A unified ledger in practice: lessons from Project Hangang

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Abstract

The unified ledger concept (BIS, 2023) builds on the existing two-tier monetary system with the central bank as the foundation. The Bank of Korea's Project Hangang, named after the river Han that flows through Seoul, is an implementation of the unified ledger concept, having recently conducted live retail transactions involving some 80,000 users using tokenised deposits, settled in tokenised central bank money. Additional use cases for Hangang are in development, including those involving the disbursement of public funds using smart contracts, illustrating the functionality that flows from tokenised platforms. This paper sets out the architecture of Hangang and discusses the nature of the tradeoffs involved. One key design choice is on how the central bank provides central bank money as the settlement medium on the unified ledger. One approach is to link the platform with the central bank's existing real-time gross settlement (RTGS) system. Another approach, taken by Hangang, is to issue wholesale central bank money in tokenised form directly on the platform. There are important tradeoffs between these two approaches, including questions on the legal nature of tokenised central bank money, as well as a range of operational issues.

1 Introduction

The history of central banking has been one of continuous evolution in response to changes in the economic and financial environment. Throughout this evolution, central banks have been the guardians of the monetary system, with central bank money serving as its anchor. In particular, central banks have progressively enhanced the functionality of RTGS infrastructure to deliver greater efficiency and robustness to the backbone of the monetary system.

Successive generations of system upgrades have introduced priority queuing, liquidity-saving mechanisms (LSMs), time-designated settlement, queue management, bilateral and multilateral limits, and gridlock resolution algorithms. Such features, which provide a degree of programmability to participants, have

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substantially reduced participants' intraday liquidity needs and enhanced the resilience of wholesale settlement, reflecting a sustained commitment to improving the efficiency of the existing monetary infrastructure.

Yet today, as tokenisation and distributed ledger technologies rapidly reshape the monetary landscape, central banks are responding to the arrival of programmable, ledger-based financial infrastructure to further enhance the two-tier monetary system by enabling large-value payment systems to interoperate with, and provide settlement in central bank money for, tokenised platforms.

Several central banks have already begun exploring the possibilities in this direction.[2] For the setting of the Sintra Forum, the European Central Bank (ECB)'s exploratory work on new technologies for wholesale settlement is of particular interest. On the one hand, the ECB's Pontes initiative illustrates how the strengths of existing RTGS infrastructure can be harnessed to support emerging tokenised environments without requiring an abrupt transition. On the other hand, the ECB's Appia initiative aims to deliver, by 2028, a blueprint for an integrated, ledger-based tokenised wholesale financial ecosystem in Europe, anchored in tokenised central bank money (ECB, 2026).

A useful guide in this journey is the unified ledger concept[3] set out in BIS (2023) where tokenised central bank money, tokenised commercial bank deposits and tokenised assets coexist on a shared, programmable platform. When the three elements coexist on the same programmable platform, the traditional separation of messaging, clearing and settlement can be combined into a single, integrated process, enabling atomic settlement. In particular, because final settlement takes place in central bank money, settlement finality is ensured and the two-tier monetary system, comprising the central bank and commercial banks, is preserved, thereby safeguarding the stability of the current monetary system. It is, by design, a two-tier construct: central bank money remains the anchor, and commercial bank deposits the principal means of payment.

Taking that concept into practice means building the system so that the core attributes of the two-tier structure – above all the singleness of money – carry over into the tokenised environment. Project Hangang can be seen as a demonstration that this can be done at scale. The project also offers useful lessons on the design choices.

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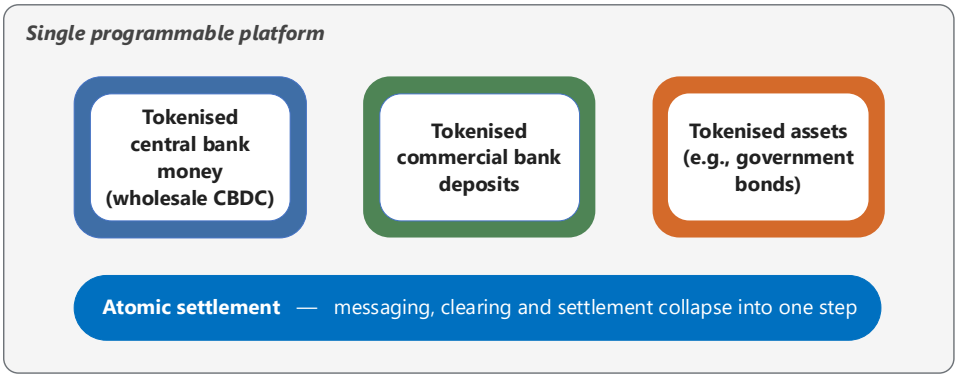
[2] Notable examples include the Regulated Liability Network (RLN), with the participation of the New York Innovation Center at the Federal Reserve Bank of New York; Global Layer One (GL1), led by the Monetary Authority of Singapore; and DREX, advanced by the Banco Central do Brasil. At the global level, the Bank for International Settlements (BIS) and the Institute of International Finance (IIF), together with seven central banks and more than 40 leading financial institutions, are currently conducting Project Agorá, which combines tokenised central bank money and tokenised commercial bank deposits to address the inefficiencies of wholesale cross-border payments (BIS, 2024, 2026).

[3] For a more detailed exposition of the unified ledger concept, see BIS (2023).

Chart 1

Trilogy underpinning a unified ledger



Sources: adapted from BIS (2023, 2025).

The Bank of Korea, in cooperation with the Financial Services Commission, the Financial Supervisory Service, other relevant authorities and participating commercial banks, is pursuing Project Hangang, which builds a permissioned ledger, the Digital Currency System (DCS), grounded in the unified ledger concept and capable of accommodating the full trilogy of tokenised central bank money, tokenised commercial bank deposits and other tokenised assets. The live transactions using tokenised wholesale central bank money and tokenised commercial bank deposits were among the first to take place in a real-world operating environment, with the participation of households and businesses.

The live transactions used wholesale central bank digital currency (CBDC) and tokenised deposits, and ran for three months from April to June 2025, involving approximately 80,000 users and 12,000 selected merchants. Beyond everyday transactions, programmability features were applied to the tokenised deposits to demonstrate the value-added functionality of digital currency through use cases such as rule-based automated transfers and safeguards against the misuse of disbursed public funds. In contrast to experiments conducted in controlled environments according to predefined scenarios, these transactions took place in a public-facing live environment, demonstrating that a unified ledger could function as part of the payment system at scale.

Two features of Project Hangang are inherent to a unified ledger. The first is the way interbank transfers are settled. Project Hangang uses the “burn-and-issue” mechanism that keeps to the spirit of the current two-tier monetary system. The system retires tokenised deposits at the sending bank and re-issues them at the receiving bank, with settlement between the banks in central bank money. This reproduces, in tokenised form, the discipline of the two-tier system and ensures that payments using deposits always go through at par, thereby preserving the singleness of money.

The second design feature of Project Hangang is a practical one which involves the separation of the currency layer, which carries value, from the programming layer, which carries the conditions of use, so that programmability cannot alter the fungibility or par value of the money beneath it. This layered architecture is not

inherent to a unified ledger but was adopted for practical considerations. Section 2 describes the design choices in more detail.

The Bank of Korea has also been working on proof-of-concept (PoC) exercises involving tokenised assets. These tested two settlement models: issuing an asset directly on a single ledger alongside wholesale CBDC, versus issuing assets on an interlinked satellite ledger whose payments settle in central bank money. These design choices highlight important tradeoffs in the design of a unified ledger between technical elegance and practical institutional considerations. Section 2 returns to this discussion of the design choices.

The remainder of the paper is organised as follows. Section 2 turns to the key design choices: why the system is built on a ledger at all, and how the new ledger is integrated into the existing settlement framework. Section 3 reports on what Project Hangang has done so far and next steps. Section 4 turns to the future agenda, from tokenising government bonds to linking up across borders through Project Agorá, and what these developments mean for monetary policy and financial stability. Section 5 concludes.

2 System architecture: key design choices

This section sets out the principal design choices behind the DCS. It begins with why the system is built on a permissioned distributed ledger and validated in the way it is, and then turns to how such a ledger is integrated with the existing RTGS system, BOK-Wire+. The remaining choices concern how the core attributes of the two-tier system are carried into the tokenised environment, from the settlement of interbank transfers to the architecture through which the ledger accommodates a broader range of tokenised assets.

2.1 Why a ledger, and an authoritative validator

A natural question arises at the outset. If the central bank is to be the authoritative validator of the system, recording and finalising every transaction, why build on a distributed ledger at all, rather than on the kind of centralised database that the central bank already operates for its RTGS system, BOK-Wire+?

The short answer is that the value of the ledger lies not in dispensing with a trusted operator but in the capabilities that the ledger brings. A programmable ledger holds money and assets as tokens whose behaviour is governed by programmes (smart contracts) that implement their transfers across holders. In this way, the terms of a transaction (its timing, its counterparties, the assets exchanged and the conditions on their use) are expressed and enforced in the same place where value moves. This is what makes atomic settlement possible: the delivery of an asset and the payment for it, or the two legs of a foreign exchange transaction, can be bound into a single, indivisible operation in which either both legs of the transaction are completed or neither is. It is also what makes the platform “composable”: independently

developed assets and contracts can interoperate on a common, shared state, so that many parties transact on the same infrastructure without the bilateral messaging and reconciliation that separate systems require. A centralised database can be programmed, but it does not give institutions that do not fully trust one another a common venue on which tokenised money and tokenised assets, issued by different parties, can be combined and settled together.

The choice of who performs the role of the validator (or validators) is a separate question from the choice of the ledger form. In a public permissionless blockchain that is familiar from the world of crypto, no single party is trusted to maintain the ledger; instead, many validators act in concert to maintain the integrity of the ledger. Validators act independently but have to reach consensus on what constitutes the true state of the ledger. In order for them to perform their role, validators are rewarded to reach such consensus, and the reward that compensates them for the risk of miscoordination rises with the stringency of the consensus mechanism. The most stringent form of consensus is that they reach unanimity in agreement. A lesser form of consensus is that a large majority – perhaps a 2/3 supermajority – agree on the true state of the ledger. The higher is the required stringency of agreement, the larger is the risk that the validators fail to reach consensus, and hence the larger must be the rewards they receive for successfully reaching consensus. Because the resources needed for such rewards are ultimately borne by fees paid by users, decentralised ledgers depend on some degree of congestion to generate the necessary fees. The more stringent is the standard for consensus, the higher are the necessary thresholds for agreement among validators and so the higher are the necessary rewards that go to validators. This argument is developed more formally in Shin (2026).

The upshot is that capacity is constrained in a decentralised ledger, and new chains with laxer consensus standards enter to serve those priced out. In this way, the landscape of decentralised ledgers is prone to fragmentation, undercutting the very network effects that give money its value as a social convention and coordinating institution.

A central bank does not face the problem of having to reward validators. As the institution that already anchors the singleness of money, it can act as an authoritative validator. The consensus mechanism is neither Proof of Work, nor Proof of Stake. Instead, the blockchain can operate under a Proof of Authority arrangement, dispensing with consensus rents and the pressure to fragment while retaining the programmability and composability of the token form.[4] Ultimately, it is the trust in the central bank that sustains the monetary system, just as it does today.

In this sense, the ledger is therefore not a device for removing the central bank from the centre of the system (as envisaged in the crypto monetary agenda); it is instead

[4] As noted in BIS (2025), a unified ledger may or may not be implemented using distributed ledger technology; the underlying programmable platform is technology-agnostic. The Bank of Korea nonetheless adopted it for the DCS, as it offers the most established available means of realising the programmability and composability central to tokenisation.

a device for extending the central bank's anchoring role into a programmable environment.

This extension of the central bank's role does not necessarily require a single ledger: as the hub-and-spoke design set out below makes clear, governance of the spoke ledgers on which other assets are issued can be distributed among their respective communities, while the payment leg remains anchored at the hub in central bank money.

2.2 Integrating the new ledger into the settlement framework

Since its launch in 1994, BOK-Wire+, the RTGS system operated by the Bank of Korea, has served as the central infrastructure of the Korean monetary system. As of end-December 2025, 134 institutions participate in the system, which processes large-value funds transfers between the Bank of Korea and financial institutions, as well as among financial institutions themselves, on a real-time gross settlement basis.

Following the migration to a next-generation system in 2009, BOK-Wire+ has provided basic programmability, most notably through bilateral and multilateral offsetting under its LSM, which has materially reduced participants' settlement liquidity needs. Beyond this, BOK-Wire+ has come to function as the hub of Korea's payment and settlement landscape, interconnecting with the country's principal financial market infrastructures across securities settlement, retail fast payments and open banking, and foreign exchange settlement through Continuous Linked Settlement (CLS).

In the securities settlement segment, the link to the Korea Securities Depository (KSD) supports delivery-versus-payment (DvP) settlement. For the exchange-traded government bond settlement system operated by a central counterparty (CCP), the Bank of Korea further provides intraday liquidity through repurchase agreements. In the retail payments segment, the link to the Korea Financial Telecommunications & Clearings Institute (KFTC) supports a deferred net settlement (DNS) arrangement that underpins a fast payment system in which banks and securities firms participate. The same DNS arrangement also underpins the open banking system, in which fintechs and big techs participate alongside banks. In the foreign exchange segment, the link to the CLS system enables payment-versus-payment (PvP) settlement, eliminating foreign exchange settlement risk.

In this context, the case for a new, programmable ledger raises the natural question on how a unified ledger is connected to the RTGS system. Two broad options can be considered. The first is to link the new ledger to BOK-Wire+ in the same way that BOK-Wire+ currently links to external systems, so that the cash leg of transactions continues to settle in BOK-Wire+. The second is to issue wholesale central bank money in tokenised form directly on the new ledger – as a wholesale CBDC.

The first option draws on the so-called "trigger" solution under which a transaction on the new ledger, on which tokenised assets are issued and circulated, automatically

triggers a corresponding funds transfer in BOK-Wire+. Structurally, this mirrors the way BOK-Wire+ already interfaces with external systems such as KSD, KFTC and CLS.

The trigger solution offers several advantages. First, participants can continue to rely on the LSM and other liquidity saving features already embedded in BOK-Wire+. Second, no separate pool of settlement liquidity needs to be ring-fenced for transactions on the new ledger, which keeps participants' liquidity management burden to a minimum. Third, this approach obviates the technical and institutional considerations associated with the central bank directly issuing wholesale CBDC on the new ledger.

That said, the trigger solution faces constraints in achieving technical interoperability arising from the difference in operating hours between the new ledger on which assets are issued and BOK-Wire+ where the cash leg settles. More fundamentally, the core benefits of tokenisation, namely programmability and composability, cannot be harnessed directly for the cash leg of a transaction. In other words, the arrangement falls short of true atomic settlement and amounts only to a partial implementation.

These limitations become more apparent in a range of potential use cases. For instance, in digital vouchers or government disbursements, the conditional nature of the disbursement of funds contingent on pre-specified conditions can be implemented far more flexibly when the settlement asset itself is tokenised.

For these reasons, Project Hangang has taken the route of tokenising central bank reserves and issuing them directly on the unified ledger, the DCS. Implementing this option, however, requires that a number of policy and operational challenges be addressed.

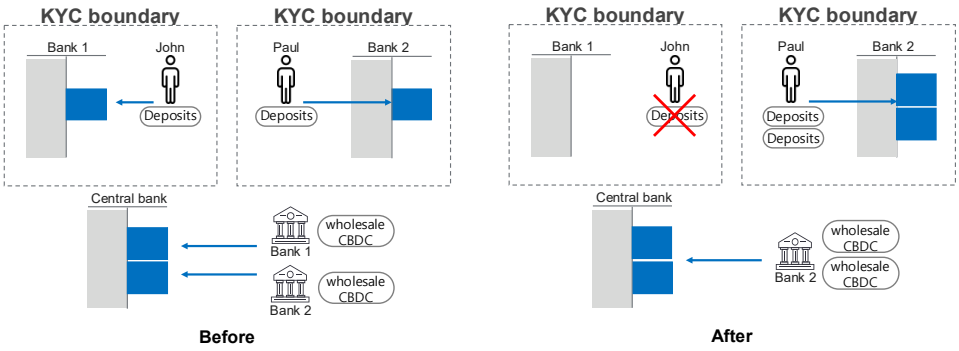
The first challenge concerns the misalignment of operating hours between BOK-Wire+ and the new ledger. The DCS is intended to operate on a 24/7 basis, whereas BOK-Wire+ closes at 8 pm. As a result, BOK-Wire+ would need to be able to provide continuous support consistent with the round-the-clock operation of the new system, which makes a comprehensive review of its operating-hours framework unavoidable.

The second challenge involves liquidity fragmentation: liquidity would be managed separately across BOK-Wire+ and the new ledger, giving rise to a more complex liquidity management problem. This is particularly acute for securities settlement on the new ledger, where settlement amounts are large and the need to secure settlement liquidity becomes correspondingly more pressing. So long as the operating-hours mismatch between the two systems persists, the central bank would therefore need to provide intraday liquidity on the new ledger as well, in the same way as it currently does for securities settlement on BOK-Wire+. Since intraday liquidity is currently provided on a collateralised basis, extending this framework to the new ledger environment would require additional system work, including modifications to the collateral management system, with a corresponding increase in the overall complexity of the system. This is a further consideration that needs to be taken into account.

2.3 Interbank transfer: burn-and-issue

Chart 2

Burn-and-issue: balance-sheet positions before and after a payment from a customer of Bank 1 to a customer of Bank 2



Sources: Garratt and Shin (2023); reproduced in BIS (2023).

Two building blocks underpin this design. Tokenised deposits are the everyday means of payment: each is a deposit at a regulated bank, redeemable at face value. That matters most when settling asset trades, where any gap between the price of an asset and the value of the money paid for it creates a dual-price problem and leaves the DvP leg exposed. A tokenised deposit on its own, though, moves money only between customers of the same bank; to settle between banks, the platform also carries wholesale central bank money. With money and assets on the same venue, delivery and payment can be locked together and settled in a single atomic step.

Interbank transfers of tokenised deposits were designed using the burn-and-issue mechanism. That is, three steps are processed as a single transaction through a smart contract: (i) the burning of tokenised deposits at the sending bank; (ii) the transfer of wholesale CBDC between the sending and receiving banks; and (iii) the re-issuance of tokenised deposits at the receiving bank. This achieves atomic settlement; should any one of the three steps fail, the entire transaction is voided, eliminating the risk of partial settlement. In Project Hangang, this mechanism operates in an environment in which wholesale CBDC and tokenised deposits coexist on a single programmable ledger. Even when the sending and receiving banks differ, the user experience remains the same as that of a conventional interbank transfer, while settlement is completed in real time, with all claims and obligations arising from the transaction discharged simultaneously.

The essence of this burn-and-issue structure lies in the fact that it reproduces, in a tokenised environment, the same procedure by which interbank deposit transfers take place under the current two-tier monetary system. That is, a transaction in tokenised deposits between individual users who are customers of different banks alters only the liability relationship between each bank and its own customer, while final settlement between the banks takes place in central bank money, with no separate credit exposure between them.

The decision to design the wholesale leg of interbank settlement as a burn-and-issue structure is a key device for preserving the singleness of money, in that it ensures that transactions in tokenised deposits always take place at par (Garratt and Shin, 2023). This is a fundamental point of distinction from stablecoins, where the claim itself is simply transferred. In such a simple-transfer model, the recipient ends up holding a claim on the issuer rather than on the sender's bank, and the value of the token can therefore deviate from par depending on the issuer's creditworthiness and liquidity position, as well as on the market's risk appetite.

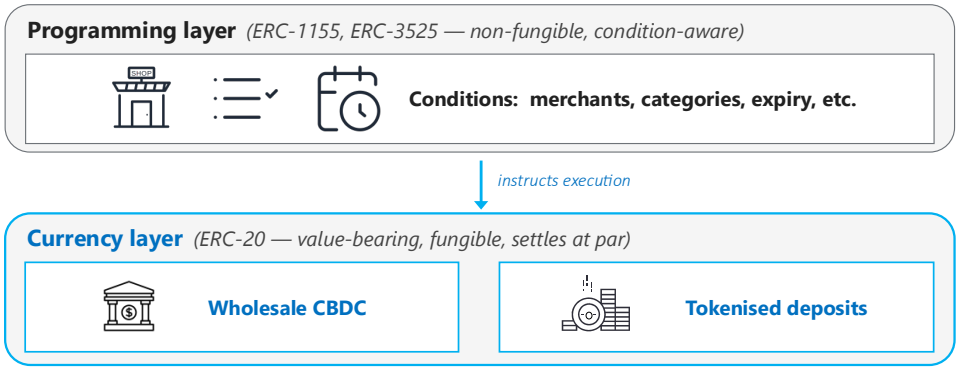
Singleness is particularly important for the settlement of large transactions, such as the purchase of government bonds. Such transactions must be exact: a token that trades at a small and variable discount cannot discharge a precisely specified obligation, and “approximate singleness” is, in this setting, an oxymoron.

By contrast, tokenised deposits use central bank money as the settlement asset and therefore payments go through at par regardless of which bank issues them. Moreover, the fact that all participating banks share the same regulatory and supervisory framework, including deposit insurance and access to the lender of last resort, provides further institutional underpinning for this equivalence. By virtue of the burn-and-issue structure, tokenised deposits are recorded, at any point in time, as a liability of exactly one bank. This eliminates at source the ambiguity over liability attribution that can arise when tokens are issued and circulated as bearer instruments: namely, the situation in which a recipient takes on a claim on an issuer with which it has no business relationship. Furthermore, at both the sending and the receiving stages, users hold a direct claim only on banks that have themselves carried out know-your-customer (KYC) checks on those users, which also resolves the potential for anti-money laundering and combating the financing of terrorism (AML/CFT) circumvention associated with the use of bearer instruments. From the perspective of the issuing bank as well, the scope of KYC responsibility is clearly delineated, since situations in which liabilities are transferred to holders on whom the bank has not itself performed KYC do not arise (Garratt and Shin, 2023). This goes beyond efficiency at the level of individual transactions and underpins the integrity of the financial system as a whole. A structure in which every token holder remains within the KYC and regulatory perimeter of an authorised bank with clearly defined responsibility helps prevent illicit fund flows associated with money laundering and terrorist financing.

2.4 The currency/programming layer separation

Chart 3

Separating the currency layer from the programming layer



Source: Bank of Korea

In terms of technical implementation, Project Hangang's DCS is built on the principle of separating the currency layer, which transfers token value itself, from the programming layer, which expresses the conditions of use and the execution logic layered above it. This is a core design decision aimed at securing the flexibility afforded by programmability without compromising the singleness of money[5], in an environment in which wholesale CBDC, tokenised deposits and the objects that implement programmability all coexist on a single distributed ledger.

More specifically, these tokens are implemented on the basis of ERC-20, the leading technical standard for fungible tokens, and have been issued in a plain vanilla form, with no restrictions on the purpose, duration or sector of use. Since no additional logic is embedded in the token itself, the inherent properties of the singleness of money and full fungibility are guaranteed at the architectural level. As a result, tokenised deposits issued by the same bank are fungible regardless of the holder or the channel through which they were acquired. Value transfers between tokenised deposits issued by different banks are processed at par through atomic interbank settlement using wholesale CBDC as the settlement asset, in accordance with the burn-and-issue structure discussed above.

By contrast, the programming layer has been constructed separately from the currency layer in order to implement programmability, for instance through digital vouchers. The objects on this layer are implemented following ERC-1155, a technical standard that separates token value from conditional logic.[6] Since programming-

[5] By keeping the conditions of use in the programming layer rather than embedding them in the currency token itself, this separation guards against any compromise of the equivalence between money subject to predefined conditions of use and money that carries none: the currency itself remains fully fungible and settles at par. The design also bears on a concern raised in connection with retail CBDC, namely the risk to individual privacy and the scope for government control. Because households and businesses transact in tokenised deposits, their personal data is held only by their own bank, so neither the central bank nor the government can monitor or control the spending of individual citizens.

[6] This is similar to the Purpose-Bound Money (PBM) wrapper pattern articulated by the Monetary Authority of Singapore in Project Orchid (MAS, 2023). The Bank of Korea plans to apply ERC-3525, an evolved form of the ERC-1155 standard, in Project Hangang Phase II.

layer objects do not themselves function as means of payment that transfer value, they are neither directly traded nor redeemable for cash; rather, they serve as messages, in that they instruct the system to execute the specified transfer in the currency layer when predefined conditions are met, such as eligible merchants, permitted categories of goods and services, and expiry dates. Accordingly, the actual movement of funds and the settlement between banks take place entirely within the currency layer, while the objects on the programming layer serve only to define and verify the conditions and flows of execution.

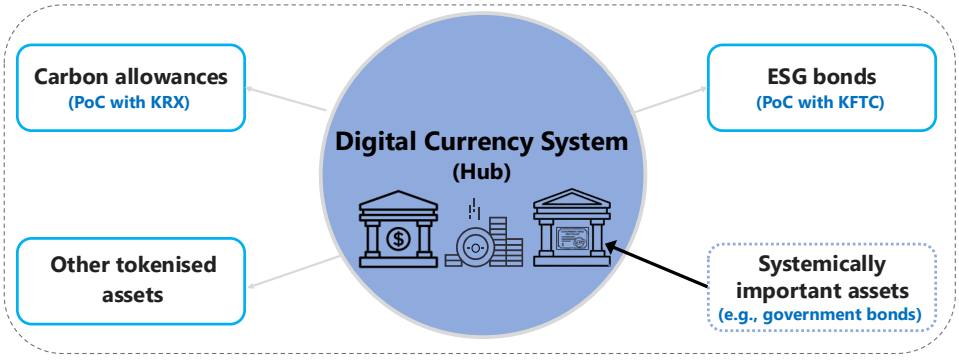
This separation of layers is significant in two respects. The first is the isolation of operational risk. Design changes or coding errors in vouchers and other programming-layer objects do not directly affect the value of the currency layer, and regardless of what conditional logic is added in the programming layer, the currency itself remains fungible and is settled at par. The second is flexibility in extending functionality. Even when new use cases emerge, functionality can be extended by adding or replacing smart contracts in the programming layer, without modifying the currency layer itself. This enables a swift response to changes in market demand. In this way, this layer separation provides a foundation on which a wide range of policy-related and commercial use cases can be safely accommodated in a tokenised environment, without undermining the inherent properties of money.

The Bank of Korea also built a system to manage the smart contracts themselves. Before a contract runs on the ledger, its code is checked and approved, so that only verified contracts are deployed: a guard against buggy or wasteful code that could misfire or slow the network.

2.5 Logically unified, but physically distributed: hub-and-spoke

Chart 4

Hub-and-spoke: a logically unified, physically distributed ledger



Source: Bank of Korea

The full benefits of tokenisation can be realised on a unified ledger, where central bank money, commercial bank deposits and financial assets are all tokenised and reside in the same venue (BIS, 2025). To accommodate a wider range of tokenised assets, however, the Bank of Korea has placed the DCS at the hub of a hub-and-spoke structure, with separate ledgers for other tokenised assets arranged around it

as spokes. These ledgers are connected through a unified inter-ledger protocol (UILP), which comprises the Secure Asset Transfer Protocol (SATP), gateways and other components, thereby ensuring the logical coherence of asset transfers across ledgers.

In this structure, each spoke ledger retains its own governance arrangements, while settlement of the payment leg is unified through the hub (the DCS) in central bank money. The PoC on carbon emission allowances under Project Hangang, conducted in connection with a simulation system operated by the Korea Exchange (KRX), and the PoC on digital ESG bond subscription are concrete instances in which this structure was tested.

As noted above, however, how much tokenisation can deliver depends on how far the perimeter of assets on the hub extends. The gateway-based linkage on which spoke ledgers rely faces inherent limitations, notably network latency and delays in transaction confirmation. More fundamentally, cross-asset composability and atomic settlement can be fully realised only when assets and money reside on the same ledger, suggesting that greater convergence would bring fuller benefits. Convergence, however, has practical limits: regulatory requirements, asset-specific market structures and governance considerations mean that a wide range of assets may need to remain on spoke ledgers. The question then becomes one of prioritisation. The greater the benefit an asset would draw from coexisting with money on a single ledger, the stronger the case for hosting it on the hub.

Government bonds are the clearest such case. As benchmark safe assets, they should preferably be tokenised on the hub, that is, on the Bank of Korea's DCS, rather than on a spoke ledger. When tokenised government bonds and wholesale CBDC reside on the same ledger, the bond and the corresponding payment settle atomically in a single DvP transaction. Moreover, since government bonds serve as the principal eligible collateral for repurchase (repo) transactions and central bank lending, the verification of their eligibility and the updating of collateral pools can be automated through smart contracts, thereby enhancing the timeliness of intraday liquidity provision. Furthermore, in times of stress, market participants rely most readily on safe assets; locating these on the hub, where settlement finality is robustly established, also helps preserve the core resilience of the financial system in a tokenised environment.

3 Project Hangang: Phases I and II

The Bank of Korea conducted the Phase I live transactions in the second quarter of 2025, with participation by retail users and merchants. Looking ahead, Phase II will refine the system in light of the areas for improvement identified in the Phase I live transactions and broaden the range of use cases. This section examines Project Hangang's live transactions in detail, focusing on the main outcomes of the Phase I live transactions and the key use cases to be pursued in Phase II.

3.1 DCS development and institutional arrangements

Once the core architecture had been settled, attention turned to the system-build stage and to the institutional arrangements needed for live transactions. This subsection describes three key decisions taken at this stage: first, the choice of the underlying ledger technology for the DCS; second, the modalities of the linkage between the DCS and BOK-Wire+, including on/off-ramps; and third, the application of deposit-related institutional rules, namely reserve requirements and deposit insurance, to tokenised deposits. Each decision is discussed in turn below, together with its background, implications and outstanding issues for future work.

Choice of the underlying ledger

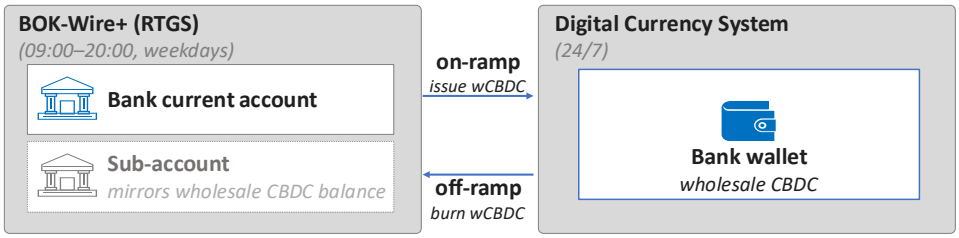
The Bank of Korea elected to build the DCS on an open-source, permissioned platform. As discussed above, the central bank is the authoritative validator, so that the DCS operates in a manner akin to Proof of Authority rather than the decentralised consensus of public permissionless blockchains. The choice of an open-source solution rested on the fact that it avoids vendor lock-in and enables a rapid response to security issues through transparent verification; its large developer community is also a natural source of skilled personnel. Among permissioned platforms, the Bank of Korea's choice reflected key requirements such as programmability, scalability, stability and general-purpose usability.

Looking ahead, accommodating large-volume transaction processing and the trading of a broader range of tokenised assets in the live operating environment will require further work on scalability and other technical issues.

Linkage between BOK-Wire+ and the DCS

Chart 5

Linkage between BOK-Wire+ and the DCS: on-ramp, off-ramp and reconciliation



Source: Bank of Korea

The linkage between the DCS and BOK-Wire+ has been designed, in light of the current constraints[7], so that the two systems do not communicate directly. Instead, transaction data are transferred offline and aligned through regular reconciliation. To support this arrangement, a sub-account has been newly opened within BOK-Wire+, separately from each participating bank's existing current account, to mirror the wholesale CBDC balance that the bank holds on the DCS.

On-ramp requests are processed in two steps. A participating bank first transfers funds from its existing current account to the sub-account; an equivalent amount of wholesale CBDC is then issued to that bank's wallet on the DCS. Off-ramps follow the reverse sequence: a wholesale CBDC is burned on the DCS and the same amount is transferred from the sub-account back to the existing current account through BOK-Wire+. Transaction records between the two systems are exchanged via encrypted, secure USB media, with a triple confirmation procedure applied at each file exchange. Changes in each bank's wholesale CBDC balance arising from interbank tokenised deposit transactions executed on the DCS during BOK-Wire+ off-hours are captured by a snapshot taken at 3 pm on the following business day, which then drives a reconciliation procedure aligning sub-account balances with the corresponding wallet balances on the DCS.

It is worth pausing on what this arrangement reveals, because the gap between concept and current practice is itself instructive. The unified ledger is often pictured as a single, seamless venue on which money and assets change hands in one atomic step. In live operation today the reality is more modest. The DCS and BOK-Wire+ do not communicate in real time; balances are mirrored across a sub-account, transaction files are exchanged on encrypted media with manual confirmation, and the two systems are squared only by a reconciliation run on the following business day. This is a serviceable arrangement for a time-boxed pilot, but it is plainly not a

[7] First, BOK-Wire+ is designated as Critical Information Infrastructure (CII) under the Act on the Protection of Information and Communications Infrastructure. A direct, real-time linkage with the DCS, whose institutional and regulatory framework is still being established, therefore requires measures that satisfy the security requirements applicable to CII. To this end, the Bank of Korea plans to engage external experts in 2026 to design a system upgrade that meets these requirements, with the final design to be confirmed following a security review. Second, BOK-Wire+ operates between 09:00 and 20:00 on business days, whereas the DCS operates on a 24/7 basis, so that on/off-ramps cannot be processed in real time during the hours when BOK-Wire+ is closed; going forward, the Bank of Korea intends to consider aligning the operating hours of the two systems by securing the necessary staffing.

foundation for continuous commercial operation. It also locates the binding constraints precisely where the two systems meet: the mismatch in operating hours, the legal status of the settlement asset that passes between them, and the provision of intraday liquidity once the large-value system has closed. These are the binding constraints, and they measure the distance still to be travelled.

Two key challenges remain to be addressed even once the current constraints have been resolved and the operating hours of the two systems have been aligned. The first concerns the status of wholesale CBDC on the DCS. Namely, the question is whether to adopt a real-time mirroring approach that also synchronises balance changes arising from transactions within the DCS itself[8], or to treat wholesale CBDC on-ramped onto the DCS as an independent native token operated separately from the bank's current account on BOK-Wire+[9].

The second challenge lies in how to address the liquidity fragmentation that arises between BOK-Wire+ and the DCS. This calls for an integrated design in which each ledger has its own liquidity-provision facility (intraday overdrafts in BOK-Wire+ and on the DCS), while integrated management arrangements, such as a consolidated view of reserve holdings and a unified calculation of required reserves, are also worth considering to ease the burden on participating banks.

Application of reserve requirements and deposit insurance

One of the core design principles for the DCS has been to place tokenised deposits within the same institutional envelope as conventional deposits. Since the DCS replicates the two-tier structure of the existing monetary system, that is, central bank money paired with bank deposits, in the form of wholesale CBDC paired with tokenised deposits, ensuring institutional consistency with the established monetary and deposit framework is fundamental to the credibility of the system.

On this basis, the Bank of Korea has, through its internal regulations, classified tokenised deposits as reserve-eligible liabilities and applied a minimum reserve ratio of 7.0%[10], the rate that the current reserve framework applies to the 'other deposits' category, which covers demand deposits and the like[11]. By placing tokenised deposits within the fractional reserve framework, the Bank of Korea has made clear that, notwithstanding their novel technological form as a means of payment,

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8 Under this approach, wholesale CBDC takes on the character of a token that represents the existing sub-account balance, that is, the underlying reserve balance. Similar approaches have been adopted in the synchronisation framework developed by the Bank of England (2026) and in the trigger-based settlement layer of the ECB's Pontes initiative.

9 If wholesale CBDC is operated independently, synchronisation with the bank's current account at BOK-Wire+ is required only at the points of on-ramp and off-ramp, rather than through continuous mirroring of the sub-account. This corresponds to the native-issuance approach being explored in the ECB's Appia initiative.

10 In Phase I, participating banks pre-funded their wholesale CBDC balances well in excess of the 7.0% requirement, so that no liquidity shortage arose.

11 Given that tokenised deposits are still in the pre-commercialisation stage, required reserves against them are to be held exclusively in wholesale CBDC.

tokenised deposits are a form of commercial bank money endowed with the credit-creation function.

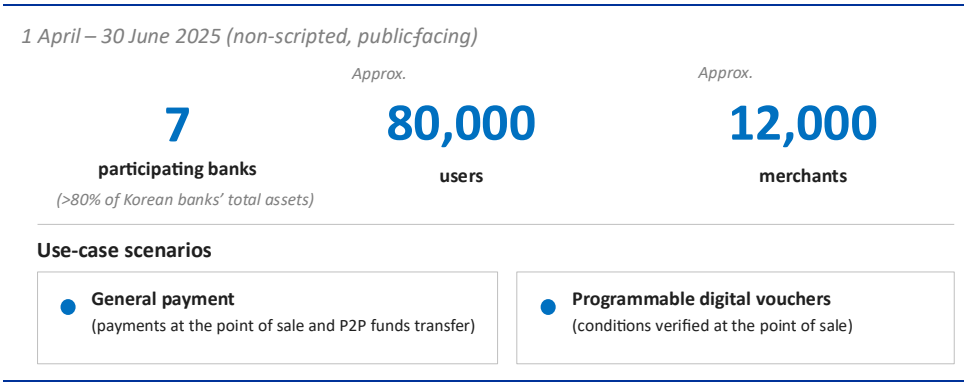
Turning to user protection, the deposit insurance scheme was extended to tokenised deposits through the financial regulatory sandbox regime. Banks accordingly fulfilled the disclosure and explanatory obligations relating to deposit insurance and paid deposit insurance premiums on outstanding tokenised deposit balances. In addition, the issuance volume of tokenised deposits has been brought within the scope of deposit-related prudential regulations, including the loan-to-deposit ratio and the liquidity coverage ratio (LCR), on effectively the same terms as conventional deposits.

That said, with the legal nature of tokenised deposits not yet clearly defined in Korea, live transactions have been conducted under the financial regulatory sandbox regime. The Bank of Korea plans to engage with the relevant authorities on these legal and related issues as tokenised deposits move towards commercialisation.

3.2 Phase I: live retail transactions

Chart 6

Phase I live transactions at a glance



Source: Bank of Korea (2025)

The Phase I live transactions deployed the DCS in a real-world operating environment, with the aim of verifying that the ledger-based system operates reliably in such an environment and of identifying the relevant legal and institutional requirements.[12] Conducted by the Bank of Korea in cooperation with seven major banks[13], the live transactions ran for three months, from 1 April to 30 June 2025. The transactions focused on payment use cases and covered two scenarios.

The first was a general payment scenario, in which users converted their bank deposits into tokenised deposits and used them to pay for goods and services at

[12] For details on the eligibility, holding and conversion limits, design and outcomes of the Phase I live transaction pilot, see Bank of Korea (2025).

[13] The seven banks are KB Kookmin, Shinhan, Woori, Hana, IBK, NongHyup and Busan. As of end-2025, these banks accounted for over 80% of the total assets of Korean domestic banks.

both offline and online merchants.[14] This design reflects the view that the broader the everyday use of tokenised means of payment, the greater the scope for leveraging programmability and the economic benefits it brings.

The second was a programmability-based digital voucher scenario, in which digital voucher functions[15] were applied to public benefit programmes run by local governments and universities.[16] This connects to the second aim, of building, through programmability, a public infrastructure on which new financial services can be built. It is intended to demonstrate, initially in the public sector, the practical benefits that smart-contract-based conditional fund disbursement can deliver in such programmes, thereby laying the groundwork for extension into private-sector financial services.

The results confirmed that a payment and settlement system built on a permissioned ledger could operate reliably even in a non-scripted real-world transaction environment, with broad participation by the general public. The full sequence of the burn-and-issue process was executed reliably throughout the period, including: (i) the opening of digital wallets; (ii) bidirectional conversion between current account balances at the Bank of Korea and wholesale CBDC, and between bank deposits and tokenised deposits; (iii) QR-code-based payment initiation; (iv) the redemption and burning of tokenised deposits at the sending bank; (v) the transfer of wholesale CBDC between banks through the DCS; and (vi) the re-issuance of tokenised deposits at the receiving bank. Furthermore, the participating banks remained in full compliance throughout the Phase I period with deposit-related regulatory requirements, including the reserve requirement ratio, the loan-to-deposit ratio and the LCR. This confirmed in practice that ledger-based monetary infrastructure can not only function reliably but also operate in a manner consistent with existing banking regulation and user-protection frameworks.

At the same time, the pilot exposed the cost of operating two systems in parallel: with no direct link between the DCS and BOK-Wire+, wholesale CBDC had to be pre-funded in advance and balances reconciled offline, an arrangement that was manageable over three months but that would not scale to continuous operation.

Likewise, the smart-contract-based digital voucher programmes operated as intended. The issuance phase proceeded smoothly, from the issuance request by the commissioning institution, through code verification, approval and deployment by the smart contract validation entity[17], and registration on the distributed ledger,

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[14] The offline merchants were Kyobo Book Centre (bookstore), 7-Eleven (convenience store), Ediya Coffee (coffee chain) and Hanaro Mart (supermarket), while the online merchants were Ttaenggyeoyo (food delivery platform), Modhaus (K-pop digital goods, via the Cosmo app) and Hyundai Home Shopping (home shopping).

[15] In this scenario, when beneficiaries used tokenised deposits to purchase goods or services, the smart contract automatically verified whether the support conditions, including item category and period, were met, and refunded part or all of the purchase amount in real time as cashback.

[16] The voucher programmes included the Seoul Metropolitan Government Youth Culture Pass (supporting attendance at performing arts events for residents aged 20 to 23 with household income at or below 150% of the median), library member vouchers issued by Daegu Metropolitan City, and freshman support vouchers issued by Silla University in Busan.

[17] In Phase I, the KFTC served as the smart contract validation entity.

culminating in the delivery of vouchers to users. At the payment stage, the user's QR code triggered the transfer of tokenised deposits to the merchant's digital wallet. At the same time, an amount of tokenised deposits corresponding to the voucher's share of the purchase was automatically refunded, in real time, from the implementing agency's digital wallet to the user's digital wallet. In each transaction, predefined conditions such as eligible merchants, the permitted categories of goods and services and the period of validity were automatically verified by the smart contract at the time of the transaction.[18] This confirmed that, unlike existing voucher schemes that have relied chiefly on ex post detection, the possibility of fraudulent use can be structurally blocked at the transaction stage itself.

In sum, the Phase I live transactions demonstrated three key points: (i) ledger-based monetary infrastructure can operate reliably in a live environment involving the general public; (ii) tokenised deposits can serve as a new digital means of payment that complements existing instruments; and (iii) programmable digital vouchers can structurally reduce the burden of reconciliation and ex post verification associated with public disbursements such as subsidies.

3.3 Phase II: scaling up

The Bank of Korea is now preparing Phase II, which aims to launch the DCS officially and to lay the foundations for the commercialisation of tokenised deposits.[19] Phase II is built around four pillars: (i) broadening the base of participating banks and merchants; (ii) enhancing user convenience; (iii) extending the application of programmability, including to government fiscal disbursements; and (iv) verifying the prospective use of tokenised deposits as a means of payment in the digital asset market. As a first step, the pilot project on the disbursement of central government funds, pursued in cooperation with the relevant government ministries, is scheduled to commence at end-July 2026. Live transactions with public participation are scheduled to begin in the second half of 2026. Unlike the Phase I live transactions, in which the various features of the DCS were tested over three months, Phase II will operate on an ongoing basis.

As for the participating banks, the seven existing participants will be joined by two additional banks, raising the total to nine. Since tokenised deposits have the potential to substantially reduce the fee burden relative to credit cards[20], the participating banks are actively recruiting merchants across a wider range of business types. These include both large merchants that account for a high share of

[18] Beyond these, complex payments, such as those exceeding the per-transaction voucher limit (KRW 70,000) under the Seoul Metropolitan Government Youth Culture Pass, in which digital vouchers were combined with the user's own tokenised deposits, as well as ex post clawback processing in response to refund requests after use, were all completed instantly within a single platform.

[19] For details, see Bank of Korea (2026).

[20] In the Phase I live transactions, MSCs were deliberately not levied on participating merchants: payments flowed directly between the payer's and the merchant's digital wallets on the DCS, bypassing the intermediaries involved in conventional card-based payments. This arrangement enables materially lower MSCs in commercial operation, since settlement can take place directly between the payer's and the merchant's bank on the DCS, with fewer intermediation layers than at present. The actual MSC level will be determined under the commercial arrangements developed in subsequent phases.

everyday consumer spending, which face the highest merchant service charges (MSCs), and smaller merchants for whom lower payment costs are particularly significant. Whereas the Phase I live transactions involved only one merchant per sector, multiple merchants per sector will participate in Phase II.

To enhance user convenience, new functions will be introduced, including biometric authentication and automatic conversion between deposits and tokenised deposits. In the Phase I live transactions, users experienced some inconvenience such as the need to enter passwords repeatedly when accessing digital wallets and initiating payments, and to request each conversion individually. In Phase II, simplified authentication using biometric methods will be enabled, together with automatic conversion within preset limits. These improvements aim to bring the user experience (UX) of tokenised deposits to a level comparable with existing mobile payment services and mobile banking.

In addition, the Bank of Korea is working closely with government ministries, including the Ministry of Finance and Economy, and with the participating banks, with a view to applying programmability on a broader scale. The government's 2026 Economic Growth Strategy has set out a goal of disbursing one quarter of National Treasury Funds, by 2030, using wholesale CBDC and tokenised deposits. The scope of application is to be extended to a wide range of fiscal programmes, beginning with central government subsidies and payments associated with expenses of public officials, while related legislation, including the Management of the National Funds Act, is to be revised in parallel. By specifying in advance, through programmability, the time windows and sectors in which disbursement is permitted, this initiative can be expected to deliver multiple benefits: preventing fraudulent use; shortening reconciliation periods through a payment structure with fewer intermediaries; and even lowering fees for small businesses. Furthermore, the Bank of Korea plans, in cooperation with the participating banks and other stakeholders, to continue developing innovative private-sector use cases that incorporate programmable functions.

Beyond this, in December 2025, the Bank of Korea demonstrated that tokenised deposits can be used as a means of payment in AI agent services, in which AI searches for and purchases goods and services in response to user requests. Follow-up research will continue.

Building on the third pillar above, the remainder of this section examines two concrete use cases pursued under the pilot project on the disbursement of National Treasury Funds: the electric vehicle (EV) charging infrastructure subsidy and official duty spending at government ministries.

3.3.1 Electric vehicle charging infrastructure subsidy programme

The expansion of EV charging infrastructure is one of the key policies underpinning the transition to carbon neutrality and electric mobility, and the government provides hundreds of billions of won in subsidies each year to operators that install and run charging stations. This pilot project[21] focuses on medium-speed charging facilities (30–50 kW output) under the Ministry of Climate, Energy and Environment's EV Charging Facility Construction Programme. The size of the 2026 programme is around KRW 30 billion, with the Korea Environment Corporation (K-eco) selecting recipients through a public call for applications and disbursing the subsidies.

Under the current arrangement, K-eco and other agencies disburse part of the funds in advance to charging infrastructure operators, and then transfer the remainder after an ex post review of the supporting documentation submitted by the operators once the chargers have been installed. Under this approach, which centres on ex post verification, it is difficult to prevent fraudulent claims in advance. Even when cases are detected in which operators have received subsidies but failed to install chargers, or have performed perfunctory installations, the recovery of those funds involves considerable time and expense. In addition, it is difficult to track whether the subsidies actually reach downstream contractors, such as charger manufacturers and construction firms, and monitoring the operating status of chargers nationwide on an ex post basis imposes a substantial administrative burden.

This pilot project seeks to address these limitations structurally by disbursing the subsidies in the form of tokenised deposits and, through programmability, specifying their conditions of use in advance.

The first is preventing fund misuse. Subsidies can be programmatically restricted to eligible firms, permitted categories of products, or specified time periods, ensuring that funds are disbursed only for designated purposes, such as the purchase and installation of chargers, and only to approved operators. As a result, any attempt to divert funds from their intended use can be blocked at the point of transaction.

The second is enhanced transparency through the conditional, automated disbursement of subsidies. The subsidies paid to operators can be structured so that, once predefined conditions such as the completion of inspection at each stage of construction and the commencement of charger operation are met, the funds flow automatically and in real time through the supply chain to the lower tiers. This substantially eases working capital pressures on small subcontractors.

The third is enhanced efficiency in the subsidy management system through automated verification. Since every transaction is recorded on the distributed ledger in real time, the relevant government ministries can track, at a glance, both the flow of funds and the implementation of the programme, without separately collecting and cross-checking supporting documentation. This not only eases the administrative

[21] To advance this pilot, the Ministry of Finance and Economy, the Ministry of Climate, Energy and Environment, and the Bank of Korea concluded a Memorandum of Understanding (MoU) in March 2026.

burden but also makes it possible to analyse the effectiveness of the programme on a data-driven basis.

At the same time, this pilot project focuses on establishing the basic framework for fund flows, namely their ex ante control and automated reconciliation. It is also working on linking external data, such as charger operating status information from the EV-Monitor portal, to smart contracts through oracles, in order to support automated verification. This model can be extended to a wide range of government-to-business (G2B) procurement programmes, such as the management of subcontractor whitelists and the staged disbursement of funds linked to contract performance.

3.3.2 Payments associated with expenses of public officials

Public officials who incur expenses in the course of their official duties are rightly subject to more rigorous scrutiny and tighter controls. In the case of Korea, such spending amounts to hundreds of billions of won each year. Cases of inappropriate use, while very rare, have attracted attention when they come to light.

At present, expense spending by public officials is disbursed through government procurement cards, issued by card companies. The governance and safeguard process involves keeping track of supporting documentation ex post, including through the review of receipts, done on an ex post basis. Under this approach, which centres on ex post verification, it is difficult to block inappropriate use in advance. The Clean Card scheme, designed to address this, blocks payments in particular merchant categories. Payments made during restricted time periods, such as weekends, are first approved, with their relevance to official duties subsequently verified through ex post justification by the user. This approach, however, has limited effectiveness in pre-emptive blocking. It also involves administrative costs such as ex post justification and recovery of funds, and remains heavily dependent on card companies in its operation. In addition, the fees incurred at each payment are borne by small businesses, such as those running restaurants.

This pilot project[22] is a first step towards structurally resolving the limitations identified above, by disbursing official duty spending in tokenised deposits and, through smart contracts, specifying their conditions of use in advance.

The first is the ex ante setting of eligible time windows and merchant categories. Conditions can be coded into the smart contracts in advance so that official duty spending is permitted only during working hours (e.g. weekdays during the day) and only at merchant categories appropriate for official duties, such as restaurants and meeting venues. In this way, use at late-night or weekend hours, or at entertainment venues, will be blocked at the system level. Going further, by linking the smart

[22] This programme was selected as a project under the Policy-Driven Regulatory Sandbox for 2026. The selection enabled an exception to the obligation under the Management of the National Funds Act to disburse National Treasury Funds through government procurement cards, thereby providing the regulatory basis for live verification using tokenised deposits.

contracts with human resources (HR) systems, payment conditions can be designed with greater precision than the previous Clean Card scheme could achieve through pre-emptive screening. For instance, individual non-working days such as annual leave or maternity leave can be reflected in the payment conditions, or any use outside the assigned work area can be verified in advance on the basis of official travel orders. As the point of control shifts from ex post justification to ex ante verification, the burden of ex post justification and audits is reduced. With every transaction recorded on the distributed ledger in real time, ex post verification is also automated. In addition, in contrast to the previous reliance on the merchant classification systems of card companies, the government can directly define and operate the use conditions as code, thereby applying consistent operational standards across institutions.

The second is resolving inefficiencies in the payment systems. Since tokenised deposits minimise the involvement of intermediaries such as card companies and payment service providers, including value-added network (VAN) operators, the MSC burden on small businesses, such as those running restaurants that receive official duty spending, can be eased, and the disbursed funds more fully serve their intended purposes.

In its current form the pilot begins with basic conditions, such as time windows and merchant categories, and is designed to grow more precise over time, as the smart contracts are linked to HR systems and to external administrative data through oracles. The same model extends naturally to other areas of fiscal disbursement, such as government operating and travel expenses, and to government-to-citizen (G2C) programmes, including childcare, welfare and disaster-relief subsidies, that require restrictions on eligible merchants or periods of validity.

Taken together, these two examples point to a more general lesson, and one that should interest a policymaker well beyond the specifics of Korean public finance. Programmability shifts the point of control over public funds disbursement from ex post audit to ex ante rule: conditions that are today verified, if at all, only after the money has been spent are instead enforced at the moment of payment, which alters the economics of fraud and reconciliation rather than merely automating existing checks. And because settlement runs directly between the payer's and the payee's banks on a shared public platform, layers of intermediation (and the fees attached to them) fall away, so that more of each disbursed won reaches its intended use. These are not exotic applications: they are ordinary problems of public finance, and they show why a programmable settlement layer anchored in central bank money is of practical, and not merely conceptual, interest.

4 Future plans and implications

As outlined in the preceding sections, the Bank of Korea has, through Project Hangang, given concrete form to the concept of a unified ledger, in which the trilogy of tokenised central bank money, tokenised commercial bank deposits and tokenised assets is brought together on a single distributed ledger. The Phase I live transactions, however, focused on the payment leg, and the asset leg, one of the three components of the trilogy, remains at the PoC stage, with its implementation in live transactions still to be achieved. Moreover, as the work to date has focused mainly on domestic transactions, cross-border scalability also calls for attention. This section sets out, in turn, the two key priorities that the Bank of Korea plans to pursue in the period ahead: (i) the tokenisation of systemically important assets such as government bonds; and (ii) securing cross-border interoperability through Project Agorá. It then steps back from these priorities to their wider implications for monetary policy and financial stability.

4.1 Government bond tokenisation

The direct issuance and circulation of systemically important assets, such as government bonds, within the DCS bears directly on central banks' core mandates of monetary policy and financial stability. On the one hand, it can contribute to financial stability by securing collateral mobility in times of stress; on the other hand, it can enhance both the precision and responsiveness of monetary policy.

Beyond simply enhancing settlement efficiency, the tokenisation of government bonds can also strengthen the robustness of the financial system. In global financial markets, where margin calls have become routine and increasingly significant, securing collateral mobility in times of stress has emerged as a key challenge for safeguarding financial stability. Through atomic settlement, tokenised government bonds can be transferred simultaneously with payment, enabling functions such as wider use of intraday repo transactions, the rapid mobilisation of collateral to meet margin calls, and the automatic substitution of collateral with eligible assets in the event of changes in collateral value or eligibility (BIS, 2025). This not only represents a material improvement in financial institutions' liquidity risk management capabilities, but also helps to mitigate the risk of cascading settlement failures across the system in times of stress.

Furthermore, when money and systemically important assets are tokenised on the same unified ledger, the benefits could extend to monetary policy implementation itself. Project Pine[23], conducted jointly by the BIS and the Federal Reserve Bank of New York, provides concrete evidence of this technical feasibility. It showed that, when the central bank's monetary policy instruments such as repo transactions and collateralised lending are implemented through smart contracts, a series of operational steps can be processed automatically without manual intervention.

[23] For further details on Project Pine, see Federal Reserve Bank of New York and BIS (2025).

These include the real-time verification of collateral eligibility and haircuts, the automatic response to margin calls in line with changes in collateral value, and the automatic redemption of repos at maturity. Real-time information on market participants' funding positions and collateral holdings also offers scope to enhance the responsiveness and precision of monetary policy. In particular, the capacity of such central bank infrastructure to operate 24/7 enables immediate liquidity provision in times of market stress.

Drawing on the results of the PoC exercises already conducted, the Bank of Korea plans to work with the government and relevant authorities to move beyond the PoC stage. In its Economic Growth Strategy for the Second Half of 2026, published in July 2026, the Korean government announced a pilot project for 2027 to issue tokenised government bonds within the DCS and to settle transactions in them using wholesale CBDC.[24] The Bank of Korea will collaborate closely with the government to ensure this pilot is completed successfully.

4.2 Cross-border interoperability

The Bank of Korea will actively explore arrangements for linking the DCS built through Project Hangang with Project Agorá. Under the current architecture of Project Agorá[25], the Bank of Korea could consider using its DCS as the jurisdictional ledger for Korea, with one such ledger to be established for each participating jurisdiction. Given that both systems use the same underlying technology (Hyperledger Besu), this is expected to facilitate technical interoperability between them.

Such linkages would go beyond merely securing technical interoperability. They are expected, on the one hand, to reduce cross-border transaction costs for Korean financial institutions and corporates, and on the other hand, to enhance the global accessibility of the DCS, thereby contributing to the broader international use of the Korean won.

For example, if assets such as government bonds were tokenised on the DCS, the linkage between the two systems would allow foreign exchange settlement and securities settlement to be programmed into a single transaction, enabling atomic settlement. This would reduce settlement risk and enhance the transparency of transactions. Moreover, where tokenised assets are issued natively on the DCS, investors could draw directly on their tokenised holdings to conduct repo transactions more easily. These benefits could in turn raise demand for Korean government bonds and other assets.

Technical linkage, however, is only part of the task. With multiple jurisdictions involved, it must be underpinned by a common rulebook governing matters such as

[24] Issuing and circulating tokenised assets directly within the DCS raises governance questions that require further discussion. The Bank of Korea will work closely with the relevant authorities in addressing them.

[25] For further details on the architecture of Project Agorá, see BIS (2026).

participation, settlement finality, risk management, compliance and data protection. Agreeing such a rulebook across all participating jurisdictions is a challenging undertaking, and one that technical experiments alone cannot deliver. The Bank of Korea plans to address both dimensions in stages, working closely with other participants as Project Agorá progresses.

4.3 Wider implications

The choices described above bear on the central bank's core mandates in ways that extend beyond the efficiency of settlement. For monetary policy, a unified ledger on which money and high-quality collateral coexist would give the central bank a real-time view of participants' funding positions and collateral holdings, and would allow open-market operations to be executed through smart contracts, as Project Pine has shown. The same infrastructure, operating around the clock, could provide liquidity at any hour. These are gains in the precision and reach of implementation; they do not alter the stance of policy, which remains a matter for the Monetary Policy Board.

For financial stability, the case is two-sided. Atomic settlement and the mobility of tokenised collateral would strengthen the system's capacity to meet margin calls and to substitute collateral in times of stress, reducing the scope for cascading settlement failures. Against this, a system that settles continuously and at high speed also transmits stress continuously. A round-the-clock environment in which deposits can move instantly between banks, or out of the banking system altogether, may sharpen the dynamics of a deposit run rather than dampen them; and a greater reliance on smart contracts and on off-ledger data feeds, or oracles, introduces operational risks that have no exact counterpart in present arrangements. The design of circuit-breakers, liquidity backstops and oracle governance therefore belongs on the financial-stability agenda from the outset, not as an afterthought.

Much of what Project Hangang has confronted is not specific to Korea. The interoperability problem at the centre of Project Hangang, namely how a continuously operating tokenised platform is to be reconciled with a real-time gross settlement system that keeps banking hours, arises wherever tokenised platforms are connected to an existing large-value payment system; the trigger, synchronisation and native-issuance approaches now being explored in several jurisdictions all address the same underlying choice. Three observations from Korea's experience may carry more widely. First, the choice between mirroring reserves onto the platform and issuing wholesale central bank money natively on it is consequential, and is best settled before the platform is in live use, because it determines how the singleness of money and the central bank's balance sheet are affected. Second, the operating-hours mismatch is not a transitional inconvenience but a structural constraint that shapes intraday liquidity provision, and it merits a dedicated liquidity facility on the platform itself, such as intraday repo against tokenised government bonds. Third, the burn-and-issue and layer-separation designs are not specific to any one currency: they would carry over to other settlement currencies without modification.

5 Conclusion

Project Hangang shows that the unified ledger concept can be put into practice at scale, thereby incorporating tokenisation without abandoning the institutional foundations of the current monetary system. A core lesson is that innovation in money need not require a choice between public trust and private-sector dynamism. By combining wholesale central bank money, tokenised commercial bank deposits and a carefully separated programming layer, the system can preserve the singleness of money while enabling new forms of conditional execution. A second lesson is more sobering. The live system today is a transitional arrangement, in which the two ledgers are reconciled offline rather than joined in real time; the distance from that arrangement to a seamless unified ledger is measured by the challenges set out below.

Looking ahead, several challenges remain before Project Hangang can move into full commercial service.

First, interoperability between the existing large-value payment system (BOK-Wire+) and the DCS must be secured. Where the operating hours of the two systems do not coincide, constraints may arise in transferring funds and coordinating processing between them. How to ensure interoperability, including the alignment of operating hours, therefore requires careful consideration as a near-term priority.

Second, the legal nature of the wholesale CBDC issued on the DCS must be defined. This is a fundamental question that arises independently of whether operating hours are aligned. Whether the wholesale CBDC is regarded as a tokenised representation of reserves held in the large-value payment system, or as a distinct form of central bank money separate from reserves, has direct implications for how the singleness of money is preserved, how the instrument is treated for monetary policy purposes, and how it is accounted for on the central bank's balance sheet.

Third, the provision of intraday settlement liquidity poses a further challenge. As the tokenisation of government bonds advances and settlement volumes on the DCS grow, ensuring an adequate supply of intraday liquidity becomes critical. In particular, if the wholesale CBDC is a representation of reserves held in the large-value payment system, DCS liquidity must be funded and defunded through that system; where the operating hours of the two systems are asymmetric, DCS liquidity may become insufficient once the large-value payment system has closed. Since this would impair the full functioning of atomic DvP on the DCS, it will be necessary to consider mechanisms for supplying intraday liquidity directly on the DCS, such as intraday repo against tokenised government bonds.

Fourth, the linkage with Project Agorá warrants attention. The Agorá platform envisages a structure of jurisdiction-specific ledgers, and the DCS could be employed as the Korean jurisdictional ledger within it. The fact that both platforms adopt the same underlying ledger technology is a favourable condition for securing interoperability. Even so, a common solution does not in itself guarantee

interoperability, and the technical and institutional requirements for connecting the two platforms will need to be examined closely.

References

Bank of England (2026), "DLT Innovation Challenge 2025: Final Report".

Bank for International Settlements (2023), "Blueprint for the future monetary system: improving the old, enabling the new", *Annual Economic Report*, Chapter III.

Bank for International Settlements (2024), "Project Agorá: central banks and banking sector embark on major project to explore tokenisation of cross-border payments", *press release*, April. https://www.bis.org/press/p240403.htm.

Bank for International Settlements (2025), "The next-generation monetary and financial system", *Annual Economic Report*, Chapter III.

Bank for International Settlements (2026), "Project Agorá: A shared programmable platform for wholesale cross-border payments".

Bank of Korea (2025), "Project Hangang: Live pilot of a unified ledger integrating wholesale CBDC and tokenized deposits (Phase I)".

Bank of Korea (2026), "Project Hangang Phase II launches in earnest", *press release*, March. (in Korean) https://www.bok.or.kr/.

European Central Bank (2026), "Appia – paving the way for a future-ready, integrated financial ecosystem leveraging tokenisation and DLT".

Federal Reserve Bank of New York and Bank for International Settlements (2025), "Project Pine: Central bank open market operations with smart contracts".

Garratt, R. and Shin, H. S. (2023), "Stablecoins versus tokenised deposits: implications for the singleness of money", *BIS Bulletin*, No 73.

Monetary Authority of Singapore (2023), "Project Orchid: programmable digital SGD", October. https://www.mas.gov.sg/schemes-and-initiatives/project-orchid.

Shin, H. S. (2026), "Tokenomics and blockchain fragmentation", *BIS Working Papers*, No 1335.