revealed inherent limitations of scalability on distributed ledger, operational concerns relating to number of nodes and the volume of end users’ simultaneous access to payment services and suggested that additional research and development required in anonymity enhancement measures.

[BOK - Central Bank Digital Currency](#)

[Cooperation For Offline CBDC](#)

[Korea CBDC Research to Include 10+ Banks](#)

[The Bank of Korea's CBDC Research: Current Status and Key Considerations](#)

Key Takeaway

While detailing the studies from the POC Experiments, the BOK issued a clear disclaimer highlighting that it has not yet decided “whether or not to issue a central bank digital currency (CBDC) nor selected any specific model or design features”.

Going forward, the BOK noted that the central bank “has been undertaking extended POC experiments in partnership with major commercial banks since the conclusion of the phase 2 experiments in June 2022.” Local news reports suggest that the BOK has started to collaborate with as many as 14 domestic South Korean banks for extended “real world” PoC experiments. Local news also reported that BOK has signed MoU with Samsung Electronics to experiment with “offline CBDC model” using NFC technology.

The BOK added that it is “considering furthering its CBDC research with a view to exploring more use cases and collecting additional technical information about CBDC circulation in a new test environment”.



Summary

In Aug 2022, the Bank of Thailand (BOT) has most recently expanded its scope of Retail CBDC development “to a pilot phase in which real-life application of Retail CBDC will be conducted in cooperation with the private sector within a limited scale.”

Details of Retail CBDC Pilot

This latest Retail CBDC pilot consists of two tracks. First track is a Foundation Track, whereby the pilot tests the efficiency and safety of Retail CBDC for use in cash like activities “such as paying for goods and services, within limited areas and scale of approximately 10,000 retail users”. Second track is an Innovation Track whereby BOT tests the programmability of CBDCs for innovative use cases for future financial services.

Since early 2021, BOT successfully completed a POC for a retail CBDC prototype using private-permissioned network whereby CBDC was issued using ERC-20 smart contract which is popular fungible token standard in digital asset issuance and transfer. This prototype sets the foundation for the current retail pilot.

The retail CBDC pilot also sees a dedicated mobile application built to enable participants to use the CBDC according to the specified conditions. The mobile application covers features such as registration, top up CBDC, transferring or paying for goods and services at participating stores, within a specified period and push notifications.

[Progress of Retail CBDC Development Pilot CBDC](#)

Past Studies

1

Project Inthanon – Lionrock Sep 2019

BOT teams up with Hong Kong Monetary Authority (HKMA) by expanding Project Inthanon to explore the use of Distributed Ledger Technology (DLT) to increase efficiency in cross-border funds transfers. The cross border CBDC project studied a THB-HKD corridor bridge linking the local DLT networks of Inthanon and Lionrock. [More details](#)

2

m-CBDC Bridge Project Feb 2021

BOT teams up Hong Kong Monetary Authority (HKMA), Central Bank of the United Arab Emirates (CBUAE) and People's Bank of China (PBoC) on a cross border project called the m-CBDC Bridge Project to “further explore the capabilities of distributed ledger technology (DLT) through developing a proof-of-concept (PoC) prototype, to facilitate real-time cross-border foreign exchange payment-versus-payment transactions in a multi-jurisdictional context and on a 24/7 basis.” [More details](#)

Key Takeaway

The BOT has highlighted that the Retail CBDC pilot is to study the suitability and design of the technology and that “At present, the BOT does not have plans to issue Retail CBDC as the issuance requires thorough consideration of benefits and associated risks for the financial system”.

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