VI. The Bank's Approach to General Purpose CBDC

A. Introduction

In recent years, many countries have been exploring the introduction of a retail, or general purpose, central bank digital currency (CBDC). This trend has also been spreading among advanced countries, particularly since the announcement of the so-called global stablecoin initiatives. In January 2020, a group of central banks, including the Bank of Japan and the Bank for International Settlements (BIS) was formed to explore CBDCs. Since then, the group has been a driving force in deepening international coordination among the central banks.[1]

In October 2020, the Bank published "The Bank of Japan's Approach to Central Bank Digital Currency,"[2] in which it described its basic approach to general purpose CBDC -- CBDC intended for a wide range of end users, including individuals and firms -- as follows.

- There is a possibility of a surge in public demand for CBDC going forward, considering the rapid developments in technological innovation with digitalization advancing in various areas at home and abroad.
- While the Bank of Japan currently has no plan to issue a CBDC, from the viewpoint of ensuring the stability and efficiency of the overall payment and settlement systems, the Bank considers it important to make thorough preparations to respond to changes in circumstances in an appropriate manner.
- The Bank will carry out experiments while proceeding with its exploration of institutional arrangements, coordinating with stakeholders at home and abroad.
- Even if the Bank were to issue a general purpose CBDC, it would still be appropriate

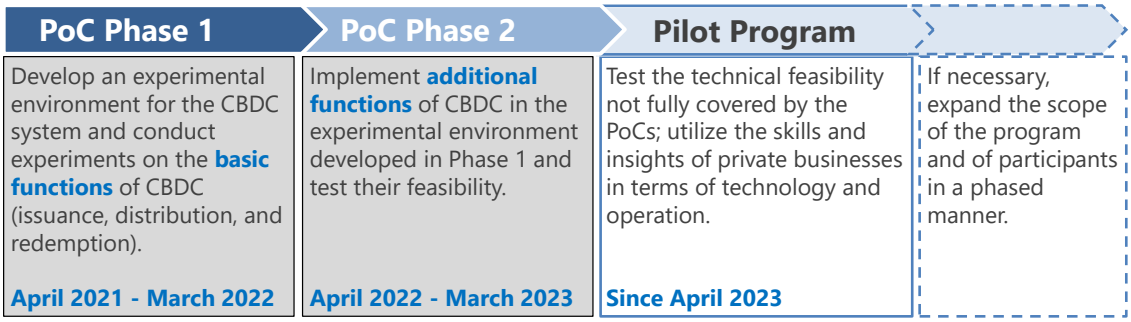
[1] A central bank group to assess potential cases for central bank digital currencies (Bank of Canada, Bank of England, Bank of Japan, European Central Bank, Sveriges Riksbank, Swiss National Bank, Federal Reserve, and BIS). As an example of explorations by the group, see "Central Bank Digital Currencies: Foundational Principles and Core Features" (October 2020).
[2] For details, see Bank of Japan, "The Bank of Japan's Approach to Central Bank Digital Currency" (October 2020).

to maintain a two-tiered system of a central bank and the private sector.

- As long as there is public demand for cash, the Bank will stay committed to supplying it.

The Bank has been proceeding with its experiments based on this approach (Figure 40).

Figure 40. Overview of the Bank's experiments



The Bank has examined whether the basic functions and features of a CBDC are technically feasible through Proof of Concept[3] (PoC) Phase 1 and PoC Phase 2, and has been proceeding with a pilot program since April 2023.

The Liaison and Coordination Committee on Central Bank Digital Currency (Liaison Committee) was established in March 2021, bringing together members from the private sector, the government, and the Bank, to share information on such topics as progress in the experiments and to deliberate on future plans. The "Liaison and Coordination Committee on Central Bank Digital Currency 'Interim Report'"[4] was released in May 2022, laying out points including the following.

- It is helpful to divide the CBDC system into two areas: the infrastructure part as a

[3] Although PoCs can be interpreted in various ways depending on the context, they generally refer to examination processes through which the technical feasibility of new products and services is evaluated. A PoC usually involves developing experimental systems based on assumptions about the main functions and performance of new products and services. PoCs are expected to improve the accuracy of these examinations compared with desktop experimentation alone.

[4] For details, see Bank of Japan, "Liaison and Coordination Committee on Central Bank Digital Currency 'Interim Report'" (May 2022).

foundational payment instrument and the overlay services part, which meets user needs on top of the infrastructure part (vertical coexistence).

- It is necessary to aim to achieve horizontal coexistence; i.e., CBDC and other types of payment instruments (cash, bank deposits, private digital money, etc.) should properly fulfill their functions and roles and thereby coexist with each other. To realize such horizontal coexistence, it is important to ensure interoperability between CBDC and other types of payment instruments.

- It is necessary to achieve privacy protection in the infrastructure part providing the foundational payment instrument. How the private sector can effectively utilize user information in overlay services will also be an issue to be considered.

B. Progress on the Experiments

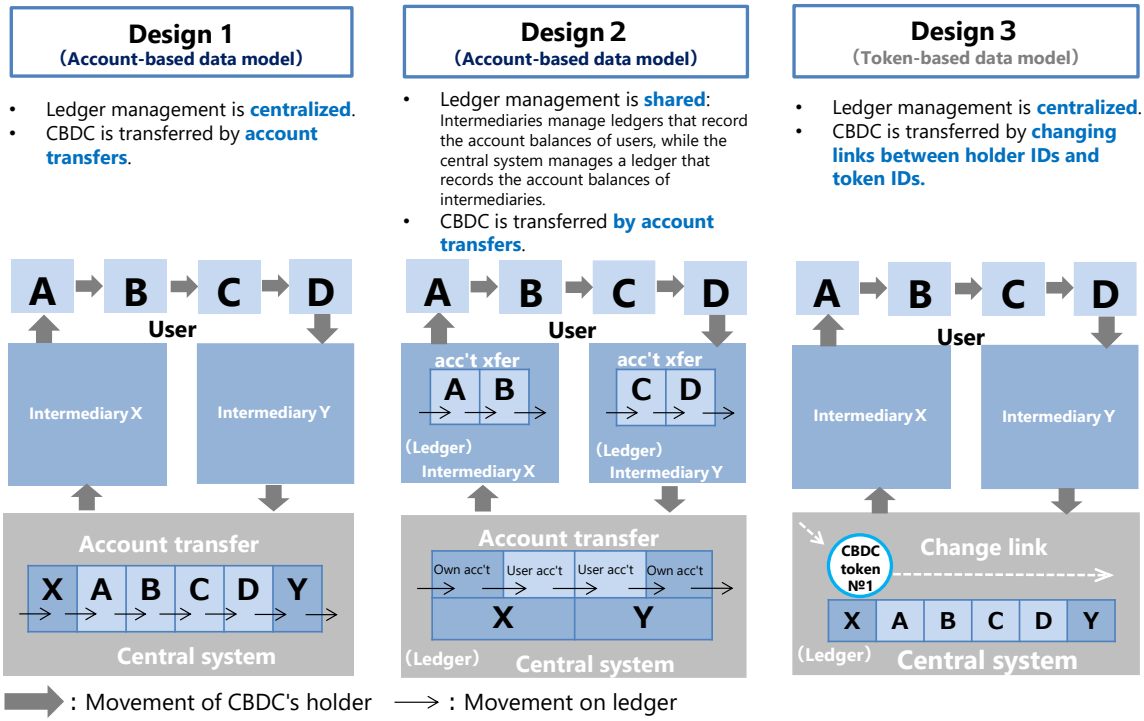
1. Proof of Concepts[5]

In PoC Phase 1, the Bank constructed three design alternatives for CBDC ledgers as the foundation of a CBDC system to evaluate whether the basic transactions related to a CBDC (issuance, payout, transfer, acceptance, and redemption) could be processed appropriately, and compared and evaluated the designs (Figure 41). The results showed that while the designs were technically feasible, challenges remained, suggesting the need to explore these further while considering various possibilities.

In PoC Phase 2, the Bank explored the processing performance and technical feasibility of additional functions (such as scheduled transfer and batch transfer) for which it would be desirable to confirm technical issues as early as possible by incorporating the functions into the experimental system built in Phase 1.

[5] For the results of the PoCs, see the following references: Payment and Settlement Systems Department, Bank of Japan, "Central Bank Digital Currency Experiments: Results and Findings from 'Proof of Concept Phase 1'" (May 2022). Payment and Settlement Systems Department, Bank of Japan, "Central Bank Digital Currency Experiments: Results and Findings from 'Proof of Concept Phase 2'" (May 2023).

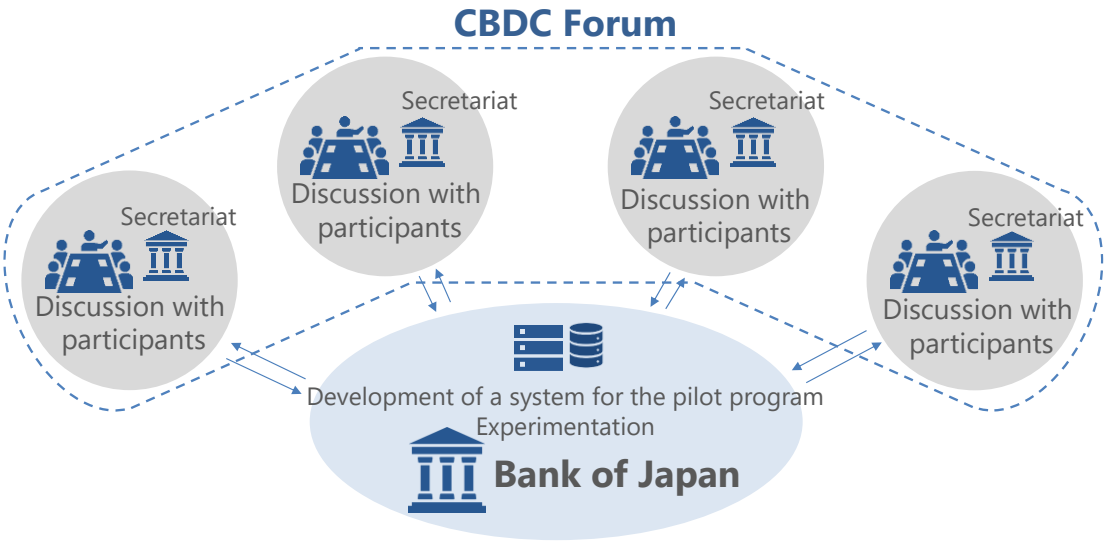
Figure 41. Ledger designs in PoC Phase1



2. Pilot program

The objectives of the pilot program are to conduct technical evaluation not fully explored in the PoCs while leveraging the skills and insights of private businesses. The pilot program revolves around two pillars: "development of a system for the pilot program and experimentation" and the "CBDC Forum." In the former, performance tests are conducted on the system developed by the Bank. In the latter, the Bank conducts discussions on a wide range of themes with private businesses related to retail payments. The findings gained through the two pillars are expected to be fed into the work of each other as necessary (Figure 42).

Figure 42. Overview of the pilot program

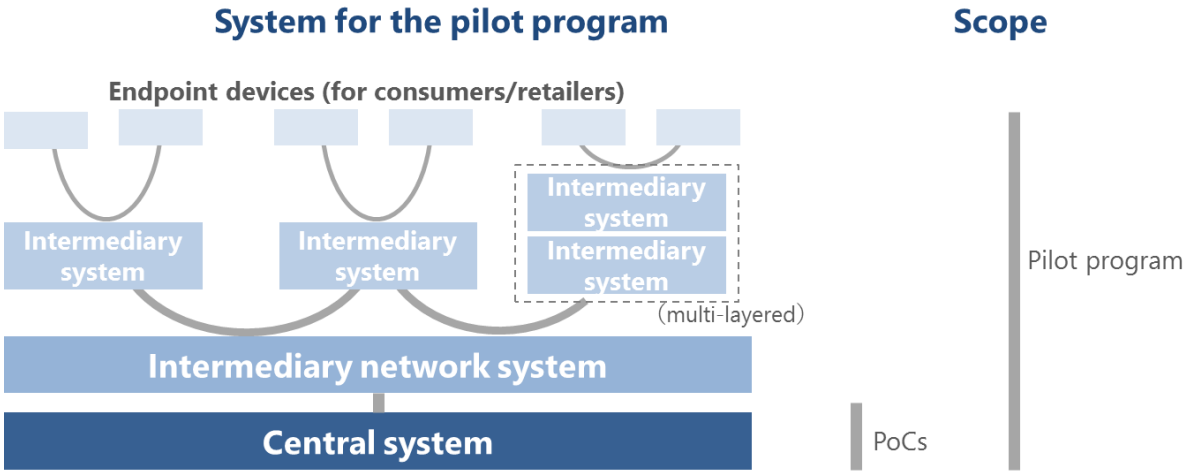


Overview and development status of a system for the pilot program

The pilot program is broader in scope than the PoCs. While the PoCs focused mainly on the ledger in the central system, the pilot program has an end-to-end coverage ranging from endpoint devices (apps for smartphones and tablets) to the central system (Figure 43).

Against this background, the system for the pilot program goes beyond the development of the central system to include that of intermediary systems, the intermediary network system connecting the central system with the intermediary systems, and endpoint devices. We will eventually test the end-to-end process flow while exploring potential challenges related to connections with external systems and measures to address them.

Figure 43. System for the pilot program and its scope



The system currently under development adopts the CBDC ledger design of an account-based data model with shared management between the central system and the intermediary systems.[6] For clarification, this does not imply that the Bank has already decided on the ledger design suitable for potential social implementation. Rather, the idea is that this ledger design has a relatively complex system configuration and is thus expected to allow for further examination of various issues. Other ledger designs will also be explored during the desktop experimentation as we take into account the findings of the experimentation using the system.

In consideration of privacy, we plan to separate the intermediary systems handling customers' user and transaction data (customer management component) from those processing payment (CBDC ledger component).[7]

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[6] This ledger design corresponds to Design 2 in the PoCs.

[7] Other central banks in developed countries have similar considerations for privacy. For example, the European Central Bank (ECB) has presented in "Digital euro market research" (January 2023) a preliminary requirement that "[t]he Eurosystem will not itself be able to monitor the holdings of any individual or track the transaction history or infer payment patterns of any user." Similarly, the Bank of England (BOE) proposed at the time of joint

With regard to performance, we aim to build a system that can handle higher load processes than the PoCs. In doing so, we will identify and evaluate technical issues and solutions in order to satisfy performance requirements in the possible event of social implementation. Furthermore, during the system design phase we plan to incorporate features that support functional and performance scalability, which may lead to the identification and evaluation of technical issues and solutions.

Overview of and recent developments in the experimentation

Once the system has been developed, relevant experimentation including performance tests will be carried out using the system. In parallel with the system development and relevant experimentation, we will perform desktop experimentation on functional and non-functional aspects of a CBDC system, such as system configuration and security measures.

Themes for desktop experimentation on functionality include (i) various functions that are not implemented in the system, (ii) interoperability with external systems, (iii) external connection interfaces, (iv) adoptability of potential offline payments, and (v) privacy enhancing technologies. Examples of non-functional themes cover system configuration aspects, such as measures to minimize system downtime as well as functional and performance scalability, and some facets of security measures.

CBDC Forum[8]

The CBDC Forum consists of members from a wide range of industries. They are financial firms and non-financial firms, including start-ups, which have insights into technologies and business practices of retail payments (64 participating firms as of

consultation with HM Treasury in February 2023 that "[a]ny information accessed by the Bank would have to be effectively anonymised off-ledger."

[8] Materials and minutes for each WG are available in Japanese (https://www.boj.or.jp/paym/digital/d_forum/index.htm).

March 2024). The Payment and Settlement Systems Department of the Bank acts as the secretariat, forming and organizing thematic working groups (WGs). The status of the discussions held in each of the six WGs (Figure 44), which are currently ongoing, is as follows.

Figure 44. Discussion themes for each WG

WG		Theme
[WG1] Sept. 2023 to June 2024	Connection between CBDC system and fundamental external systems	• Connection with core banking systems • Connection with private payment and settlement infrastructure • Coordination with internet banking apps
[WG2] since Sept. 2023	Overlay services and CBDC ecosystem	• Business utilization of CBDC (overlay services) • External coordination of a CBDC system regarding overlay services • Design of CBDC ecosystem
[WG3] since Oct. 2023	KYC and user authentication/authorization	• Current practices of KYC and AML/CFT checks • Authentication/authorization
[WG4] since Jan. 2024	New technologies and CBDC	• Back-end layer (e.g. alternative data models) • Front-end layer (e.g. "wallets") • Coexistence with other types of payment methods and assets (stablecoins, asset tokenization, interoperability with DLT platforms, etc.)
[WG5] since Mar. 2024	User devices and UI/UX	• UI/UX and accessibility • Endpoint devices • Offline payments
[WG6] since July 2024	Horizontal coexistence of CBDC and other payment instruments	• Smooth conversion to and from electronic money and other forms of money
[WG7] Sept. 2024 onward (tentative)	Operational flow of basic functions	• Operational flow of basic functions • Conversion between cash and CBDC

WG1 has gained insights into the technical and operational aspects of connection methods between a CBDC system and fundamental external systems, such as core banking systems, after exploring connections between existing external systems and core banking systems along with their operational flow. The WG has also discussed non-functional aspects such as performance and scalability.

WG2 has discussed the concept of a CBDC ecosystem and surveyed precedents in the payment landscape. The WG has also discussed specific technologies that support the development of the ecosystem, such as application programming interfaces (APIs). Going forward, the WG will continue to explore the potential of overlay services and the features of CBDC as "an enabler for services." The WG will also discuss whether opportunities of leveraging new technologies and building new systems can bring greater convenience and scalability while continuing to ensure stability and safety.

WG3 has aimed to grasp an understanding of Know Your Customer (KYC), AML/CFT (anti-money laundering and combating the financing of terrorism), and user authentication/authorization processes in existing payment services as well as the operational challenges they face in this regard, and to gain technical and procedural insight into KYC and authentication/authorization for a potential CBDC system while introducing the latest technical developments and trends.

WG4 has focused on and discussed new technologies possibly relating to CBDC with the aim of considering a CBDC system inspired by them. Specifically, as is the case with other WGs, the scope of the discussions covers the CBDC system itself (back-end and front-end layers)[9] as well as the coexistence of CBDC with other types of payment methods and assets. The WG has explored new technologies, including ones that have significant limitations in their use at present but could possibly be utilized in the future.

WG5 has explored universal access and UI/UX in the context of CBDC, while deepening its understanding of the flow of messages from user devices to intermediary systems.

[9] For discussion purposes, the CBDC system is divided into back-end and front-end layers: the back-end layer covers technologies such as ledger systems, which have no user touchpoints, while the front-end layer covers technologies such as wallets, which do have user touchpoints.

WG6 has considered the coexistence of CBDC and private digital money or other payment instruments (e.g., money issued by fund transfer service providers, prepaid payment instruments) as well as their interoperability.

C. Next Steps

Whether to issue a general purpose CBDC in Japan should be decided by discussions among the public, taking into account various changes in the environment both at home and abroad. The Bank will continue to thoroughly explore CBDC with a view to providing a basis for such discussions.