



Central Bank Digital Currency Experiments

Progress Report on the Pilot Program (June 2026)

Payment and Settlement Systems Department, Bank of Japan

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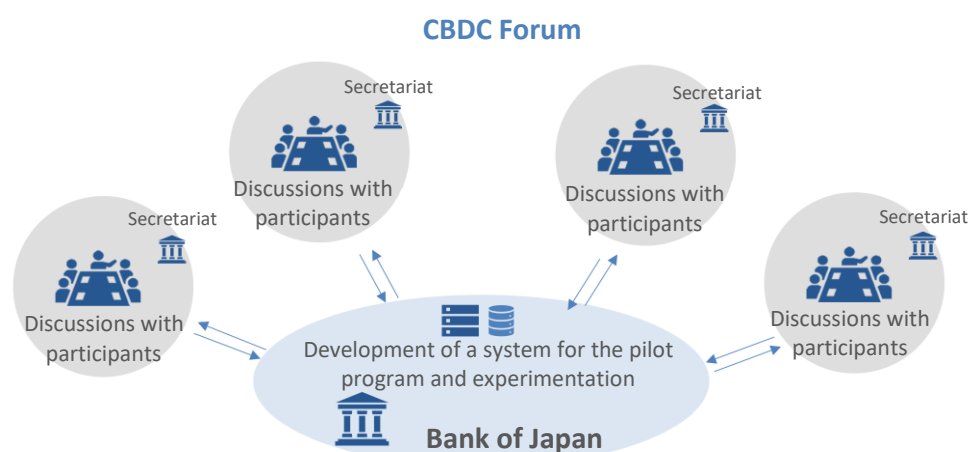
1. Introduction

Based on "The Bank of Japan's Approach to Central Bank Digital Currency," which was released in October 2020, the Bank of Japan conducted proofs of concept (PoCs) from April 2021 to March 2023, and has examined whether the basic functions and features of a central bank digital currency (CBDC) are technically feasible.¹

Since April 2023, the Bank has moved forward with a pilot program that has the aim of conducting technical evaluations not explored in the PoCs while leveraging the skills and insights of private businesses. The pilot program consists of two pillars: "development of a system for the pilot program and experimentation" and "the CBDC Forum" (Figure 1). In the former, performance tests are conducted on the system developed by the Bank, and various types of desktop analysis are also carried out on functions not implemented in the system. In the latter, the Bank serves as the secretariat and conducts practical discussions on a wide range of themes with private businesses related to retail payments. The findings gained through each pillar are shared with the other pillar, as necessary.

This report on the pilot program to date has been compiled by the Payment and Settlement Systems Department of the Bank. It should be noted in advance that the design and other considerations described herein represent the current stage of the pilot program and not the finalized design for social implementation.

Figure 1. Overview of the pilot program



¹ 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)
<https://www.boj.or.jp/en/paym/digital/rel220526a.pdf>

Payment and Settlement Systems Department, Bank of Japan, "Central Bank Digital Currency Experiments: Results and Findings from 'Proof of Concept Phase 2'" (May 2023)
<https://www.boj.or.jp/en/paym/digital/dig230529a.pdf>

2. Development of a system for the pilot program and experimentation

The pillar "development of a system for the pilot program and experimentation" aimed to: (i) develop an experimental system that implements components ranging from the central system to the intermediary network, intermediary (customer management and ledger management) systems, and endpoint devices in an integrated manner; (ii) verify its end-to-end process flow; and (iii) examine issues and countermeasures regarding connection with external systems.² The following sections outline the progress since the previous report was published in May 2025³ (hereinafter referred to as the "2025 Progress Report"). Specifically, as the 2025 Progress Report indicated that the results of the performance verification using the system would be reported at a later date, those results are described in section 2.1. In addition, with the 2025 Progress Report indicating that desktop analysis would be conducted on topics such as interoperability, availability, and security, those details are provided in section 2.2 of this report. Further details are provided in the "Central Bank Digital Currency Experiments: Progress Report on the Pilot Program (June 2026): Development of a System for the Pilot Program and Experimentation (Supplement)," which is available in Japanese.

2.1 Results of experimentation using the system

Given the general acceptability of CBDC, performance requirements for the CBDC system in the event of social implementation are expected to be considerably demanding. On the other hand, since the system for the pilot program has been built on a smaller scale than full-blown social implementation, we evaluated the results of performance tests of the system for the pilot program (single-account concentration test and mixed workload test), and subsequently examined the implications on the system's performance design for meeting the performance requirements when implementing CBDC in society.

2.1.1 Performance testing

Single-account concentration test

Upon the social implementation of CBDC, a large volume of transaction processing is expected to concentrate on a single account (hereinafter referred to as "single-account

² Payment and Settlement Systems Department, Bank of Japan, "Commencement of Central Bank Digital Currency Experiments: Pilot Program" February 2023
<https://www.boj.or.jp/en/paym/digital/dig230217b.pdf>

³ Payment and Settlement Systems Department, Bank of Japan, "Central Bank Digital Currency Experiments: Progress on the Pilot Program (May 2025)"
<https://www.boj.or.jp/en/paym/digital/dig250718a.pdf>

The report outlines the design characteristics of the system for the pilot program and explains the end-to-end process flow.

concentration"). Examples of this phenomenon include a large volume of transactions hitting an intermediary's own account at the central system when performing CBDC payouts/acceptances for users, or massive transaction spikes targeting a specific store's CBDC account when numerous users make payments simultaneously at that store. If single-account concentration occurs without specific measures in place, the records of the relevant account on the database, such as the account balance, will need to be sequentially updated under exclusive control (record locking), which may result in an inability to achieve sufficient throughput. As a countermeasure to this phenomenon, the system for the pilot program implemented a mechanism to limit the scope of the locked records even when processing concentrates on a single account (record splitting),⁴ thereby improving parallel processing performance. To assess the effectiveness and limitations (side effects) of this mechanism and the implications for social implementation, we then conducted a single-account concentration test.

The results of the test showed that the processing capacity of the system for the pilot program, which would be limited to approximately 50 to 100 TPS⁵ per account without specific measures in place, can be increased to 6,000 TPS per account, by properly splitting the records of the accounts. Conversely, it is confirmed that there exists a drawback whereby excessive record splitting reduces processing performance. Consequently, for social implementation, it will be critical to ascertain the appropriate number of record splits during the system design phase, as well as consider incorporating a mechanism that allows the number of record splits to be flexibly adjusted according to changes in transaction volumes.

Mixed workload test

Upon the social implementation of CBDC, it is anticipated that the CBDC system database will concurrently experience both "update transactions" for account balance updates associated with payments and "balance inquiry transactions" for account balance inquiries. To evaluate the performance requirements of the CBDC system with greater precision, conducting performance tests under assumptions that closely reflect an actual operational environment is deemed appropriate. We therefore conducted a mixed workload test combining update transactions and balance inquiry transactions.

The test confirmed that the system for the pilot program was capable of processing a total load of 50,000 TPS, combining 10,000 TPS of update transactions and 40,000 TPS of balance inquiry transactions. However, the experimental process revealed the need to

⁴ A mechanism that splits the balance of the accounts owned by users and customer management intermediaries into multiple records on the database to allow parallel processing of credits and debits concurrently using each of the split records. For details, please refer to section 2.1.3 Consideration of performance (measures to enhance parallel processing) in the 2025 Progress Report.

⁵ An abbreviation for "Transactions Per Second."

address significant latency increases associated with processing spikes.⁶ Based on this experience, it is considered crucial for the execution of smooth high load processing to thoroughly understand the performance, characteristics, and limitations of the database product being used, and to carry out appropriate system configuration planning (including sizing), database tuning, and performance testing.

2.1.2 Implications on performance design for social implementation

These tests enabled consideration of the implications on the performance design of the CBDC system, assuming significantly high transaction volumes at the time of social implementation (tentatively assuming a total of 500,000 TPS, combining 100,000 TPS of update transactions and 400,000 TPS of balance inquiry transactions).

Specifically, the tests using the system for the pilot program confirmed: (i) the importance of controlling the number of incoming requests per unit time to the request intake points (such as front-end servers) of the customer management system and ledger management system to handle processing spikes, and (ii) the need to be resourceful in improving the implementation method of the cumulative limitation check,⁷ as conducting the check may increase the system load. Furthermore, the desktop analysis based on the results of the single-account concentration test (iii) verified computationally that splitting each account into 600 records allows for a processing speed of 18,500 TPS. Finally, the desktop analysis (iv) confirmed that, at the time of social implementation, processing of significantly high transaction volumes will likely be achievable through the scale-out of AP servers⁸ and DB servers,⁹ as well as the scale-out and scale-up of network and communication lines.

Based on the scope of the experiments to date, no technical knockout factor (fatal and insoluble factor) was identified for the expansion of processing capability to handle the significantly high transaction volume expected upon social implementation.

However, given that the server and network resource consumption was fairly large despite the system for the pilot program being simplified, careful attention must be paid to system resources. Specifically, a massive amount of server and network resources may

⁶ This refers to a temporary sharp increase in processing.

⁷ The system for the pilot program implements features for cumulative transaction amount limits and cumulative transaction count limits (on a monthly and daily basis) per account. Note, however, that whether such limits are necessary in the institutional design remains undecided.

⁸ An abbreviation for "Application Server," representing the server where business applications run to control the business logics.

⁹ An abbreviation for "Database Server," representing the server that accepts requests and runs the database used to store and manage data.

be required for social implementation due to various functional and non-functional requirements (e.g., increases in transaction volumes, processing overheads associated with additional error handling and message complexity, redundant configurations to enhance availability, and the preparation of testing and developing environments in addition to a production environment). Toward social implementation, therefore, it is important to consider ways to utilize system resources efficiently. For example, potential measures include increasing the processing capacity per server by streamlining the process flow to handle transaction volume with fewer servers, and reducing required network resources.

Based on the above, when aiming for social implementation, it will be important to design the overall system architecture, taking into account various functional and non-functional requirements and to perform appropriate sizing, while remaining mindful of the efficiency of server and network resources.

2.2 Results of desktop analysis

In the desktop analysis, challenges and countermeasures for social implementation were examined from both functional and non-functional perspectives, focusing primarily on functions not implemented in the system for the pilot program (Figure 2).

The 2025 Progress Report explained the main themes of the desktop analysis, categorized by envisioned CBDC usage scenarios (upper half of Figure 3). Keeping these envisioned CBDC usage scenarios in mind, this section outlines various functions and use cases related to credit transfers, a review of the process flow for credit transfer, endpoint devices, interoperability, security, and availability (lower half of Figure 3), focusing on details not covered in the 2025 Progress Report.

Figure 2. Overview of desktop analysis

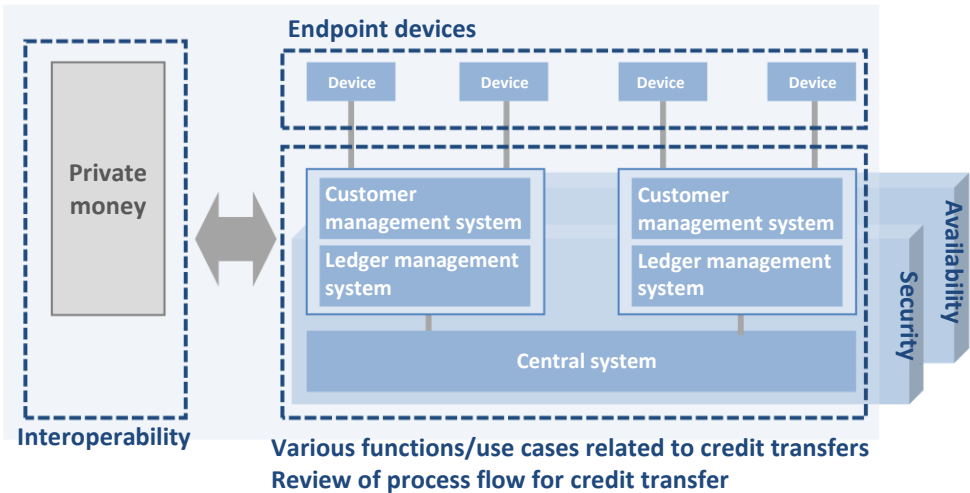
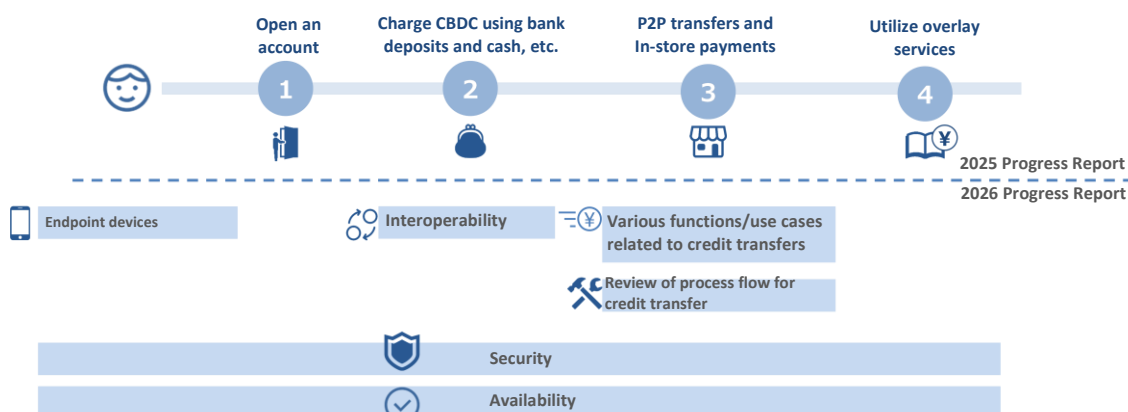


Figure 3. Contents of desktop analysis categorized by envisioned CBDC usage scenarios



2.2.1 Various functions and use cases related to credit transfers

The 2025 Progress Report cited person-to-person (P2P) transfers and in-store payments as basic CBDC use cases and explained their process flows for credit transfer. As we move toward the social implementation of CBDC, it is necessary to gain a clearer picture of the process flows for credit transfers, including the various use cases and functions required. This section organizes various functions and use cases related to credit transfers.

Destination information management

For the management of destination information,¹⁰ which is one of the pieces of information required to execute a credit transfer, we examined the following: (i) alias function (function to easily identify payees using phone numbers or other information), (ii) account ID tokenization function¹¹ (function that conceals a user's account ID from the counterparty of credit transfers), and (iii) destination confirmation function (function that automatically searches for the customer management intermediary ID¹² from the account ID upon a credit transfer). In particular, (ii) the tokenization function is considered to be one of the key elements when designing with privacy in mind (privacy by design). Since the implementation methods for (i) alias function, (ii) tokenization function, and (iii) destination confirmation function vary depending on whether account portability¹³ is

¹⁰ Information that is required to uniquely identify the payee's customer management intermediary and the payer's CBDC account.

¹¹ This refers to the ID that uniquely identifies the CBDC account.

¹² This refers to the ID that uniquely identifies the customer management intermediary.

¹³ This refers to an arrangement that allows users who wish to switch their customer management intermediary to transfer their CBDC account to another customer management intermediary while maintaining their account ID unchanged. Thus, even if the intermediary changes, the account ID before and after the switch remains unchanged.

taken into consideration, it is important to evaluate the implementation methods based on characteristics and features of each approach upon social implementation.

Reverse transaction processing

Regarding reverse transaction processing in cases of in-store payment refunds, from the perspective of privacy protection, a mechanism may be necessary to link the initial transaction to the reverse transaction based on the transaction ID¹⁴ (instead of the user's account ID) or to tokenize the account ID.

EC payments (e-commerce)

Non-face-to-face transactions using CBDC, such as EC payments, can be implemented in several ways, as with existing non-face-to-face payment methods. In this regard, for example, if the design allows a purchase on an EC site to be completed solely with account ID information, the impact of an account ID leak would be critical, potentially leading to losses from fraudulent use. It is therefore important to avoid such a design. Given the characteristics of CBDC as a real-time payment instrument, where funds reach the payee's account immediately once a credit transfer is executed, key discussion points may include the introduction of mechanisms for transaction authentication¹⁵ and additional user authentication, as well as non-technological risk mitigation measures (e.g., limits on CBDC transaction amounts). Furthermore, depending on the process flow of non-face-to-face transactions such as EC payments, the functions required for each customer management system would differ, which could be another point of discussion when considering the implementation methods.

2.2.2 Review of process flow for credit transfers

The 2025 Progress Report organized basic process flows such as P2P transfers and person-to-business (P2B) transfers. Upon the social implementation of CBDC, various errors are expected to occur during credit transfer processing, such as network failures. Therefore, in order to execute CBDC payments, it will be critical to proceed with the process flow for credit transfers while conducting appropriate handling of these errors. This section organizes the functions required to address such errors and the process flows utilizing these functions.

¹⁴ This refers to the ID that uniquely identifies the transaction in the CBDC system.

¹⁵ This refers to the process whereby the customer management intermediary of the payer (individual) confirms that the transaction information of "who paid how much to whom" is based on the intent of the payer (individual). Furthermore, the discussion here is conducted under the premise that proper user authentication has been executed when the payer (individual) logs into the wallet app.

Organization of timeout management function and hold function

First, the functions required for social implementation include the timeout management function and the hold function. The timeout management function treats a transaction as a timeout error and cancels the credit transfer process when a set time limit is exceeded. The hold function temporarily places the funds in a hold state (temporarily setting aside the funds so they cannot be used for other credit transfers) during credit transfer transaction processes and, if an error occurs, reverts the hold state to restore the pre-error state (i.e., returns to the state prior to the credit transfer). Appropriate combination of these two functions may enable the construction of a process flow that executes CBDC payments while ensuring consistency among ledgers even when errors occur during the credit transfer process. While holding funds until the error is resolved is considered beneficial from the perspective of ensuring consistency among ledgers, from the user's perspective, this signifies a continuation of the situation where the process remains incomplete. It is thus necessary to design the screen display of endpoint devices in a way that enables users to gain an appropriate grasp of the processing status of credit transfers.

Alternative process flows for credit transfer

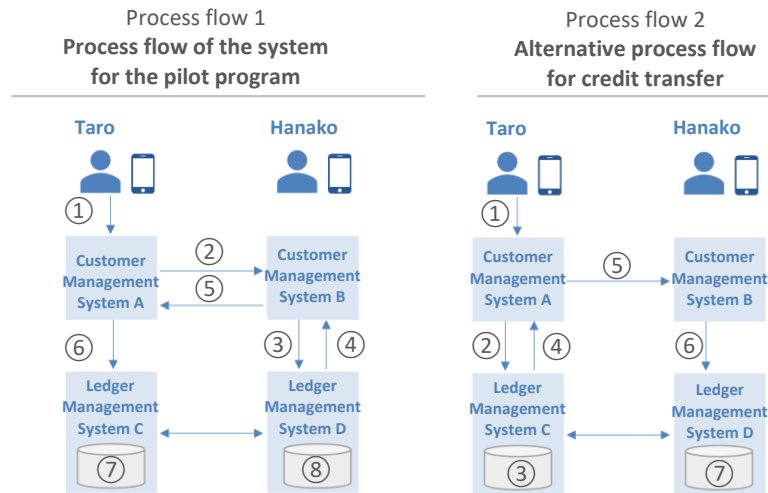
Out of concern for making the process flows for credit transfer implemented in the system for the pilot program¹⁶ more efficient, we examined the possibility of an alternative flow, referencing examples in FPSs¹⁷ operated by other central banks. That is, while the system for the pilot program processes a credit transfer by first executing processing in the customer management systems of both the payer and payee of the CBDC (A, B), followed by their respective ledger management systems (C, D), we examined an alternative flow in which processing is executed first in the CBDC payer's customer management system (A) and ledger system (C), followed by the payee's customer management system (B) and ledger system (D).¹⁸

¹⁶ See the process flow for credit transfer organized in the 2025 Progress Report.

¹⁷ An abbreviation for "Fast Payment System," referring to a system that enables credit transfers between bank accounts 24 hours a day, 365 days a year, and allows the receiver of the funds to use them immediately.

¹⁸ For the actual examination, we compared the process flow for the system for the pilot program (Figure 4, Process flow 1) with an alternative flow (Figure 4, Process flow 2), assuming that the timeout management function and the hold function (credit hold) are implemented, although these functions are not actually implemented in the system for the pilot program.

Figure 4. Alternative process flow for credit transfer



It can be said that the process flow of the system for the pilot program prioritizes completion of transaction limit checks in the customer management systems, whereas the alternative process flow prioritizes the prior securing of funds necessary for the credit transfer. Furthermore, the former may, relatively speaking, simplify error handling after debit entry on the CBDC ledger to place funds in a hold status has been processed, whereas the latter may be more efficient with a relatively smaller number of communication rounds.

Upon the social implementation of CBDC, it is essential to determine the process flow for credit transfer by sufficiently understanding such characteristics and differences and identifying the requirements that should be prioritized.

2.2.3 Endpoint devices

The 2025 Progress Report cites P2P transfers and in-store payments as the basic use cases of CBDC, and envisioned devices for using CBDC (endpoint devices) to be smartphones or card-type devices for individuals, and some form of payment terminals (hereinafter referred to as "in-store payment terminals") for stores. Toward the social implementation of CBDC, it is important to examine CBDC endpoint devices while taking into account core features required for CBDC, such as universal access (allowing use by anyone) and security (ensuring usage safety). This section outlines these discussion points.

First, from the perspectives of universal access and security, we outlined the elements required for endpoint devices, envisioning a scenario where an individual makes an in-store payment. Smartphones are considered strong candidates as CBDC endpoint devices for several reasons: (i) smartphones are compatible with multiple payment methods

(various types of code payment methods and IC payments [contactless methods]¹⁹), and particularly for small-scale stores without in-store payment terminals, code payments using the static MPM method are expected to be compatible in terms of cost and operation, making the introduction of CBDC relatively easy; (ii) smartphone screens and display methods can be customized to a certain extent through wallet app enhancements, making it easier to accommodate individual circumstances of users; (iii) smartphones enable user authentication and transaction authentication on the smartphone itself.

While card-type devices²⁰ could be candidates primarily from the perspective of accommodating non-smartphone owners, they require the existence of in-store payment terminals, which may place a burden on stores and other entities currently handling cash only, and require the in-store payment terminals to be equipped with certain functions (such as PIN entry and verification function, biometric data input, and transaction amount display) if any authentication is performed from security perspectives.²¹

Furthermore, if existing infrastructure, such as in-store payment terminals for CPM QR code payments or IC card payments (contactless methods), are to be used for CBDC payments, modifications to the merchant payment terminal software and other components on the existing infrastructure side are required, as message data are processed through various entities. Upon the social implementation of CBDC, it may be important to enhance the ease of CBDC adoption for stores and make CBDC available at a large number of stores by leveraging existing infrastructure such as in-store payment terminals. In doing so, aligning, to the extent possible, the specifications of the CBDC system, such as message formats, with those of the existing infrastructure can be an effective option for suppressing modification costs on the existing infrastructure side.

¹⁹ Methods that utilize NFC (Near Field Communication).

²⁰ Discussion in this report assumes a typical physical IC card with an embedded IC chip that is not equipped with a fingerprint recognition function, display, or PIN pad.

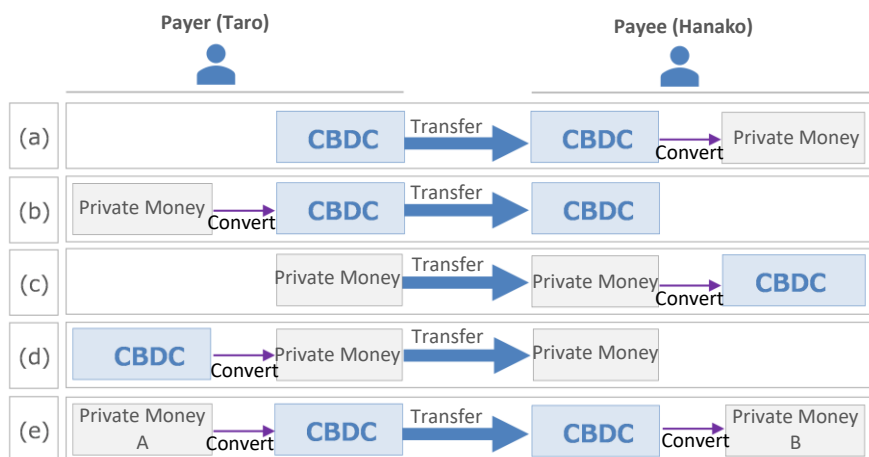
²¹ In addition to these challenges, regarding card-type devices, there are several issues that need to be considered. These include: (i) how to accommodate CBDC balance inquiries (whether or not to provide a function that enables individual users to check their balances using devices such as in-store payment terminals) and (ii) whether or not to assume concurrent use with a PC (whether it is acceptable to assume PC use for individuals who do not own a smartphone due to digital literacy or financial constraints, and if PC use is not assumed, how account opening and CBDC payout should be handled).

2.2.4 Interoperability

The "Relevant Ministries and the Bank of Japan Liaison Meeting on Central Bank Digital Currency (CBDC), Interim Report"²² cites, as a premise for interoperability of CBDC, that "CBDC can be converted with other payment means (cash, bank deposits, electronic money, etc.)." Toward the social implementation of CBDC, examination of these aspects is important. This section organizes the implementation methods regarding interoperability between CBDC and private money (here, primarily assuming QR code payments via fund transfer service providers), keeping the use cases of P2P transfers and in-store payments in mind.

Taking P2P transfers as an example, if we roughly categorize how CBDC and private money interact with users, five patterns can be envisioned, as shown in Figure 5. In these cases, if the CBDC system and the system managing the private money are interconnected and CBDC becomes convertible to and from various types of private money, it would enable users to convert CBDC into private money and then execute credit transfers or payments using that private money (Figure 5 [d]), or to convert private money into CBDC and then reconvert that into another private money (Figure 5 [e]), among other possibilities.

Figure 5. Patterns of interoperability between CBDC and private money



However, various implementation methods for achieving interoperability with private money are conceivable. Depending on the implementation method, it is considered that additional mechanisms may need to be introduced by the customer management intermediaries of both parties of the conversion to enable the coordination of various types of information between private money and CBDC.

²² Ministry of Finance, "Relevant Ministries and the Bank of Japan Liaison Meeting on Central Bank Digital Currency (CBDC), Interim Report" (April 2024)
https://www.mof.go.jp/english/about_mof/councils/meeting_of_cbdcli/20240612chuukanseirien.pdf

In addition, generally speaking, to interoperate systems with different operating entities, it may also be necessary for the connecting entities to standardize connection interface specifications (such as API specifications including authentication and authorization) and to agree on non-functional requirements (such as operating hours and performance requirements) and operational requirements (such as demarcation of responsibilities, protocols for system modifications, and operations during system failures).

Furthermore, as mentioned in the "Relevant Ministries and the Bank of Japan Liaison Meeting on Central Bank Digital Currency (CBDC), Second Interim Report,"²³ depending on the implementation method for interoperability, the barriers between different payment instruments could be lowered, which may affect the nature of competition based on the prevailing "merchant acquiring model." Interoperability between CBDC and private money needs to be examined while paying attention to such horizontal coexistence perspectives.

2.2.5 Security

It goes without saying that ensuring system security is crucial upon the social implementation of CBDC, and measures to achieve it will be essential. Regarding the confidentiality and integrity of the system, this section organizes general concepts of cybersecurity measures, as well as risks requiring special attention in CBDC and characteristic risks in conventional payment services, with a primary focus on the point of contact with users in the ledger management systems and customer management systems.

General concepts of cybersecurity measures

In general, as part of cybersecurity measures for critical infrastructure, it will be important for the CBDC systems to align with the concept of "Security by Design,"²⁴ which implements consistent security measures from planning to operation.

In addition, regarding "encryption," which is vital for ensuring confidentiality among security countermeasures, it is necessary to be mindful of the use of PQC (Post-Quantum Cryptography) and migration to such cryptography, anticipating future realization of

²³ Ministry of Finance, "Relevant Ministries and the Bank of Japan Liaison Meeting on Central Bank Digital Currency (CBDC), Second Interim Report" (May 2025)
https://www.mof.go.jp/english/about_mof/councils/meeting_of_cbdcli/20250725_2nd_chuukanseirien.pdf

²⁴ Digital Agency, "Security by Design Guidelines for Government Information Systems" (January 2024, available in Japanese)
https://www.digital.go.jp/assets/contents/node/basic_page/field_ref_resources/e2a06143-ed29-4f1d-9c31-0f06fca67afc/7e3e30b9/20240131_resources_standard_guidelines_guidelines_01.pdf

large-scale and practical quantum computers. Toward that end, it is important to: (i) take PQC transition into account in system design; (ii) incorporate strategies for PQC migration; (iii) give consideration to processing performance when using PQC; (iv) use cryptographic algorithms that have been thoroughly evaluated by experts as having confirmed security and implementation performance (algorithms on the CRYPTREC Ciphers List); and (v) continuously gather information regarding the latest trends in cryptographic technology including PQC, and appropriately execute necessary measures.

Countermeasures against unauthorized access and fraudulent transactions

As risks requiring special attention in CBDC and characteristic risks in conventional payment services, the first is the risk of unauthorized access and fraudulent transactions due to user identity theft and similar acts. As countermeasures against these, it is important to conduct appropriate authentication and authorization according to the degree of risk. In particular, regarding authentication, especially in the connection between users and customer management systems, it is important to appropriately combine authentication technologies across various factors such as "user authentication," "transaction authentication," and "device authentication,"²⁵ depending on the degree of risk. Furthermore, the utilization of "risk-based authentication,"²⁶ which is used to complement these authentication means, is also effective. It should be noted that when analyzing these risks, since business preconditions (on basic operations such as credit transfers and balance inquiries) are provisionally established, attention must be paid to the fact that the nature of risks and countermeasures may vary depending on how these preconditions are set.

Countermeasures against unauthorized creation

Second, there is the risk that unauthorized creation of CBDC (i.e., fraudulent altering of a CBDC balance recorded on the ledger management system) may occur through the tampering of databases, programs, and messages in the ledger management system via external attacks or similar acts. As countermeasures against this, it is essential to implement appropriate preventive and reactive measures. As preventive measures, it is important to: (i) execute appropriate authentication and authorization on the premise of performing security design and security implementation in general cybersecurity practices; and (ii) apply security patches promptly upon their release as part of security operations to minimize vulnerabilities. As reactive measures to detect the occurrence of unauthorized creation, it is important to confirm the total amount of CBDC in circulation and to verify consistency among ledgers (whether credits and debits are executed as a

²⁵ An action verifying that the device (e.g., smartphone, IC card) trying to use a service is the pre-registered device.

²⁶ An action requiring additional authentication when a transaction is determined to be suspicious or high risk.

set during credit transfers). However, it should be noted that these measures may include those that increase system load.

2.2.6 Availability

Upon the social implementation of CBDC, it goes without saying that ensuring system availability²⁷ is essential, and measures to achieve this are important. This section organizes measures to ensure availability, taking the infrastructure of ledger management systems as an example.

Planned downtime

As a basic measure to minimize planned downtime of the service associated with system maintenance work, there is a method of multiplexing the components that constitute the system and performing maintenance by sequentially stopping one part at a time such that the system and service are not interrupted. Additionally, for maintenance work where a wide range of system equipment and components are affected, such as large-scale system updates, the utilization of a backup site²⁸ may also be considered. Furthermore, in terms of site architecture, (i) a synchronous active-active configuration²⁹ or (ii) an asynchronous main-backup configuration³⁰ can be considered.

Upon social implementation, a decision will be made whether to adopt an active-active configuration or a main-backup configuration, considering requirements for planned service downtime duration, processing time for each transaction, the distance between the main and backup sites, and advances in data transmission technology between remote locations. Furthermore, when assuming 24/7 operations, the system design will

²⁷ Generally, this refers to the capability of systems or services to be used continuously whenever necessary without disruption due to failures.

²⁸ A setup where a standalone data center (backup site) independent of the primary data center (main site) used to operate the system at normal times is prepared for natural disasters and system failures. This would be a setup where a standalone data center (backup site) independent of the primary data center (main site) running the regular system is prepared for disasters or system failures. To provide continuous services even during maintenance, an approach can be adopted where operations are switched to the backup site during maintenance of the main site, and subsequently switched back to the main site during maintenance of the backup site. From the perspective of maintaining further resilience against natural disasters and system failures, an approach can be adopted where three sites are prepared with rotating roles -- such as main, backup, and maintenance -- thereby maintaining a two-site configuration of main and backup even while one of the sites is undergoing maintenance.

²⁹ For example, this refers to a configuration where users can access services by connecting to a server in either site A or B (where site A and site B are located in remote regions).

³⁰ A configuration where data associated with the processed tasks is transmitted to the backup site after completion of the task on the main site.

need to consider various operational factors, such as how to execute online processing in parallel with batch processing -- including daily and monthly aggregation processing.

Downtime due to system failures

In this section, we outline measures assuming a scenario where the main site function of one of the multiple ledger management systems stops due to a large-scale system failure. For downtime due to failures, in addition to the measures for planned downtime, responding to the loss of data being processed is important. In an asynchronous main-backup configuration, if a switch to the backup site occurs due to a failure at the main site, data for certain accounts may be lost,³¹ resulting in a state where consistency among the ledger management systems is not maintained. To prepare for such a situation, a mechanism to accumulate transaction histories³² can also be considered.

Moreover, responding to data loss could require a significant recovery time, and the scale of implementing systematic mechanisms to shorten recovery time could be substantial. Upon social implementation, it is considered necessary to examine not only mechanisms to accumulate transaction histories, but also other countermeasures,³³ such as making data loss less likely to occur by synchronizing data between remote sites, in a similar manner to planned downtime.

Resilience

From the perspective of early recovery from failures, in a CBDC system involving multiple entities, not only securing general redundant configurations, but also mechanisms to prevent failures from spreading to the entire system may be crucial. Measures such as geographically distributing and placing multiple ledger management and customer management systems to prevent the impact of a disaster in a specific region from spreading to the entire system can also be considered.

Additionally, from the perspective of ensuring resilience, given the nature of CBDC as a retail payment service, measures such as securing alternative means and prompt public relations (i.e., prompt notification to users), along with efforts for early recovery from failures, are also important.

³¹ If a failure occurs in the ledger management system, data associated with the processing of multiple debit and credit transactions for a specific account may be lost. Recovery of this data requires understanding of the chronological sequence of the transactions.

³² For example, building a mechanism that continuously gathers and accumulates transaction histories from all ledger management systems can be considered. However, construction of such a system requires examination of technical issues from the perspective of system resources and availability.

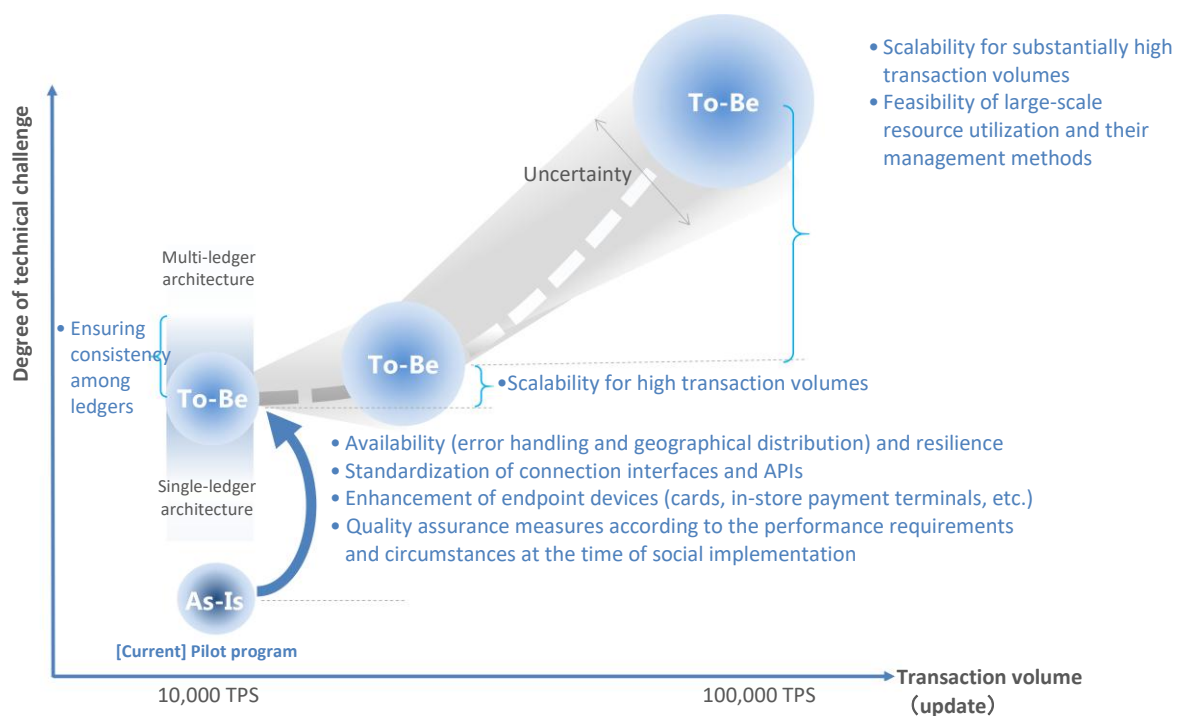
³³ Under such circumstances, technical mechanisms are required to ensure that processing times do not increase due to network delays caused by distance (i.e., mechanisms that transmit high-capacity data with low latency even over long distances), and close attention must be paid to trends in such technological developments.

2.3 Conclusions and future initiatives

Our technical exploration of CBDC through the development of a system for the pilot program and experimentation, assuming online payments, has not found any technical knockout factors for social implementation at this time.

However, there exist significant differences between the system required upon the social implementation of CBDC and the system for the pilot program, and we have confirmed that there remain many technical considerations that need to be addressed before social implementation can take place. Therefore, even if the anticipated transaction volume upon social implementation were equivalent to that of the system for the pilot program, technical considerations would remain regarding ensuring safe and secure use of CBDC. Thus, the difficulty of building a CBDC system for social implementation would be significantly higher than that of building the system for the pilot program. Moreover, as the anticipated transaction volume increases, these considerations will increase further, raising the technical level of difficulty (Figure 6). We discuss these technical considerations below.

Figure 6. Relationship between transaction volume and degree of technical challenge for CBDC social implementation



Ensuring consistency among ledgers

If we adopt an architecture in which the ledger management systems are distributed among intermediaries for the social implementation of CBDC, a mechanism that secures the consistency among ledgers will be required. Specifically, our experiments verified the following: (i) a mechanism will be required to ensure data integrity between multiple DB servers through process flows and message exchanges within them; (ii) although a mechanism for recovery in the event of ledger inconsistencies may be needed, there are technical discussion points that must be addressed to achieve it.

Availability (error handling and geographical distribution) and resilience

Upon the social implementation of CBDC, mechanisms to secure availability and resilience will be required. Specifically, our study confirmed the following: (i) multiple error-handling flows combining the timeout management function and the hold function can be envisioned; (ii) implementing error-handling may complicate the process flows, potentially resulting in larger system resources; (iii) therefore, from the perspective of efficient utilization of various system resources, it is important to compare and weigh the advantages and disadvantages when selecting process flows; (iv) measures to minimize planned and system failure downtime (geographical distribution using backup sites and mechanisms to resolve inconsistencies between ledgers) are important to ensure availability; (v) to ensure resilience, it is important to prevent a system failure from system-wide spread through early recovery and geographical distribution, as well as securing alternative means and timely public notifications.

Standardization of connection interfaces and APIs

Upon the social implementation of CBDC, interconnections with systems operated by various entities will be required to build a CBDC ecosystem. Consequently, the standardization of connection interfaces (such as API specifications) will need to be considered. Specifically, our review showed the following: (i) depending on the implementation method for interoperability with private money, additional mechanisms will be required for both the payer's and payee's customer management intermediaries; (ii) it will be necessary, among connecting entities, to standardize the connection interface specifications and agree on the non-functional and operational requirements; (iii) depending on the implementation method of interoperability, the barriers between different payment instruments could be lowered, which may affect the nature of competition based on the prevailing merchant acquiring model; (iv) attention needs to be paid to differences in processing performance and operating hours between systems when connecting customer management systems that handle payouts and acceptances with the core banking systems of banks and other institutions;³⁴ (v) considerations are

³⁴ This was referred to in the 2025 Progress Report. For example, from the perspective of avoiding a high load on the core banking systems of banks and other institutions due to differences in the processing performance between systems, "based on the assumption that it is acceptable not to require the

necessary regarding information management methods (whether to manage information in a centralized or non-centralized manner) for functions such as aliasing, account ID tokenization, and destination confirmation.

Enhancement of endpoint devices (such as cards, in-store payment terminals)

The social implementation of CBDC will require enhancement of endpoint devices. Specifically, our experimentation confirmed the following: (i) smartphones are strong candidates as endpoint devices for individuals; (ii) while card-type devices could serve as alternatives for non-smartphone owners, they will require in-store payment terminals, which may place a burden on stores and other entities currently handling cash only, and in-store payment terminals will need to be equipped with certain functions (such as PIN entry and verification function, biometric data input, and transaction amount display) if any authentication is performed from security perspectives.

Quality assurance measures according to the performance requirements and circumstances at the time of social implementation

System security assurance measures necessary for mission-critical systems will be essential for the social implementation of CBDC. Specifically, our verification confirmed the following: (i) it is important to consider security measures based on the security by design concept; (ii) in particular, while authentication and authorization as countermeasures for unauthorized access and fraudulent transactions are important, preventive and reactive countermeasures against unauthorized creation are also required.

Scalability for substantially high transaction volumes, feasibility of large-scale resource utilization, and their management methods

The social implementation of CBDC may, depending on its transaction volume, require performance scalability for a substantially high level of transaction load and a massive amount of system resources. Therefore, the efficient use of system resources will need to be considered. Specifically, we confirmed the following: (i) due to various functional and non-functional requirements (increases in transaction volumes, processing overheads associated with additional error handling and message complexity, redundant configurations to enhance availability, and the preparation of environments for development and staging in addition to the production environment), a massive amount of server and network resources may be required; (ii) to address such issues, the efficient use of system resources must be considered toward social implementation -- for example, it is important to streamline the process flows to increase the processing capacity per server, to handle transaction volume with fewer servers, and to reduce required network resources; (iii) since systems may be operated by various entities with different processing

conversion of accepted CBDC to bank deposits and other forms of money in real time, it is possible to aggregate processing operations for a certain period of time on the customer management side and then collectively coordinate with core banking systems."

capabilities, it will be important to request intake points (such as front servers) on the customer and ledger management systems to handle processing spikes by controlling the number of incoming requests per unit time; (iv) system loads may increase when a cumulative limitation check is conducted, suggesting the need to improve its implementation approach.

Future initiatives regarding the development of a system for the pilot program and experimentation

Toward the social implementation of CBDC, we must be conscious of the technical considerations mentioned above. In particular, considerations related to the ledger management systems, which form the core of the CBDC system, need further in-depth examination. For example, regarding error handling and other aspects handled through simplified implementation in the current system for the pilot program, there is a strong necessity for evaluation of performance to a certain extent incorporating measures required for social implementation, and there is room to consider more efficient process flows for credit transfers.

3. CBDC Forum³⁵

The CBDC Forum consists of members from a wide range of industries. They are financial and non-financial firms, including start-ups, that have insights into the technologies and business practices of retail payments (64 participating firms as of March 2024). In steering the Forum, the Payment and Settlement Systems Department of the Bank serves as the secretariat, forming and organizing thematic working groups (WGs). This report mainly presents discussions held by the seven WGs (Figure 7) during fiscal 2025. For details on the discussions conducted since the establishment of the CBDC Forum in July 2023, please refer to the "Central Bank Digital Currency Experiments: Progress Report on the Pilot Program (June 2026): Summary of Discussions in the CBDC Forum (Supplement)," which categorizes and summarizes the deliberations by topic.

Figure 7. Discussion themes for each WG

WG		Theme
WG1 from 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 a 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 instruments 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 June 2024	Horizontal coexistence of CBDC and other payment instruments	- Smooth conversion to and from electronic money and other forms of money
WG7 since Sep. 2024	Operational flow of basic functions	- Operational flow of basic functions
		- Conversion between cash and CBDC

³⁵ Information regarding the CBDC Forum (such as materials of general meetings as well as materials and minutes of each WG are available on the CBDC Forum webpage in Japanese (https://www.boj.or.jp/paym/digital/d_forum/index.htm).

3.1 [WG1] Connection between the CBDC system and fundamental external systems

3.1.1 Overview

Since its first meeting in September 2023, WG1 has held a total of 11 meetings to discuss connection methods for the CBDC system. Through these meetings, determined that its objectives had been achieved to a certain extent after having completed the review of each given issue, WG1 became inactive upon conclusion of the 11th meeting. Therefore, no meetings were held in fiscal 2025. Instead, the members participated in other WG meetings, where feedback was provided on the Bank's development of a system for the pilot program and experimentation.

Figure 8. Overview of WG1

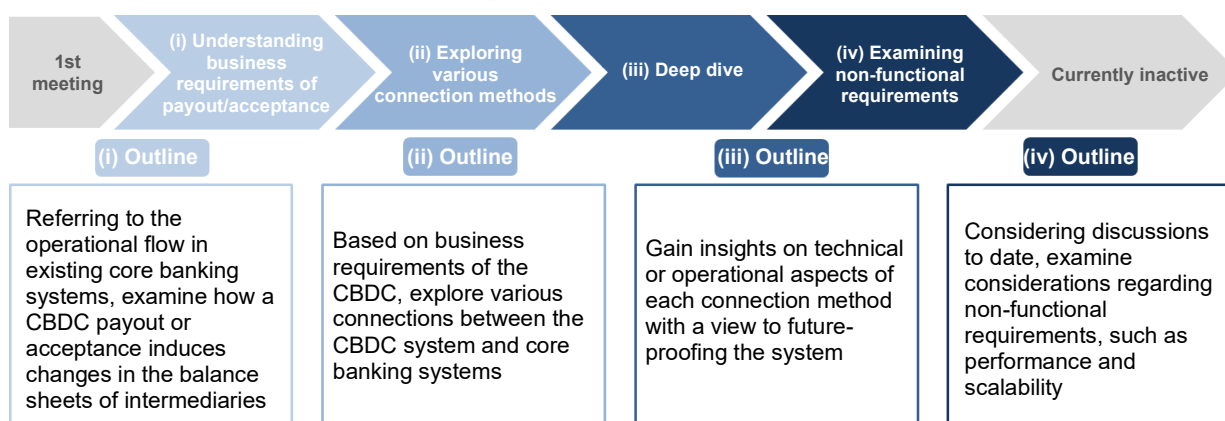


Figure 9. Themes and presenters of WG1 meetings

	Date	Theme	Presenter (Company names are as of the date of each meeting. The same applies hereinafter.)
1st	September 20, 2023	Overview of WG, assumptions, approach, etc.	Bank of Japan
2nd	October 13	Business requirements for payout/acceptance	Mizuho Bank Ltd.
			Fukuoka Financial Group, Inc.
3rd	November 2	Various connections between CBDC system and core banking systems	Sumitomo Mitsui Banking Corporation
			Chiba Bank
4th	November 22		Bank of Japan
			Seven Bank, Ltd.
5th	December 12		JAPAN POST BANK Co., Ltd.
			BIPROGY Inc.
6th	January 17, 2024	Various connections between CBDC system and	Aeon Bank, Limited.

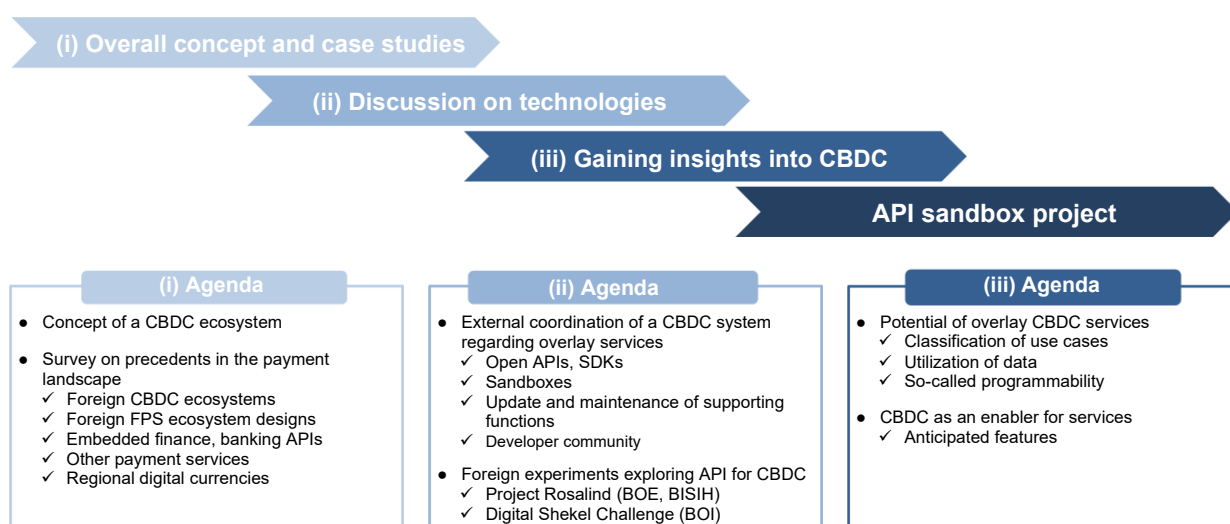
		core banking systems	
		Deep dive on connection methods	NEC Corporation
7th	February 7	Deep dive on connection methods	NTT DATA Financial Technology Corporation
			The Shinkin Banks Cooperative Center The Shinkin Banks Information System Center Co., Ltd.
8th	March 15		MUFG Bank, Ltd.
9th	April 24	Deep dive on non-functional requirements of connection methods	Fukuoka Financial Group, Inc.
			Mizuho Bank Ltd.
10th	May 15		NTT DATA Japan Corporation
			IBM Japan, Ltd.
11th	June 13	Deep dive on connection methods	Resona Holdings, Inc.
			THE SHIZUOKA BANK, LTD.

3.2 [WG2] Overlay services and CBDC ecosystem

3.2.1 Overview

Since its first meeting in September 2023, WG2 has held a total of 17 meetings (including two joint meetings with another WG) to discuss the following: the concept of a CBDC ecosystem, case studies for an ecosystem in the payment landscape, the examination of use cases of overlay services, and the technological characteristics of CBDC as an enabler of services. In parallel with those discussions and through the API sandbox project, in which volunteer members of WG2 participated, discussions have also focused on the functional scalability, programmability, and composability of CBDC.

Figure 10. Overview of WG2



3.2.2 Major issues discussed since the previous report

Through the API Sandbox Project, volunteer members presented additional APIs developed and implemented, as well as overlay services and use cases examined, which served as topics for discussions with member firms. For specific details on the implemented APIs and proposed overlay services, see BOX.

Figure 11. Themes and presenters of WG2 meetings

	Date	Theme	Presenter
1st	September 26, 2023	Scope of discussion, operation method	Bank of Japan
2nd	October 17	Discussions in other jurisdictions on CBDC ecosystems (mainly in Europe)	Bank of Japan

		Concept of a CBDC ecosystem	NEC Corporation
3rd	November 7	Foreign FPS ecosystem	Bank of Japan
		Embedded finance and potential of CBDC	Infcurion, Inc.
		Toward a CBDC ecosystem	Money Forward, Inc.
4th	December 8	API policy	Fukuoka Financial Group, Inc.
5th	January 18, 2024	Introduction of Project Rosalind by BIS	Bank of Japan
		Presentation	Merpay, Inc.
6th	February 27	API sandbox project	Bank of Japan
		Discussion on potential use of CBDC	MUFG Bank, Ltd.
7th	March 27	Architecture requirements and process requirements for developing and promoting CBDC	Sony Corporation
		Issues for the social implementation of CBDC from the perspective of regional currency in the Aizu region	TIS Inc.
8th	April 23	Introduction of Project Sela by BIS	Nomura Research Institute, Ltd.
		CBDC and foreign payment service providers	PayPay Corporation
9th	June 25	Progress of API sandbox project	Bank of Japan
		Dialogue on visions of the CBDC ecosystem world	BIPROGY Inc.
10th	September 3	Introduction of the Digital Shekel Challenge by the Bank of Israel	Bank of Japan
		Strategy and implementation of launching a public goods platform	Startale Labs Japan KK
11th	November 20	E-Agro ecosystem and potential use of CBDC in Japan	IBM Japan, Ltd.
		Study of issues in linking overlay services	Money Forward, Inc.
12th	January 23, 2025	Initiatives on API sandbox project	NTT DATA Japan Corporation Nomura Research Institute, Ltd.
		Potential use of digital currencies in gaming and the metaverse	Sumitomo Mitsui Banking Corporation

13th	April 24	External connection of CBDC system for overlay services and business applications	NTT DATA Japan Corporation
		Creating an environment where everyone can make secure CBDC payments: Coexistence of universal access and user protection	NEC Corporation
14th	May 30	Initiatives on API sandbox	Fukuoka Financial Group, Inc.
		MyNaPi (tentative): Proposal of CBDC payment using the Individual Number Card ("My Number Card")	Money Forward, Inc.
15th	June 3	Initiatives on API sandbox project	Nomura Research Institute, Ltd.
		Presentation of joint use case: CBDC x tokenization	TIS Inc.
			Datachain, Inc.
16th	October 14 (jointly held with WG4)	Building a trusted internet infrastructure without barriers between Web2 and Web3	Startale Labs Japan Inc.
		Research on deposit tokens by advanced foreign banks	TIS Inc.
		Token standards and compliance: Discussion based on foreign case studies	Sumitomo Mitsui Trust Bank, Limited
17th	December 22 (jointly held with WG4)	Overview of the experimental system for CBDC pilot program	Bank of Japan
		Introduction of the discussion paper "A Retail CBDC Design for Basic Payments: Feasibility Study" by the Bank of Canada	

(BOX) Examples of overlay services developed and proposed in the API sandbox project

Since April 2024, the Bank has prepared a shared experimental environment on the cloud (the Bank's core layer), separate from the system for the pilot program, and volunteer members have been implementing additional APIs to conduct research on the functional scalability of CBDC as well as examination of overlay services and their use cases.

From April 2025 onward, as outcomes of overlay services developed and implemented by volunteer members, proposals have been made for new features and use cases of overlay services that enhance the convenience of CBDC from various perspectives, including implementation of programmable functions, realization of composability through API linkage, improvement of in-store payment experiences, and utilization of new technologies. Specific examples are shown below.

(1) Implementation of programmable functions, realization of composability through API linkage

(i) Transfer enabling function under specific conditions, purpose bound money (PBM)

Dummy money equipped with programmable functions was developed by connecting basic APIs on the Bank's core layer with independently developed additional APIs, which were also connected to the blockchain infrastructure. A function that allows transfers under specific conditions was implemented, as well as a programmable function, such as purpose bound money (PBM) that allows purchases of specific items only, were implemented. Furthermore, a smartphone app with a purpose bound function was developed and its payment experience was demonstrated at an event.

(ii) Data utilization

An automated payment data aggregation function capable of consolidating transaction data recorded through APIs and enabling bulk retrieval of payment-related information on fund usage, etc. was implemented.

(iii) Automated principal and interest payments for retail securities transactions and automation of tax administration processes

API-based functions for automated payments of coupons and redemption in retail securities transactions, as well as automation of tax administration processes related to interest income, were implemented.

(iv) Region-based payment restriction function, age-based payment function

Assuming the issuance of CBDC with region-based restrictions, a function was implemented that enables payments only within designated regions by referencing merchant information. In addition, an age-based payment function was implemented to verify age prior to payment when purchasing age-restricted products such as alcoholic beverages. The latter function was achieved through integration with a third-party API, demonstrating composability.

(v) Temporary hold on funds using a locking function

By utilizing basic APIs with a locking function implemented on the Bank's core layer, an API was implemented that temporarily holds funds in the account at the time of reservation or contract. For example, funds are temporarily held at the time of reservation at a

restaurant, which will automatically be settled upon the rendition of services (i.e., upon condition verification). Broader applications across diverse payment use cases are envisioned, including payments for EC websites, train fares, and gas stations.

(2) Improvement of in-store payment experiences

(i) "Hands-free" payments using biometric authentication

A concept of biometric authentication payment using facial recognition technology was introduced from the perspective of achieving universal access, which is one of the core features of CBDC. Utilization of facial recognition technology enables device-free, operation-free payments, demonstrating the feasibility of an environment where everyone can use CBDC hands-free.

(ii) "Universal" payments using Individual Number Cards ("My Number Cards")

A prototype system that enables payments simply by tapping a My Number Card without requiring a smartphone, bank account, or credit card was developed, demonstrating that even non-smartphone users can make payments safely. It was also noted that the use of My Number Cards could facilitate prompt benefit disbursement from local governments and support offline payments.

(3) Utilization of new technologies

(i) Connection between the core API layer and DLT platforms

JGB tokens backed by government bonds for retail investors and CBDC-backed CBDC tokens were issued on a blockchain, and functions including DVP settlement using Hashed TimeLock Contract (HTLC), automated interest payments, and instant early redemptions were implemented.

(ii) Interoperability using a bridge function of DLT platforms

A mechanism that enables seamless conversion of CBDC-backed CBDC tokens into JGB tokens or PBM using a bridge function of DLT platforms was implemented.

(iii) Exploration of DeFi use cases with CBDC backed stablecoins

Stablecoins backed by CBDC were issued on a public blockchain in a test environment, and cross-chain transfers were conducted across different DLT platforms, as well as DeFi applications including token swaps with foreign currency-denominated stablecoins and liquidity provisions.

(iv) Implementation of "3-way DVP" involving the transfer of rights on real assets

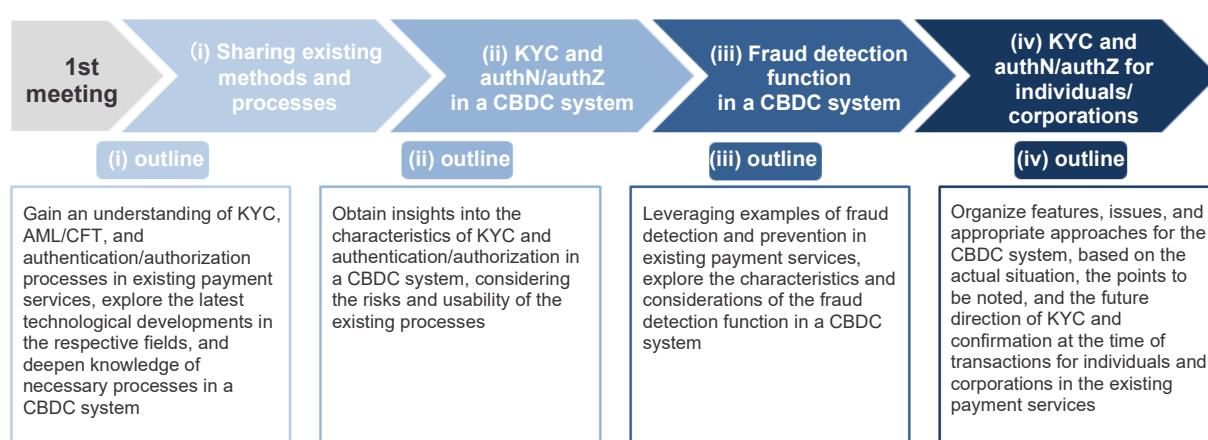
"3-way DVP" was implemented, enabling transfers of the rights on real assets (vehicles) and security tokens backed by the real assets, as well as payments using CBDC backed stablecoins, to be conducted simultaneously on a blockchain connected to the Bank's core layer.

3.3 [WG3] KYC and user authentication/authorization

3.3.1 Overview

Since its first meeting in October 2023, WG3 has held a total of 15 meetings (including one joint meeting with another WG). Focusing on Know Your Customer (KYC) and authentication/authorization, which are fundamental to the safe and secure use of payment services, WG3 has advanced discussions on usage by individuals and corporations (non-face-to-face and face-to-face).

Figure 12. Overview of WG3



3.3.2 Major issues discussed since the previous report

Based on insights gained through business practices related to KYC and AML/CFT in the existing payment services for individuals and corporations, members discussed considerations and challenges for conducting identity proofing, customer due diligence, prevention and detection of fraud, and system sharing.

Regarding authentication and authorization, the WG discussed the importance of authentication and the possibility of simplifying the process, as well as the importance of the appropriate development and operation of standards and guidelines.

Figure 13. Themes and presenters of WG3 meetings

	Date	Theme	Presenter
1st	October 25, 2023	Overview of WG, assumptions, approach, etc.	Bank of Japan
2nd	November 21	User action and operational process regarding KYC checks and user authentication in existing payment services	NTT DOCOMO, INC. and another company
3rd	December 11		Aeon Bank, Limited.

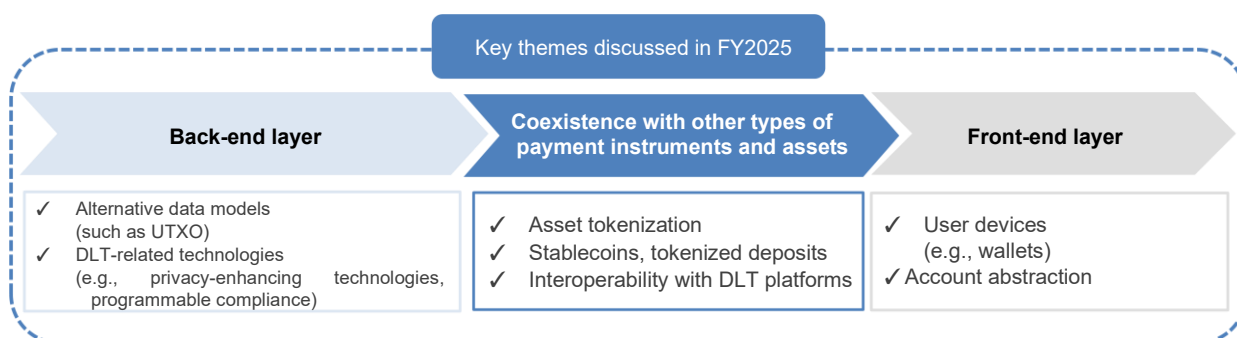
			MUFG Bank, Ltd.
3rd	December 11	Discussions in other jurisdictions related to WG3 (progress on the investigation phase of a digital euro)	Bank of Japan
4th	January 24, 2024	Existing AMT/CFT process and its latest development	Microsoft Japan Co., Ltd.
			Mizuho Bank Ltd.
5th	February 15	Existing KYC process and its latest development	NEC Corporation
			Sumitomo Mitsui Banking Corporation
6th	March 25	Existing user authentication process and its latest development	SECOM Co., Ltd.
			JAPAN POST BANK Co., Ltd.
7th	April 16	Existing use cases and technological aspects of authentication/authorization and their latest developments	Money Forward, Inc.
			NRI SecureTechnologies, Ltd.
8th	May 24	KYC and authentication/authorization in a CBDC system	Dai Nippon Printing Co., Ltd.
			FeliCa Networks, Inc.
9th	July 5		Microsoft Japan Co., Ltd.
			NEC Corporation
10th	September 11	Fraud detection function in a CBDC system	PayPay Corporation
11th	November 14		Chiba Bank
12th	February 4, 2025	KYC and authentication for individuals (face-to-face)	Dai Nippon Printing Co., Ltd.
			Mizuho Bank Ltd.
			Sumitomo Mitsui Banking Corporation
13th	March 12	KYC and authentication/authorization for corporations (face-to-face, non-face-to-face)	Chiba Bank
			NRI SecureTechnologies, Ltd.
14th	May 27	KYC and authentication/authorization for corporations (face-to-face, non-face-to-face)	MUFG Bank, Ltd.
			SECOM Co., Ltd.
15th	October 31 (jointly held with WG5)	Measures against fraudulent withdrawals in internet banking	Sumitomo Mitsui Banking Corporation
		Application platform utilizing payment terminals	Sumitomo Mitsui Card Company, Limited

3.4 [WG4] New technologies and CBDC

3.4.1 Overview

Since its first meeting in January 2024, WG4 has held a total of 12 meetings (including two joint meetings with another WG). The scope of the discussions covered the CBDC system (back-end and front-end layers)³⁶ and the coexistence of CBDC with other types of payment instruments and assets. At the same time, the discussions have focused on technologies that could be utilized in the future, without necessarily being constrained by existing technical premises or limitations.

Figure 14. Overview of WG4



3.4.2 Major issues discussed since the previous report

For the back-end and front-end layers of the CBDC system, the WG has discussed comparisons of data models for ledger systems, the potential use of DLT-related technologies, and future design options. Regarding coexistence with other payment instruments and assets, the WG has discussed domestic and international initiatives related to asset tokenization, technologies related to stablecoin and tokenized deposit, and interoperability technologies with DLT platforms.

Figure 15. Themes and presenters of WG4 meetings

	Date	Theme	Presenter
1st	January 30, 2024	Overview of WG, scope of discussion	Bank of Japan
		Characteristics of UTXO model	SBI R3 JAPAN Co., Ltd

³⁶ We have decided, regarding the CBDC systems, to proceed with the discussion by defining the technological field without direct user touchpoints, such as ledger systems, as the "back-end layer," and the technological field with direct user touchpoints, such as wallets, as the "front-end layer."

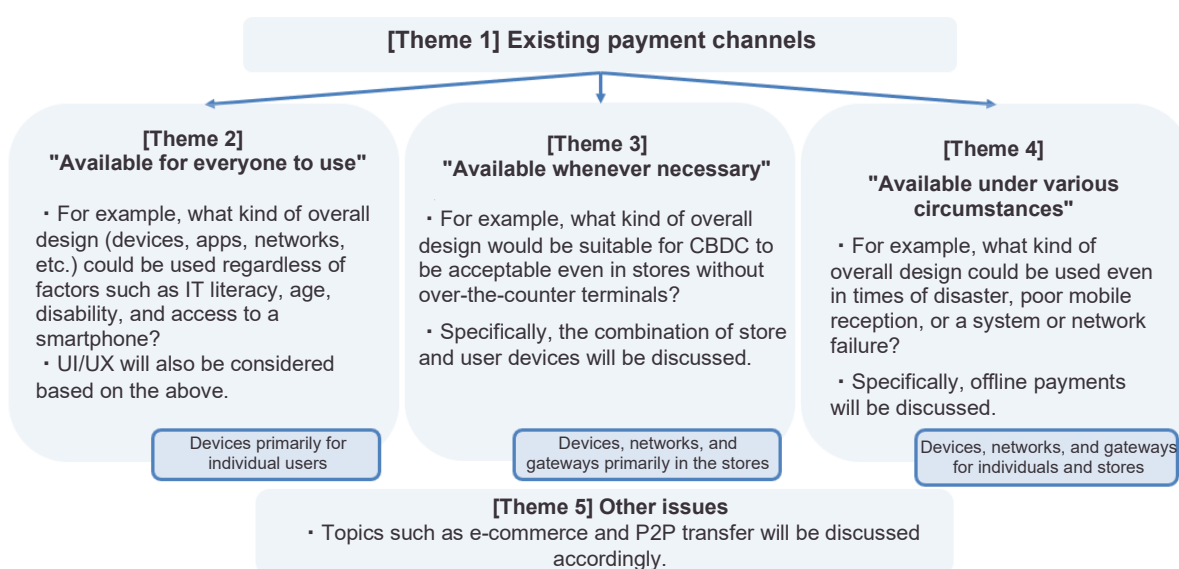
2nd	March 13	Future of UTXO model	SBI R3 JAPAN Co., Ltd
		Applicability of recent data models and distributed ledgers to CBDC	Coincheck, Inc.
3rd	April 10	Performance issues in CBDC and directions for countermeasures	NTT DATA Japan Corporation
4th	May 14	Potential of CBDC using blockchain	Startale Labs Japan KK
5th	July 4	Comparison of ledger data model	JPX Market Innovation & Research, Inc.
		Applicability of DLT to CBDC	Soramitsu Co., Ltd.
6th	September 12	Comparison of ledger data model	Soramitsu Co., Ltd.
		Securities settlement using CBDC	Daiwa Securities Co. Ltd., Nomura Securities Co., Ltd.
7th	November 1	Introduction of digital securities, study of DVP settlement	JPX Market Innovation & Research, Inc.
		Initiatives on DLT at JSCC	Japan Securities Clearing Corporation
8th	January 15, 2025	Interoperability technologies	Datachain, Inc.
		Security token (ST) and CBDC	BOOSTRY Co., Ltd.
9th	March 25	Introduction of use cases of asset tokenization from other jurisdictions	Sumitomo Mitsui Trust Bank, Limited
		Stablecoins, deposit tokens	NTT DATA Japan Corporation
10th	May 28	Value transfer protocol (electronic cash)	NTT DATA Japan Corporation
		Offline payments	Soramitsu Co., Ltd.
11th	October 14 (jointly held with WG2)	Building a trusted internet infrastructure without barriers between Web2 and Web3	Startale Labs Japan KK
		Research on deposit tokens by advanced foreign banks	TIS Inc.
		Token standards and compliance: Discussion based on foreign case studies	Sumitomo Mitsui Trust Bank, Limited
12th	December 22 (jointly held with WG2)	Overview of the experimental system for CBDC pilot program	Bank of Japan
		Introduction of the discussion paper "A Retail CBDC Design for Basic Payments: Feasibility Study" by the Bank of Canada	

3.5 [WG5] User devices and UI/UX

3.5.1 Overview

Since its first meeting in March 2024, WG5 has held a total of 12 meetings (including two joint meetings with other WGs) to discuss from the perspective of universal access and user interfaces (UI)/user experiences (UX) how to make CBDC available for everyone, anywhere, and under various circumstances.

Figure 16. Overview of WG5



3.5.2 Major issues discussed since the previous report

The WG continued discussion on the user devices for individuals, in-store payment terminals, and "device-free payments" using biometric authentication from the perspective of making CBDC available for everyone to use wherever necessary, as well as on UI/UX designs conscious of universal access.

Furthermore, from the perspective of making CBDC available under various circumstances, the WG discussed offline payment methods such as immediate device-to-device settlement and deferred settlement after connecting to a system center, as well as measures during system glitches or outages (e.g., prevention of duplicate payments).

In relation to these topics, security measures for devices used in in-store payments and P2P transfers as well as utilization of secure elements in smartphones were also discussed.

Figure 17. Themes and presenters of WG5 meetings

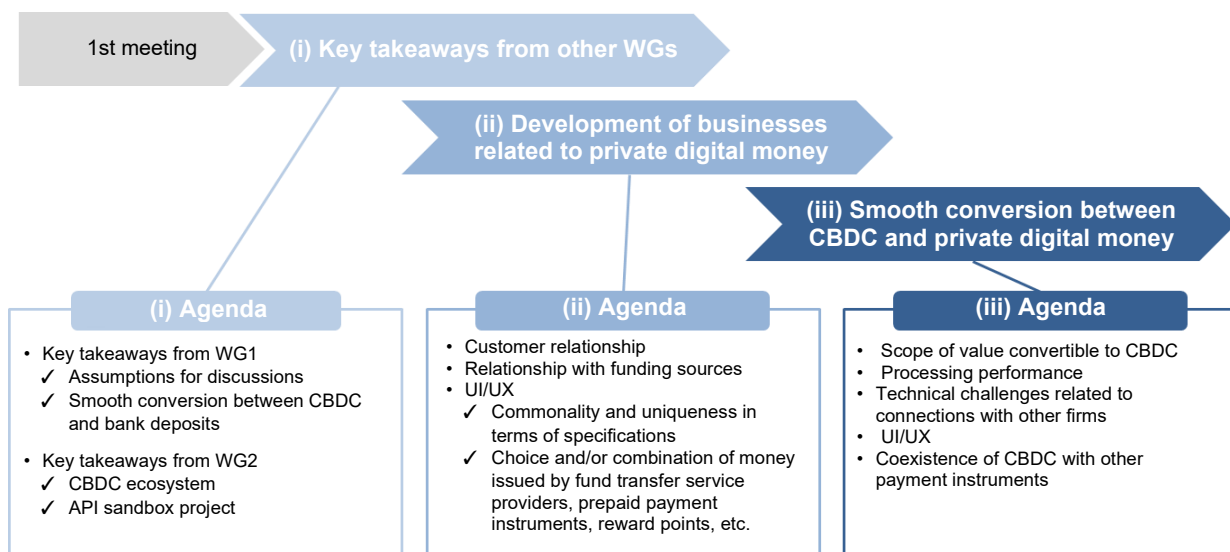
	Date	Theme	Presenter
1st	March 21, 2024	Scope setting of WG, sharing of basic matters	Bank of Japan
		Overview of cashless payments and key considerations	Lawson, Inc.
2nd	May 9	Introduction of foreign initiatives on offline payments	Bank of Japan
		Experiment focusing on P2P transfers in offline environments	JCB Co., Ltd.
3rd	July 17	Devices for individual users	Dai Nippon Printing Co., Ltd.
		Case studies related to utilization of existing payment infrastructures	NTT DOCOMO, INC.
4th	September 25	CBDC from the perspective of in-store payment terminal UI/UX	Panasonic Connect Co., Ltd.
		Use of smartphones as payment terminals and its application to CBDC	Ridgelinez Limited
5th	December 11	Payment environments that are "available for everyone to use"	TOPPAN Edge Inc.
		Desktop analysis in the pilot program (various considerations related to endpoint devices)	Bank of Japan
6th	February 12, 2025	CBDC deployment utilizing QR code payment system (CPM method)	Canal Payment Service, Ltd.
		Utilization of biometric authentication for CBDC	NEC Corporation
7th	April 15	Introduction of payment process of credit cards and possible CBDC payment process	Mitsubishi UFJ NICOS Co., Ltd.
		Overview of secure element and integration into smartphones	FeliCa Networks, Inc.
8th	May 22	UI/UX of Minna no Ginko App	Minna Bank, Ltd.
		Initiatives for retail payments by banks and UI/UX (panel discussion)	Joyo Bank, Ltd. Resona Holdings, Inc. Minna Bank, Ltd.
9th	July 14	Security assessment and system design of CBDC from the perspective of existing cashless payments	NRI SecureTechnologies, Ltd.
		Utilization of biometric authorization for CBDC	Hitachi Solutions, Ltd. Hitachi Consulting Co., Ltd.
10th	September 22	Desktop analysis in the pilot program (UX challenges in in-store payments)	Bank of Japan
		Value transfer protocol (electronic cash)	NTT DATA Japan Corporation
11th	October 31 (jointly held with WG3)	Measures against fraudulent withdrawals in internet banking	Sumitomo Mitsui Banking Corporation
		Application platform utilizing payment terminals	Sumitomo Mitsui Card Company, Limited
12th	December 9 (jointly held with WG6)	Diversification of discussions in other jurisdictions related to CBDC offline payments	Bank of Japan
		Offline payment mode of PayPay	PayPay Corporation
		Realization of hybrid function combining online and offline of Suica and its prospects	East Japan Railway Company

3.6 [WG6] Horizontal coexistence of CBDC and other payment instruments

3.6.1 Overview

Since its first meeting in July 2024, WG6 has held a total of eight meetings (including one joint meeting with another WG). While organizing the current state of businesses related to private digital money, issues including its smooth conversion and coexistence with CBDC, and competitive and collaborative areas were discussed.

Figure 18. Overview of WG6



3.6.2 Major issues discussed since the previous report

Building upon the overview of the current state of businesses related to private digital money, the WG continued to discuss topics such as smooth conversion between CBDC and private digital money, horizontal coexistence patterns, universal access, onboarding, instant payment capabilities, privacy and data utilization, and the potential of CBDC to boost cashless payments. Specifically, regarding the coexistence of CBDC and private digital money, the WG discussed issues including the role of payment service providers as intermediaries, the challenges for private digital money in smooth conversion to and from CBDC, and service designs of CBDC that enable horizontal coexistence.

In relation to these topics, considerations for introducing CBDC into in-store payments, cost allocation models for CBDC issuance and circulation, and initiatives regarding offline payments by private digital money providers were also discussed.

Figure 19. Themes and presenters of WG6 meetings

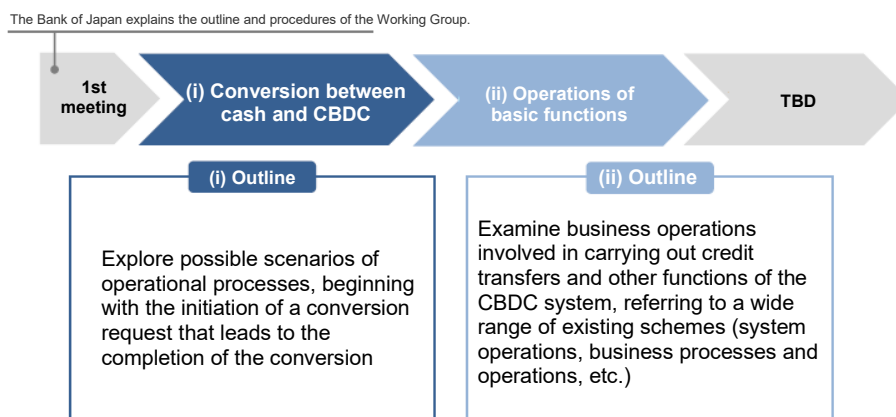
	Date	Theme	Presenter
1st	July 11, 2024	Scope and overview of WG6	Bank of Japan
2nd	September 18	Working Group (WG1)	Bank of Japan
		Overview of WG1 and proposal on how to proceed with discussions	NTT DATA Japan Corporation
3rd	November 15	CBDC ecosystems and horizontal coexistence patterns	Nomura Research Institute, Ltd.
4th	January 29, 2025	Introduction of white paper	JCB Co., Ltd. Ridgelinez Limited
		Presentation	PayPay Corporation
5th	March 27	Expectation for CBDC	East Japan Railway Company
		CBDC usage other than in-store payments	Rakuten Payment, Inc.
6th	June 13	Possibility that payment service providers play a role as intermediaries	NTT DOCOMO, INC.
		Smooth conversion between CBDC and private digital money	au Payment Corporation
7th	September 16	In-store payments and payment infrastructure of CBDC	Nomura Research Institute, Ltd.
8th	December 9 (jointly held with WG5)	Diversification of discussions in other jurisdictions related to CBDC offline payments	Bank of Japan
		Offline payment mode of PayPay	PayPay Corporation
		Realization of hybrid function combining online and offline of Suica and its prospects	East Japan Railway Company

3.7 [WG7] Operational flow of basic functions

3.7.1 Overview

Since its first meeting in September 2024, WG7 has held a total of eight meetings. The WG discussed possible operational processes involved in the conversion between cash and CBDC, as well as operations for the basic functions of the CBDC system. Discussions were held with feedback provided by the Bank on its development of a system for the pilot program and experimentation.

Figure 20. Overview of WG7



3.7.2 Major issues discussed since the previous report

Addressing a common process flow for CBDC transfers implemented within the system for the pilot program developed by the Bank, the WG discussed methods for ensuring consistency between ledgers and instant payment capability, as well as countermeasures for possible system downtime during processing. The WG also discussed issues in the process flow corresponding to CBDC system configuration patterns (i.e., a single system or a distribution across multiple systems).

Figure 21. Themes and presenters of WG7 meetings

	Date	Theme	Presenter
1st	September 26, 2024	Overview of WG, prerequisites, approach, etc.	Bank of Japan
2nd	November 7	Conversion between cash and CBDC	Seven Bank, Ltd.
			BIPROGY Inc.
3rd	January 30, 2025		Lawson Bank, Inc.
			Hitachi Channel Solutions, Corp.
4th	March 17	Operations of basic functions	Bank of Japan
5th	May 16	Background of the common process flow for credit transfers	Bank of Japan
6th	September 3	Error handling in private payment services	MUFG Bank, Ltd. NTT DATA Japan Corporation Bank of Japan
7th	November 5	Alternative method for common process flow for credit transfers	IBM JAPAN, Ltd. Bank of Japan
8th	December 10	CBDC system configuration	NEC Corporation

3.8 Future operations of the CBDC Forum

The CBDC Forum has held 84 meetings since July 2023, with presentations from a cumulative total of 163 firms, actively conducting discussions in cooperation with private businesses.

Figure 22. Record of meetings held to date

		2023						2024												2025												26	Total
		Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ja n	
	General Meeting	•						•									•							•							•	5	
	WG1			•	•	••	•	•	•	•	•	•																			11		
	WG2			•	•	•	•	•	•	•		•			•		•		•			•	•	•							15		
	WG3				•	•	•	•	•	•		•			•		•			•	•		•								14		
	WG4							•		•	•	•		•		•		•		•		•					•		•		12		
	WG5									•				•					•		•		•	•		•		•	•			11	
	WG6													•		•		•		•		•		•			•			•		8	
	WG7															•		•		•		•		•			•		•	•		8	
Number of meetings (monthly total)		1		2	3	4	3	5	3	5	4	4	2	4		6	1	5	1	4	2	4	2	5	3	1		3	2	1	3	1	84
Number of presenting firms (monthly total)					5	10	7	8	9	10	9	8	4	7		9		10	3	10	5	7	4	14	5	2		4	5	1	7		163

As discussions within each WG deepened, topics that span multiple WGs became increasingly common. In addition, there was growing demand to discuss such topics with member firms across WGs. To address these developments, we organized four joint meetings, and hosted webcasts open to other WGs from last autumn through winter.

Figure 23. Record of jointly held meetings

Date	Theme	WG
October 14, 2025	• Research on deposit tokens by advanced foreign banks • Privacy protection mechanisms in blockchain transactions • Token standards and compliance • Building a trusted internet infrastructure without barriers between Web2 and Web3	WG4, WG2
October 31	• Measures against fraudulent withdrawals in Internet banking • Application platform utilizing payment terminals	WG5, WG3

December 9	• Offline payments in private digital money	WG6, WG5
December 22	• Overview of the experimental system for CBDC pilot program • Introduction of the discussion paper "A Retail CBDC Design for Basic Payments: Feasibility Study" by the Bank of Canada	WG4, WG2

From the outset, the policy for operating the forum was to review discussion themes and schedules according to domestic and international developments as well as the progress of discussions. In light of this, from summer to autumn last year, we widely solicited comments from forum members regarding the operational methods and theme settings, followed by individual interviews mainly focusing on those who requested them.

As a result, regarding the operational methods, the following views were expressed: (i) increasing information sharing from the Bank while promoting more interactive discussions with member firms; (ii) reorganizing WGs to discuss a broader range of topics and cross-cutting themes; and (iii) allowing free participation in other WGs while providing a clearer overall view including the future schedule to the extent possible. Regarding theme settings, strong interest was observed related to the following areas: (iv) CBDC architecture, including institutional and system dimensions, (v) new technologies, including DLT-related technologies and tokenization, and (vi) CBDC ecosystem, including the API sandbox and its social implementation.

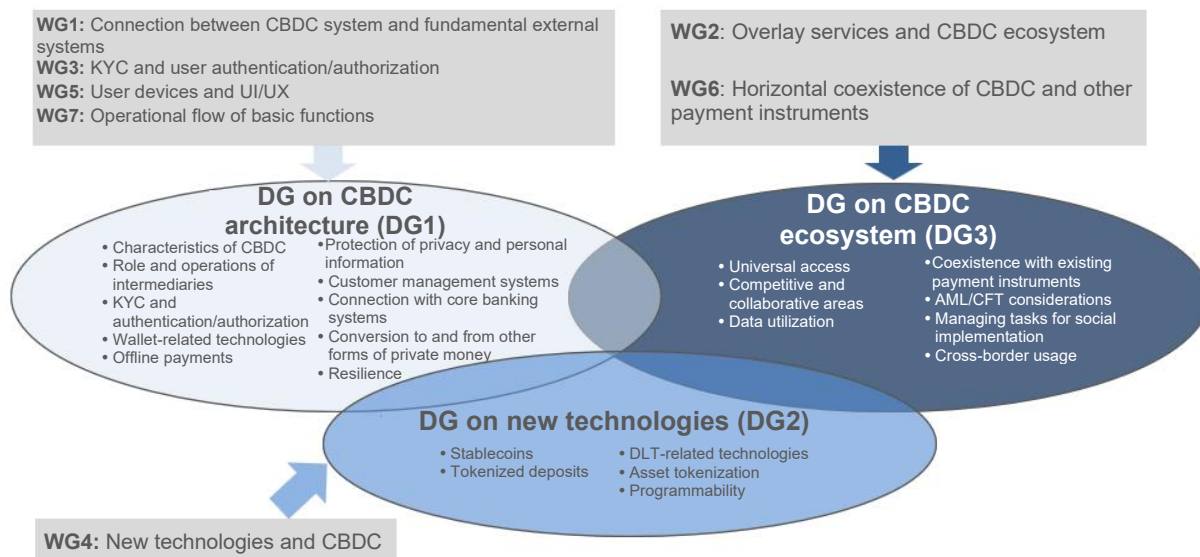
Figure 24. Feedback from interviews, etc.

Issues for operational methods	Issues for theme setting
(i) Information sharing from the Bank, interactive discussions	(iv) CBDC architecture (institutional and system dimensions)
(ii) Maturity of discussions in WGs, reorganizing WGs	(v) New technologies
(iii) Providing an overall view, future schedule	(vi) Ecosystem

Based on the above, we have decided to reorganize the current seven WGs into the following three discussion groups (DGs): (i) CBDC architecture (DG1), (ii) new technologies (DG2), and (iii) CBDC ecosystem (DG3). Keeping in mind the future landscape of payment systems including CBDC, we plan to conduct interactive and detailed discussions between the Bank and private businesses on a broad range of topics. Furthermore, the restructured CBDC Forum will be operated with a focus on initiatives that also contribute to the Bank's efforts related to wholesale payment systems.

Tentative agendas for the newly organized DGs and their relationships with WGs are roughly outlined below. For the time being, we plan to discuss issues mainly related to functions and frameworks that are required in the early stage of CBDC introduction, its social implementation and coexistence with existing payment instruments, as well as DLT-related technologies and tokenization.

Figure 25. Tentative agendas for new DGs and their relationship with WGs



4. Conclusion

In the pilot program, the Bank is continuing experiments and discussions from a broad perspective, based on the two pillars: "developing a system for the pilot program and experimentation" and "the CBDC Forum."

Going forward, the Bank will further explore technical considerations related to the ledger management system that forms the core of the CBDC system, as mentioned in 2.3. Regarding the CBDC Forum, the Bank plans to conduct interactive and detailed discussions with private businesses on a broad range of topics, keeping in mind the future landscape of payment systems including CBDC, as mentioned in 3.8.

The decision on whether to issue a CBDC in Japan should be made through public discussions. The Bank will remain committed to exploring measures that contribute to the development of a stable and efficient payment system suited to a digital society, thereby supporting said discussions.