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Japan Central Bank Digital Currency (CBDC) – Bank of Japan Completes Proof of Concept and Begins Pilot for Japanese CBDC

by Stephen M. Anstey

The Bank of Japan has completed its two-year proof-of-concept research for its prospective central bank digital currency (CBDC) and has now launched a pilot program. This makes Japan one of the largest economies in the world to advance to the pilot stage of CBDC development. Financial experts predict that $5 trillion in CBDCs will be circulating through the hands of up to 4 billion people by 2030. As the third largest economy, the potential adoption of a digital yen will have significant implications for global financial systems and the advancement of digital asset financial technology.

I. What is a Central Bank Digital Currency (CBDC)?

To understand the implications of Japan's significant advancement, it is necessary to understand what a central bank digital currency is.[1] A central bank digital currency, otherwise known as a CBDC, is "central bank-issued digital money denominated in the national unit of account" that "represents a liability of the central bank."[2] In other words, a CBDC is "a digital form of a country's sovereign currency."[3]

A CBDC operates by issuing "electronic coins or accounts" that are "backed by the full faith and credit of the [issuing] government."[4] The value and ownership of a CBDC is based on "the maintenance of a history of issuances and transactions" in what is known as a ledger.[5] While there are alternative models,[6] the "domestic implementation of many of the major CBDCs is expected to be on a centralized ledger," whereby the central bank will monitor and facilitate the digital transactions.[7]

This makes CBDCs unique from both cryptocurrency and traditional methods of digital payment.[8] Cryptocurrency is a blockchain based digital asset that relies on decentralized distributed ledger technology (DLT) where a digital database is "held and updated by distributed network participants independently, without any central authority."[9] And traditional "digital payment instruments" like credit cards are the "liabilities of private institutions," not the central bank.[10]

II. Japan's CBDC

The Bank of Japan is developing a CBDC for retail and wholesale use that relies on the cooperation of trusted institutions and the public. It defined its approach in October 2020 and has since conducted two years of trials. The Bank of Japan has now launched a three-year pilot program[11] to test additional functionality and bring in trusted intermediaries to facilitate the wider adoption of a digital yen by the public.

a. Proof of Concept

This two-year trial period was conducted in two proof-of-concept phases.[12]

Phase One began in April 2021 and ran through March 2022.[13] The Bank of Japan built "an experimental environment using several design alternatives" for the CBDC ledger and "evaluate[d] whether its basic

functions could be processed appropriately."[14] It evaluated three ledger designs: centralized account-based, centralized token-based, and shared account-based.[15] For Phase One, the Bank of Japan also relied upon a more traditional database structure.[16] To test system performance, each ledger was subject to a simulation of 100,000 users transacting through 5 intermediaries with between 500 and 3,000 transactions per second.[17]

Phase Two began in April 2022 and ran through March 2023.[18] Using the same experimental environment, the Bank of Japan "evaluated additional functions" it thought "would be desirable to confirm technical issues as early as possible."[19] In addition to the three ledger designs from Phase One, in Phase Two, the Bank of Japan also evaluated a shared token-based ledger design.[20] Phase Two ran the same performance test on each of the ledger designs as used in Phase One to assess the impact of the additional features and use of new technologies.[21]

Phase Two evaluated the "three separate blocks" of "additional functions" for CBDC. [22] The first block was "economic design" to evaluate "various types of safeguards for preempting a sudden shift from bank deposits to CBDC," including limits on holdings, amounts, and the number of transactions, automatic conversion of excess value, and the application of interest on holdings.[23] The second block explored "improving convenience of payments" to enhance "user convenience in payments," including scheduled remittance, batch execution of multiple remittances, and remittance as a payment request.[24] The third block evaluated "functions of coordination among intermediaries and connection with external systems," including the use of "multiple accounts" by one user, limits "per user on holding and transaction amount[s]," and alternative external system connection methods. [25]

In addition to new functions, Phase Two also tested the impact of new technologies on CBDC performance. Instead of the "traditional relation databases" used in Phase One, Phase Two experimented with a new and "increasingly popular" NoSQL database design. [26] The Bank of Japan also "explored the flexible-value token model in which the token's face value changes as tokens are merged or split as needed."[27] This differs from a "fixed-value token model" where the "token's face value is fixed and tokens are converted to ones of lower value as needed."[28]

Phase Two was an informative success. The Bank of Japan found that while "the performance advantage" of a "token-based" ledger would be "more easily utilized" with a "flexible-value approach" to tokens, "the resource requirements and difficulty of implementing additional functions might increase compared with the account-based model."[29] Regardless, and despite the additional functions and new technologies, "none of these additional functions would cause significantly lower performance and could ensure the scalability and reliability required for social implementation."[30]

In short, the Bank of Japan "has confirmed the technical feasibility of the basic functions of a CBDC." [31] It has now begun its pilot program.

b. Two-Part Pilot Program

The Bank of Japan launched its pilot program in April 2023.[32] The pilot program consists of two parts: conducting additional experimentation and exploring institutional arraignments.[33]

The pilot program will develop "a system for experiments, in which a central system, intermediary network systems, intermediary systems, and endpoint devices are configured in an integrated manner."[34] It will also specifically "test the end-to-end process flow while exploring the measures and potential challenges for connecting the experimental system with external ones."[35] Critically, the pilot

program is not assuming any transactions between "retailers and consumers in the program." [36]
To establish the necessary institutional arrangements for full implementation of a CBDC, the pilot program includes a "CBDC Forum" where relevant parties will "discuss and explore a wide range of topics with private businesses related to retail payments."[37] Some topics for discussion include the "operational process of intermediaries," "connecting the CBDC system with external ones," and dealing with "offline payments." [38]
Participants for the CBDC Forum will be announced by the end of July 2023 after which the Forum is slated to begin.[39]

III. Implications for the Future

Japan's advancement towards launching a digital yen is a milestone for the adoption of CBDCs as well as digital assets and financial technology more broadly.
In May 2020, only 35 countries had begun exploring a CBDC, but now "114 countries, representing 95 percent of global GDP, are exploring a CBDC."[40] Of those 114, 11 have "fully launched a digital currency," and only 18 have reached the pilot stage.[41] These launches, however, have not led to widespread adoption. "Less than 0.5% of Nigerians are using the eNaira," its CBDC, and even in China, the largest economy to pilot a CBDC, the e-RMB, its CBDC, only accounts for "0.13% of [its] outstanding monetary base."[42] Experts predict, however, that "more recent activity by a major western economy" like Japan may be what motivates "granter interest in having the optionality to launch" a CBDC. [43]
While the use of digital assets and distributed ledger technology has grown exponentially in recent years, main-stream consumer adoption has been somewhat limited. Some argue that because digital assets concern "the realm of money—a highly regulated domain in most countries," a lack of regulatory clarity has impaired widespread adoption. Experts predict that "mass adoption" requires "the support of sovereign institutions, regulated financial institutions, and large companies."[44] As such, the development and implementation of CBDCs have the potential to bring digital assets to the mainstream by putting government authorized digital money into the hands of billions of users for their "daily activit[ies]." [45]
In sum, the advancement of the world's third largest economy towards adoption and use of a CBDC is a significant step towards a future in which billions of people will transact trillions of dollars in CBDC at home and abroad. While the potential benefits of widespread CBDC use are considerable, such a fundamental change of global payment structures will require the "legal plumbing" to "be altered," providing "a whole new set of rails for global commerce and finance to run on." [46]

Kilpatrick Townsend's Digital Assets Regulation Blog

Kilpatrick Townsend's Digital Assets Regulation Blog (DARB) covers various aspects of digital assets (cryptocurrency, stablecoin, tokenization, and central bank digital currency (CBDC)) and distributed ledger technology (DLT) regulation, development, and administration, as well as related topics. For more information, please visit our website at Digital Assets Regulation (kilpatricktownsend.com).

Footnotes

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[1]For more information on CBDCs and digital assets generally, *see gen.*, Stephen Anstey, "A Brief Primer on Cryptocurrencies, Stablecoins, Tokenization, and Central Bank Digital Currencies, Digital Assets Regulatory Blog (DARP), April 3, 2023, A Brief Primer on Cryptocurrencies Stablecoins Tokenization and

Central Bank Digital Currencies (kilpatricktownsend.com).

[2] Citi GPS, "Money, Tokens, and Games," p. 24; *but see* Kumar, Brownstein, et. al., "Central Bank Digital Currency Tracker," Atlantic Council, Accessed June 9, 2023, Central Bank Digital Currency Tracker - Atlantic Council, defining a "Synthetic CBDC Architecture" as "not [having] a direct claim on the central bank" but rather an architecture by which "claims are a liability of private financial institutions that facilitate payments and real-time transactions." This architecture has yet to be adopted by any country considering a CBDC and is not relevant here.

[3] U.S. Dept. of the Treasury, *The Future of Money and Payments*, p. 19 (2022).

[4] Kumar, "Central Bank."

[5] White House Office of Science and Technology, *Technical Evaluation for a U.S. Central Bank Digital Currency System*, Sept. 2022, p. 34, 09-2022-Technical-Evaluation-US-CBDC-System.pdf (whitehouse.gov).

[6] *See id.*

[7] Citi GPS, "Money, Tokens, and Games, p. 26.

[8] For a more in-depth look at digital assets, *see gen.*, Stephen M. Anstey, "The State of Digital Assets Regulation and Foundational Terminology (Crypo, Stablecoin, and CBDC)," Jan. 3, 2023, The State of Digital Assets Regulation and Foundational Terminology (kilpatricktownsend.com).|

[9] Citi GPS, "Money, Tokens, and Games," p. 13.

[10] *Id.* at p. 24.

[11] *See* Norbert Gehrke, "The Bank of Japan's Framework for Participation in the CBDC Forum," *Medium*, March 24, 2023, The Bank of Japan's Framework for Participation in the CBDC Forum | by Norbert Gehrke | Tokyo FinTech | Medium.

[12] *See* Payment and Settlement Systems Department, Bank of Japan, "Central Bank Digital Currency Experiments Results and Findings from 'Proof of Concept Phase 2'" (May 2023), p. 1, dig230529a.pdf (boj.or.jp).

[13] *See id.*

[14] *Id.*; *see also* Payment and Settlement Systems Department, Bank of Japan, "Central Bank Digital Currency Experiments Results and Findings from 'Proof of Concept Phase 1,'" (May 2022), rel220526a.pdf (boj.or.jp).

[15] *See* Payment and Settlement, "Proof of Concept Phase 2," p. 3.

[16] *See id.*

[17] *See id.* at p. 7.

[18] *See id.* at p. 1.

[19] *Id.* at p. 1.

[20] *See id.* at p. 3.

[21] *See id.* at p. 7.

[22] *Id.* at p. 4.

[23] *Id.* at p. 2, 4.

[24] *Id.*

[25] *Id.* at p. 2.

[26] *Id.*

[27] *Id.*

[28] *Id.*

[29] *Id.* at p. 24.

[30] *Id.*

[31] *Id.*

[32] *See Bank of Japan,* "Commencement of Central Bank Digital Currency Experiments: Pilot Program," Feb. 17, 2023, dig230217b.pdf (boj.or.jp).

[33] *See id.* at p. 1.

[34] *Id.*

[35] *Id.*

[36] *Id.*

[37] *Id.*

[38] *Id.* at p. 3

[39] *Gehrke, "Framework for Participation."*

[40] Kumar, "Central Bank."

[41] *Id.*

[42] Citi GPS, "Money, Tokens, and Games," p. 28.

[43] *Id.* at p. 33 (also specifically suggesting Europe's interest as a motivator).

[44] *Id.* at p. 9.

[45] *Id.*

[46] *Id.*