



NATIONAL BANK OF KAZAKHSTAN



NATIONAL PAYMENT
CORPORATION OF KAZAKHSTAN

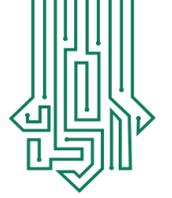


STATUS REPORT ON THE IMPLEMENTATION OF THE NATIONAL DIGITAL CURRENCY
IN THE REPUBLIC OF KAZAKHSTAN

DIGITAL TENGE:

IMPLEMENTATION PLAN FOR PHASE ONE

Almaty
September 2023



Abbreviations

AML/CFT	Anti-Money Laundering/Countering the Financing of Terrorism
AMM	Automated money maker
API	Application programming interface
BIS	Bank of International Settlements
BISIH	Bank of International Settlements Innovation Hub
CB	Central bank
CBDC	Central bank digital currency
DeFi	Decentralized finance
DvP	Delivery versus payment
DLT	Distributed ledger technology
DT	Digital Tenge
ECB	European Central Bank
GA	Government agency
GDP	Gross domestic product
IMF	International Monetary Fund
KYC/KYB	Know your customer/Know your business
MVP	Minimum viable product
NBK	National Bank of Kazakhstan
NFC	Near-field communication
PoC	Proof of concept
POS	Point of sale
PvP	Payment versus payment
Q&A	Questions and Answers
QR-code	Quick Response code
R&D	Research and Development
WB	World Bank



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Summary

Since 2021, the National Bank of the Republic of Kazakhstan (NBK) has been implementing the "Digital Tenge" (DT) project. In 2022, the NBK completed the study on the need to introduce DT in close cooperation with financial market participants, the expert community, and international financial organizations. According to the [study's published results](#), Kazakhstan's government decided to have phased implementation over three years until the end of 2025.

To this date, the DT project has focused on developing a retail CBDC project. However, there were numerous news and events in the past several months, followed by the NBK's consultations with stakeholders and the market related to the broader use and adoption of the Kazakhstani digital currency.

All these aspects resulted in several sub-projects and initiatives covering wholesale applications and usage, including securities settlement, stablecoin-related initiatives, and cross-border and social payments, in addition to the study on retail CBDC conducted by the NBK in previous years. Therefore, the broader DT initiative has become more of a "general purpose" CBDC story than the initial retail proposition. Demand for a general-purpose CBDC with greater functionality has provided the foundation for this pivot that, in turn, complements the study on retail CBDC and provides a third format of central bank money for Kazakhstan's financial needs for a variety of users - from consumers and merchants to banks and exchanges.

A general-purpose DT CBDC will create the foundation for settlement between consumers or banks, including cross-border transactions.

This document provides information about the current state of the DT project and the results expected by the end of 2023. The general-purpose DT research investigates widespread use by all users and covers advanced scenarios to test new hypotheses and ideas for wholesale and retail DT. In this regard, two separate environments of the DT platform are planned for the 2023 work - industrial and experimental ones (also known as R&D).

Moreover, studying innovative scenarios with the DT has identified new business models that can transform the national economy. For instance, the DT's programmability can lead to digitizing numerous products and services that previously were difficult to evaluate, monetize, or fragment.

The DT platform's industrial environment is designed to implement the main functionality of the DT and its subsequent operation – pilot one followed by industrial one. In 2023, two scenarios will be implemented in this environment.

Several innovative pilot scenarios will be tested in the R&D environment (technological sandbox for experiments). They were provided by market participants who were winners of the IDEATHON-2022 contest. In addition, the scenarios of two international organizations, one scenario with the stock exchange, one scenario with government agencies in cross-border payments, as well as issuance of stablecoins backed by the DT, tokenization of securities and government procurement will be tested.

All obtained results will be published in the 2023 final report in December. This information will be utilized to determine and select optimal architectural trade-offs for developing the DT's target architecture.



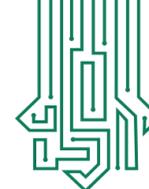
Review of the international agenda

The interest in CBDC has grown dramatically over the past four years. In 2020, only 35 countries explored CBDCs; currently, 130 countries representing 98% of the global GDP are investigating national digital currencies. 64 countries are at an advanced study stage (developing, piloting, or launching). The Bank of International Settlement (BIS) also predicts up to 15 retail and 9 wholesale CBDCs in circulation by 2030.

Only four jurisdictions have implemented CBDC at the industrial level: the Central Bank of the Bahamas, the Eastern Caribbean Central Bank, the Central Bank of Nigeria, and the Bank of Jamaica.

A critical driver of CBDC projects is building proper communications with financial market participants. For example, the Nigerian e-naira project had a successful technical implementation. It proved its sustainability in 24/7 mode, but the number of users did not exceed that of the first wave of newcomers, and the number of connected retail customers could not reach 1% of the total number of active bank accounts. Such results demonstrate that a new policy coordinated by all stakeholders is needed to overcome the initially low level of adoption, and it should also consider the population's readiness to use digital currencies. About 36% of Nigeria's population do not have bank accounts and use cash. At the time of the CBDC being launched, cash-out limits were developed to encourage the use of digital money. Still, these regulatory measures caused massive cash outflows and low demand for the Nigerian CBDC. The role of digital naira and other digital currencies in countries with identical backgrounds should be considered concerning mobile money as an alternative to bank deposits, given that the retail use cases of these two products are similar.

Numerous pilot CBDC projects are currently being implemented around the globe. As important examples for Kazakhstan, the Central Banks of China, Brazil, Russia, and the European Union should be considered for further investigation due to several peculiarities of digital currency implementation. The experience obtained by the most successful pilot projects (including the ones mentioned above) demonstrates the necessity of coordinated work of central banks and all market participants for the CBDC implementation. Thus, the most optimal solution is the two-tier CBDC architecture (with payment service providers playing an important role in distributing digital currencies and providing related services for customers). In addition, a step-by-step approach to implementing national digital currencies with active outreach and engagement of all stakeholders is a crucial success factor.



	CHINA	BRASIL	ECB	RUSSIA
YEAR OF THE PROJECT LAUNCH	2014	2017	2022	2019
UTILIZED PLATFORM	Celo	Drex (in-house developed)	In-house developed platform	In-house developed platform
KEY DESIGN PARAMETERS	<p>Two-tier model: the People's Bank of China is responsible for the issuance, redemption, and management of the wallet ecosystem.</p>	<p>Two-tier model: the Central Bank of Brazil issues digital currency and provides access to the platform through intermediaries.</p>	<p>Two-tier model: in the European Central Bank's two-tier model, intermediaries (payment service providers) are responsible for the distribution of digital euros. Individuals have access to digital euros through the payment service providers application through the Eurosystem application.</p>	<p>Two-tier model: the Central Bank of Russia is the platform operator and is also responsible for the transaction security. It is possible to access the wallet through any financial organization in which the client is serviced.</p>
NUMBER OF PARTICIPANTS	<p>As of June 2023, more than 20.8 million individual wallets and 3.5 million corporate wallets were created; 70.7 million transactions worth approximately 34.5 billion yuan (\approx\$5.4 billion) were conducted.</p> <p>In 2023, citizens and visitors of 43 provinces in China can use digital yuan for everyday transactions.</p>	<p>14 financial institutions were selected for the participation in the pilot project (May 2023).</p>	<p>The ECB works with the European Commission, the European Parliament and Eurozone finance ministers for the digital euro project development.</p> <p>The project participants are still unknown at the current stage.</p>	<p>In August 2023, a pilot project in the friends and family format was launched. 13 banks and 30 merchants from 11 cities were participating.</p>
FEATURES OF THE PROJECT	<ol style="list-style-type: none"> Digital yuan is used for tax payments (Hainan province). Civil servants receive their salaries in digital yuan (Changshu). Pilot projects with SIM-based offline wallets is planned. 	<ol style="list-style-type: none"> The digital currency launch into circulation is planned for end of 2024 At the current stage of the pilot project, the Central Bank of Brasil is testing the confidentiality and programmability features of the platform for the DvP scenario. 	<ol style="list-style-type: none"> From July 2022 to February 2023, the ECB conducted test of the digital euro platform. The test assessed how the digital euro can be integrated into the current European payments landscape. There is an ongoing study of offline transactions. Non-resident access is possible. QR code and NFC payments are being investigated. The decision on the implementation of the digital euro is planned for 2023. 	<ol style="list-style-type: none"> Reduced commission for businesses in case of accepting payment for goods and services in digital rubles (0.3% of the payment amount). A law on the digital ruble has been adopted (Federal Law No. 339-FZ of 24.07.2023). Monthly limits on the transfer of non-cash funds into the digital ruble are implemented. Smart contracts are planned for the launch in 2023. Plans for the project's next stages include offline payments.



Numerous countries find the advantages of CBDCs for retail payments in offering a highly liquid, low-risk, and universally accessible means of payment.

According to the survey conducted by the BIS, 80% of the 86 CBs surveyed see potential value in having both a retail CBDC and a fast payment system because CBDCs can provide access to a broader range of financial institutions for the unbanked population. In addition, programmability and offline payments were cited as features that fast payment systems do not provide.

Meanwhile, the main advantages of wholesale CBDC can be found in providing faster, safer and cheaper cross-border settlements. The following advantages can be brought to cross-border payments by digital currencies:

- *Reduced number of intermediaries and simplification of the process.*
- *Increased efficiency via processes automation (e.g., document collection and verification) and reduction in intermediate stages of the process.*
- *Improved integration capabilities (especially in case of integration functionality being considered as one of the priorities in the CBDC development).*
- *Increased technical compatibility.*
- *Improved information security due to the application of new mechanisms and standards.*
- *Decreased cross-border and macro-financial risks.*

Main insights from the international review of retail and wholesale CBDC

1. There is a growing interest in wholesale CBDC due to their capability of improving the efficiency of cross-border payments

The very first CBDC projects focused on wholesale CBDC: for instance, the projects Jasper (2016), Ubin (2016), and Stella (2017) can be mentioned. After that, most countries started studying retail CBDCs to find the value for end users. However, in countries with developed financial infrastructure, it is challenging to demonstrate the new capabilities of CBDCs due to the convenience and accessibility of existing payment systems. At the same time, wholesale CBDC projects for cross-border payments discovered considerable benefits of digital currencies. For example, the BIS Innovation Hub (BISIH) in collaboration with various CBs, has identified and explored several key aspects of possible support for cross-border and foreign exchange transactions using CBDCs.

In addition to cross-border or offshore payments, the three completed wholesale CBDC projects focus on use cases in which CBDC are transferred either in exchange for other CBDC (payment versus payment, PvP model) or in exchange for tokenized securities (delivery versus payment, DvP model). While there are systems designed for cross-border transfers under the PvP and DvP models, their coverage is low, and the costs are often considered relatively high.

As can be seen from the table below, the three completed cross-border CBDC projects have two common features. Firstly, all projects created a common distributed ledger platform because this approach was more straightforward and promising than others (such as separate national platforms). Secondly, all projects assumed that CBs would provide access to their CBDC to non-resident financial institutions. Such direct access allows cross-border payments in a single system without intermediaries involving correspondent banks.



BISIH cross-border CBDC projects

EXPERIMENT DESIGN

	JURA	DUNBAR	MBRIDGE	ICEBREAKER	MARIANA
BISIH CENTERS					
CB					
OUTPUT	Prototype	Prototype	Pilot	PoC	PoC
CBDC TYPE	Wholesale, trading day	Wholesale, O/N w/o interest	Wholesale, Intraday & O/N	Retail	Wholesale
CURRENCIES	EUR, CHF	AUD, MYR, SGD, SAR	HKD, CNY, THB, AED	ILS, NOK, SEK	EUR, SGD, CHF
TRANSACTION TYPE	Real value	Simulated	Real value	Simulated	Simulated
INTEROPERABILITY MODEL	Common platform w subnetworks	Common platform	Common platform	Hub and spoke	Common platform for FX
DISTRIBUTED LEDGER PLATFORM	Corda	Corda, Quorum	mBridge Ledger	Corda, Hyperledger Besu, Ethereum Quorum	Ethereum
OPERATOR	Private	CB	CB	CB	CB
EXTRA USE CASES	PvP, DvP, offshore	PvP, DvP, offshore	PvP	PvPvP	Forex trading, PvP

Source: BIS, "Lessons learnt on CBDCs" report, July 2023



International organizations are also actively investing in the CBDC study. In 2022, SWIFT proposed a solution for interoperability of CBDC networks using the BIS-2 model. Swift developed a CBDC sandbox environment providing access to experiments and research for 18 global banks. Multiple technical sessions were held to explain solutions in detail and get feedback. Considering the information, Swift is developing a beta version of CBDC Connector Gateway. Once the beta version is confirmed, Swift intends to develop a publicly available product offered by CB as an international solution for CBDC transactions.

2. Ensuring the efficiency of integration with the financial market participants' systems (including APIs) becomes more important

One of the most interesting CBDC-related studies is a joint project of the Bank of England and BIS called Rosalind. This project investigated the capability of a universal and extensible application programming interface (API) to link CB and private sector infrastructures and facilitate retail payments within the CBDC. It was demonstrated that a well-designed API layer could work with a variety of private sector and CB applications and that a set of simple and standardized API functions can support a variety of use cases. The study examined 33 API functionalities and more than 30 retail use cases of CBDC.

A well-designed API also has other advantages. Firstly, it can facilitate CBDC retail payments. It will enable the CBDC to interoperate with other payment systems (e.g., fast payment systems or global card networks) and other forms of money (e.g., commercial bank money and stablecoins) while supporting a variety of use cases (e.g., shopping via online platforms). Secondly, it can be applied to various CB ledger types, third-party applications, and systems. This broad interoperability will be important in a world where CBs are experimenting with different ledger designs and technologies. At the same time, private sector systems may be based on different accounting technologies and systems.

3. There is a growing interest in using CBDC platforms to ensure interoperability with the financial industry and the industry of digital assets and DeFi

This topic is becoming more popular on the international level. BIS is working on integrating CBDC into the DeFi ecosystem. As part of the Marianna project, the BIS is exploring using Automated Market Makers (AMMs) to enhance the efficiency, security, and transparency of trading and settlements in the foreign exchange market and improve cross-border payments. The origin of AMMs can be seen in the world of decentralized finance, where they enable users to acquire one stablecoin by selling another based on a liquidity pool and an algorithmic protocol that automatically (to some extent) determines the exchange rate based on the relative shares of stablecoins in the pool. This research involves the Bank of France, the Monetary Authority of Singapore, and the Swiss National Bank.

Additionally, as part of the Guardian project, the Monetary Authority of Singapore is exploring aspects of tokenization and DeFi protocols. This project aims to assess the viability of DeFi applications and explore options for transforming tangible assets into digital tokens without risking global financial stability and integrity.

According to CryptoNews, China shared its efforts to enhance payment systems' functionality using digital currency at the World Economic Forum, where a new universal digital payment network (UDPN) was introduced. This network facilitates interaction between regulated stablecoins (digital assets pegged to stable reserve assets like gold or the US dollar) and CBDC, thus reducing the cost of digital payments and expediting banks' adoption of digital assets. The network was developed by Red Date Technology, which is also responsible for creating China's blockchain-based service network.



4. Alternative forms of tokenized money are actively investigated

Tokenized deposits are an innovative topic in CBDC development. The BIS (as part of the Dynamo project) and the Digital Euro Association are exploring tokenized bank deposits (traditional bank deposits converted into digital assets using DLT platforms). Mastercard also investigates this field, and as a part of this study, pilot trials with tokenized bank deposits will be conducted in the United Kingdom using the Multi-Token Network.

Tokenized deposits are linked to existing bank deposits. Digital representations of bank liabilities are held at licensed depository institutions and recorded in distributed ledgers. However, they can be utilized within the existing banking system and transfer funds directly between accounts. Cryptocurrencies are notoriously volatile and require increased regulatory oversight. Backed by specific assets and thus linked to these assets' value, stablecoins can still break these links in some cases. The benefits of tokenized non-cash money include the technological capability of innovative payment implementation (such as micropayments via both distributed ledger and government channel integration, machine-to-machine payments, better pay-per-use license models, programmable payments/money, atomic multi-asset transactions, payment vs. payment and payment vs. delivery use cases. Tokenized deposits with embedded regulatory checks and instant settlement via wholesale CBDC can improve global supply chains, enhance data sharing on potential borrowers, and leverage privacy technologies.

There is also a growing global discussion on the potential use of tokenized non-cash money in commercial bank accounts. According to a report by the Bank of Russia, such tools can add new capabilities to existing cashless settlement systems and projected CBDCs, such as:

- *reducing transaction costs*
- *speeding up and simplifying transactions*
- *creating conditions for new products and services, including those related to Web 3.0 and the Internet of Things*
- *providing additional opportunities to control funds and program settlement terms with the use of smart contracts*
- *keeping familiar user experience of previously existing mechanisms for arising new opportunities*
- *creating a safe environment for informed users*
- *creating technological alternatives to money surrogates*
- *creating conditions for cross-border payment improvement.*

In addition, tokenized non-cash money can affect the speed of money circulation and the transmission mechanism of monetary policy. The value of tokenized non-cash money can be seen clearly in the case of token interoperability and smart contracts provided by different issuers. The optimal way to achieve such conditions is via collaborative market platform architectures (e.g., the concept of a regulated liability network) or a single national platform created by the regulator (including CBDC-based infrastructures).



Comparison of different money types' characteristics

		MONEY ISSUED BY THE CENTRAL BANK		MONEY ON BANK ACCOUNTS	
FORMAT		Cash money	CBDC	Traditional non-cash funds on accounts	Tokenized non-cash money
ISSUER		CB	CB	Account holding bank	Account holding bank
ORGANIZATIONAL AND TECHNICAL CHARACTERISTICS					
MEDIUM		Secure banknote or coin	Digital record or code in the CB's platform	Digital record or code in the bank's database	Digital record or code in the bank's or independent operator's platform
STORAGE		Wallet/safe deposit box	Account	Account	Account
PERSONALIZATION		A bearer type	Personalized	Personalized	Personalized
COMPATIBLE WITH SMART CONTRACTS		—	✓	✓ (depends on platform compatibility)	✓
ECONOMIC CHARACTERISTICS					
MEANS OF PAYMENT	ONLINE	—	✓	✓	✓
	OFFLINE	✓	— (discussion and design are still going on)	—	—
VALUE STABILITY		✓	✓	✓	✓
VALUE MEASURE		✓	✓	✓	✓
MEANS OF SAVING		Non-interest bearing	Non-interest bearing	Can be interest bearing	Can be interest bearing

Source: Bank of Russia, "Tokenized non-cash money in bank accounts" analytical report

The BIS proposed a new type of financial infrastructure that combines CBDC with tokenized bank deposits and other tokenized obligations on a DLT-based programmable platform. There are claims that the potential benefits will go beyond faster speeds and lower costs and will enable entirely new types of transactions (for example, new methods of security settlement that combine individual stages into one seamless operation).



5. There is an investigation of possible balance between privacy and CBDC programmability

Finding a balance between privacy and desired characteristics (such as financial integrity and security) is a complex challenge, but developing technologies can open new approaches to this problem. For instance, privacy-enhancing technologies such as "blind signatures" can enable CBs to issue retail CBDC without knowing the holder's identity. Moreover, such mechanisms can be enhanced to resist quantum computer attacks without sacrificing scalability.

There is a large number of CBs raising privacy concerns during their study on CBDCs. As an example of possible solutions to this problem, the People's Bank of China emphasizes the importance of transaction privacy and security in developing the digital yuan. The digital yuan's transaction data is encrypted, ensuring high security and user data protection. However, the CB can still track transactions to comply with AML/CFT regulations.

The BIS is working on its new Tourbillon project that explores how to improve the cyber resilience, scalability, and privacy of CBDC and analyzes the trade-offs between the named characteristics. For example, higher cyber resilience (especially considering the rise of quantum computers) requires additional cryptography that can slow down payment processing. Another crucial aspect is privacy, an important user requirement and a source of AML/CFT-related issues. The project aims to balance the characteristics by combining technologies such as hidden signatures, mixed networks, and others.

6. The interest in the potential of CBDC programmability to raise the efficiency of settlements and introduce new innovative services is growing

As a part of numerous CBDC researches, innovative functionality enabled by the implementation of CBDCs is being analyzed.

In the previously mentioned BIS project named Rosalind, the following innovative use cases for CBDC were explored:

1. Reserving CBDC for making a purchase and settling the payment upon physical delivery of the goods.
2. Providing real-time social assistance for electricity bills.
3. Earning and saving points with offline transactions and using them for charitable purposes.
4. Using open banking to open CBDC accounts and make payments.
5. Programmable payments - settling payments after work completion.
6. Programmable payments - refunding the ticket cost in case of a train delay,

etc.

Cross-border payment projects are exploring the possible use of smart contracts. For example, in projects like Ubin and Inthanon-LionRock, smart contracts are utilized for PvP transactions.

Digital Real is inspired by Ethereum (the second-largest blockchain in the world). According to Campos Neto, it will become a sort of native token for a large ecosystem in which banks and other financial institutions should be able to tokenize deposits to include new functionalities.

"Banks may obtain permission to tokenize deposits for use on the new intermediary platform jointly with CBDC, thus accessing programmable money and smart contract features," said the President of the CB of Brazil.

He also confirmed that Digital Real would enable the Brazilian financial system to utilize applications geared towards the Internet of Things (IoT). This Central Bank is exploring opportunities to link the Digital Real platform with existing public blockchains like Ethereum (ETH), Binance Smart Chain (BSC), Solana (SOL), Cardano (ADA), Tron, and others.

All the results obtained from international research were considered in the study of the DT implementation and contributed to shaping further work such as engagement with market participants, development of APIs, exploration of offline payment methods, and determination of the balance between anonymity and AML/CFT requirements.



About the Digital Tenge Project

As mentioned above, the NBK successfully conducted the first project phase (Proof-of-Concept) to explore the feasibility of implementing the DT in Kazakhstan in 2021. A prototype of the DT platform was utilized to test the concept's viability. At the same time, an initial economic model assessed the impact of the DT on the economy, financial stability, and monetary policy. Moreover, possible approaches to regulation were identified. The necessity of the DT implementation was explored in close cooperation with all stakeholders and international partners.

The results of this study were published in the report at the end of 2021. Subsequently, it was decided to continue the study and move to the minimum viable project (MVP) stage with two directions of work. Namely, they were implementing the most important functionality of the new payment system in close cooperation with the banks at the industry level and developing innovative services with market participants in a closed environment.

In this regard, the NBK continued a comprehensive study on the benefits and costs of the possible implementation of the DT in 2022 because the implementation above could significantly impact all market participants, ecosystem, financial and economic stability.

Another significant milestone of the DT project was the publication of the "Decision-Making Framework for Digital Tenge Issuance" in July 2022. It considered international experience, results of economic and regulatory studies, technological parameters assessment, quantitative and qualitative studies of consumer behavior, results of project sessions, and expert discussions. The Framework was developed concerning the recommendations of international organizations. Additionally, an Advisory Council of independent experts from the International Monetary Fund, the Bank for International Settlements, and the World Economic Forum was formed.

In October 2022, the DT platform was successfully tested with real consumers and merchants. The entire life cycle of the DT (from issuance to redemption), integration with market participants, and the programmability for targeted payments were tested. The chain of transactions without access to the Internet was also demonstrated. Prototypes of innovative financial products proposed by market participants and developed in collaboration with them were created and tested on the DT platform.

According to economic modeling results, the DT implementation does not lead to risks to monetary policy implementation and financial stability.

On December 15, 2022, the detailed results of the study were released to the general public in the format of a final report (White Paper).

Given all these aspects, the decision to implement the DT in three phases by the end of 2025 was made.



2021

Proof of Concept

- Implementation of basic DT life cycle scenarios without testing with real customers: issuance, distribution, marking, transfer, purchase
- Testing transfers and purchases
- Testing single offline transaction

2022

Testing in controlled environment

- Testing the viability of key life-cycle scenarios and scenarios with advanced functionality under near-realistic conditions of pilot project with 200 customers and 4 merchants
- Transfers and purchases with the use of phone number and QR, token reissuance
- Testing limited programmability
- Testing chain of offline transactions

2023

Integration with payment systems

- Rapid commercialization of the DT-based scenarios in 2023 (with 2-3 banks and limited number of users)
- Limited number of integrations (integration with bank systems involved in the pilot)
- Testing cross-border transactions and public procurement scenarios
- Testing advanced smart contracts of market participants and stock exchange in closed environment
- Conducting tests with SWIFT, the digital asset industry's market participant in closed environment

2024

Building a target architecture

- Implementing advanced programmability via tokens including advanced smart contracts
- Developing the mechanisms for social payments, public procurement, and market participants' scenarios
- Connecting at least 10 banks to the DT platform
- Launching the pilot operation of cross-border settlement mechanism
- Launching the pilot operation of offline transactions

2025

Launching the industrial operation

- Launching the full-scale DT industrial-grade platform on the target architecture
- Increasing the number of participants (customers and merchants), connecting the Kazakhstani banks to the DT platform
- Industrial operation of cross-border settlements
- Simplified access for external parties to develop smart contracts
- Building the DH ecosystem and cross-border community
- Scaling up offline payments



Plans for 2023

According to the DT project's roadmap, future implementation of digital currency in Kazakhstan should be done step-by-step. In 2023, it is planned to test integration with systems and market participants' services/platforms to verify the viability of innovative features and scenarios provided by the DT platform.

The objectives of the DT platform development in 2023 align with the key trends in the CBDC development around the globe. They include the following goals:

- **Providing effective integration with Kazakhstani financial market participants.** This integration will be realized using APIs and will be available for all market participants regardless of their internal IT systems' specifics. This approach simplifies and minimizes the amount of work to be done by the participants and thus leads to more participants connecting to the DT platform in the future.
- **Ensuring interoperability with different CBDC, digital assets networks and decentralized finance.** There will be pilot studies on cross-border CBDC transactions using Swift's CBDC connector. The pilot study will be facilitated by Swift and conducted by integrating DT with other central banks' CBDC networks. In addition, possible integration with decentralized finance will be investigated. This includes cooperative projects with the digital asset industry to test the issuance of stablecoins backed by the DT and with the stock exchange to test the securities settlement using the DT.
- **Maintaining a balance between privacy and traceability of CBDC.** Previous experiments demonstrated that the DT settlements were more anonymous than traditional non-cash instruments. This was achieved by implementing anonymity customization: every user could independently determine whether to show personal data to other participants of the transaction or not. As a result, KYC and AML/CFT requirements were met without any threat to privacy. Solutions developed during the 2021-2022 research will be actively utilized to achieve this balance.
- **Increasing the efficiency of settlements by the implementation of innovative services including CBDC programmability.** The introduction of innovative services based on CBDC is becoming a global trend. Programmability can provide digital currencies with innovative properties such as targeted purposes, addressability, reducing or eliminating counterparty risk, new processes, etc. In 2023, a pilot study with market participants will focus on implementing a smart contract for an automatic tax deduction on goods purchased at the point of sale from specific merchants. Similar smart contracts implementation experiments will continue in the following stages of the development of the DT platform.
- **Integrating the DT platform with the existing payment infrastructure.** Despite its unique features, the DT ecosystem cannot and should only exist in the landscape of Kazakhstan's financial system, as this contradicts the idea of interoperability of CBDC. As part of the 2023 work, integration will be carried out with several payment systems to ensure that the DT platform can effectively interact with them.
- **Launching a pilot operation in cooperation with the commercial banks.** Maintaining the two-tier architecture of the DT remains one of the most critical priorities of the NBK. For this reason, the participation of banks in the pilot project and obtaining feedback is critical for the further development of digital currency. Due to the extreme novelty of the CBDC topic in Kazakhstan and globally, the number of banks participating in the project at the first stages is expected to be relatively small. Nevertheless, the experience gained through this initial cooperation will be critical in creating the fastest and most efficient integration of the DT platform with banking systems in the future.



- **Conducting tests with real customers and merchants in an open environment.** The acceptance of the digital currency predetermines its further development - the trust of end users is necessary for the project's success. In addition to the main tasks (identification and correction of errors, verification of functional and non-functional properties of the platform, etc.), these tests will allow customers to acquire their first experience of interacting with digital currency. Such an opportunity is vital for the DT adoption in the future. The 2023 work includes similar testing and several related activities.
- **Continuing the studies of market participants' scenarios, cross-border payments, and integration with DLT.** Exploring and testing such scenarios will test their viability, assess the complexity of implementation, and identify new use cases of the DT. In addition, such interaction with market participants will positively impact digital currency adoption in the future due to market-oriented scenarios being implemented on the DT platform. For these reasons, research in the above areas will continue in 2023.

All tasks above were selected considering further expansion of the platform functionality followed by the launch of industrial-scale operation. Their completion will enable further development of the platform.

In addition to these tasks, the works planned for 2023 also include the creation of **industrial** and **experimental** (also known as the **R&D**) environments of DT platforms.

Industrial environment scenarios

The main objective of the 2021 and 2022 pilots was to test the viability of the Digital Tenge lifecycle's key scenarios. It was achieved via both theoretical and empirical approaches, and all related results were published on the National Bank's website. In 2023, a new ambitious goal was set - to create an infrastructure that includes technical, organizational, and legal components required for the full-fledged implementation of digital currency by 2025. To achieve this goal, the following tasks will be addressed by means of the DT industrial environment:

- Integrating the DT platform with the existing National Bank's account infrastructure to ensure a seamless launch of the digital currency into circulation;
- Integrating the DT platform with the banks' and other market participants' infrastructure to create mechanisms of the Digital Tenge distribution to end users;
- Integrating the DT platform with banking service interfaces for individuals and legal entities to incorporate digital currency into services familiar to users without additional costs related to the creation of special devices and interfaces;
- Providing participants with documentation describing the technical and technological aspects, legal framework, and security measures related to the use of the DT.



Before planning the pilot operation and related tests, the selection of scenarios for further implementation in an industrial environment was made in collaboration with market participants and other stakeholders. These scenarios were designed to cover each stage of the DT lifecycle. They include all processes related to an initial issuance, distribution, conversion, spending digital currency in ways familiar to the consumers, various transfer operations, and redemption/termination. The main aim of these processes being tested in numerous ways is to guarantee the system's stability and efficiency of real operating conditions and to demonstrate the possibility of settling transactions in the context of different participants. The table below summarizes possible transaction flows on the DT platform and related scenarios planned for realization in 2023.

	GOVERNMENT	BUSINESS	CUSTOMER
GOVERNMENT	Technologically feasible	Technologically feasible, realized in the "Digital Vouchers" scenario	Technologically feasible
BUSINESS	Technologically feasible	Technologically feasible, realized in the "Digital Vouchers" scenario	Technologically feasible, realized in the "CBDC card" scenario
CUSTOMER	Technologically feasible	Technologically feasible, realized in several scenarios	Technologically feasible, realized in several scenarios

Description of industrial environment scenarios

"CBDC card" scenario

This scenario requires the involvement of participants in the "friends and family" format, several banks will be also involved. The number of participating merchants is not determined in advance due to the planned integration of existing payment mechanisms (QR and POS terminals) with the DT platform. Under the scenario, participants will be able to open a digital account via the bank's mobile application and to transfer non-cash funds to this account. In addition to this, participants will be able to conduct payment transactions via merchants' POS, transfer the DT to other participants, and convert the DT into cash or non-cash money. The functionality of digital accounts under this scenario is similar to that of bank current/card accounts.

The main objectives of this scenario are:

- to test the DT platform under conditions of integration with payment systems and bank services,
- to test the DT's viability as a full-fledged means of payment,
- to investigate the problems of building the digital tenge ecosystem,
- to identify problems that could have been missed under different testing conditions while receiving accurate feedback as quickly as possible.



"Digital Vouchers" scenario

Within the framework of this scenario, several government agencies and merchants will participate. Implementation of this scenario provides an opportunity for instant payment for services using the infrastructure of POS terminals and cards linked to specific users. A technological integrator will provide the infrastructure and will be deployed in advance. Applying the card to the pre-deployed POS terminal will create a trigger event for the DT platform thus transferring money from the organization's digital account to the merchant's one.

The main objectives of this scenario are:

- to test the DT platform to implement voucher schemes
- to create an automated system of payment for services by the state without intermediaries
- to create the foundation for further scaling up the use of digital currency for other similar projects.

In September, it is planned to publish the description of the procedures for integration with the DT platform. Additionally, a detailed implementation plan and the API methods for following processes will be officially presented:

METHOD NAME	FUNCTIONS AND TASKS
Opening an account of a legal entity on the DT platform	Basic method for opening a digital account on the DT platform
Opening an account of an individual on the DT platform	Basic method for opening a digital account on the DT platform
Conversion of non-cash KZT to the DT at the "bank - CB" level	Method to enable banks to purchase the DTs from the NBK in exchange for non-cash tenge
Conversion of non-cash KZT to the DT at the "legal entity - bank" level	Method to enable legal entities to purchase the DTs from the NBK in exchange for non-cash tenge via banks
Legal entity-to-legal entity payment	Method to conduct payments between legal entities (in particular, merchants and state organizations)
Legal entity-to-individual payment	Method to transfer the DTs from legal entity to individuals (in particular, from state organizations to end users)
Individual-to-individual transfer	Method to transfer the DTs from individual to individual (QR-code and phone/card number)
Payment at merchant	Method to conduct purchase in the DTs by an individual at merchants' point of sales
Conversion of the DT to non-cash KZT to at the "legal entity - bank" level	Method to conduct purchase of non-cash tenge by legal entities from banks in exchange for the DTs
Conversion of the DT to non-cash KZT to at the "individual - bank" level	Method to conduct purchase of non-cash tenge by individuals from banks in exchange for the DTs
Conversion of the DT to non-cash KZT to at the "bank - CB" level	Method to conduct purchase of non-cash tenge by banks from the NBK in exchange for the DTs
Monitoring	Method to monitor the state of platform components (nodes, wallets, etc.) with respect to implemented role model
Receiving balance-related data	Method to obtain information about the balance of nodes and wallets with respect to implemented role model
Receiving notifications	Method to receive notifications with respect to implemented role model



Later, by the end of September 2023, access to a repository with the necessary documentation will be provided for market participants.

A specialized working group will be established with each market participant to make optimal use of the platform's capabilities and provide the best experience for end users. The objective of this group will be to jointly develop a value proposition that will maximize the benefits provided by the DT platform.

This approach will ensure both technical and commercial integration of the digital currency into the existing financial landscape, thus making digital currency attractive to a wide range of users.

Based on the results of the first wave of 2023 scenarios launch and subsequent discussions with market participants, it is planned to select at least 10 banks to jointly development the DT-based products in 2024. Details will be presented in the 2023 final report.

R&D scenarios

CBDC helps to build a new-age economy based on trust, speed, and complete freedom of choice. At first glance, changes towards a new economy with tokenizing all values and linking them to new payments are developing without the CBDC. But in reality, the ability to program the DT (tie any triggers to payments and fragment them) can blurs the boundaries between closed ecosystems due to the essence of CBDC money, thus leading to increasing consumption and decreasing fees.

Users desiring to create their projects only need to manage the provided opportunities properly. The tokenization of real-world assets opens up a new way to monetize illiquid assets. For example, a numismatist or philatelist might tokenize a rare coin or stamp collection by splitting and sharing ownership of the assets with buyers worldwide and transferring the underlying assets to a museum for display and storage. It can help them maintain partial ownership and unlock liquidity.

The DT can benefit all market participants, provided their efforts are effectively coordinated. The work on elaborating all aspects of the development of the DT ecosystem has led to several events at the DT Hub - meetings and roundtables (including these with international organizations such as Visa, MasterCard, CBDC ThinkTank, R3, BIS, etc.), design sessions, meetings, and Q&A sessions with the expert community and opinion leaders.

Several top projects were selected based on the results of the IDEATHON-2022. The selection criteria included consumer, business, and government benefits, scenario innovativeness, the possibility of applying smart contracts, and the DT's programmability. The winner's scenarios will be implemented in 2023 in the experimental sandbox.

The objectives of engaging market participants during the piloting phase are:

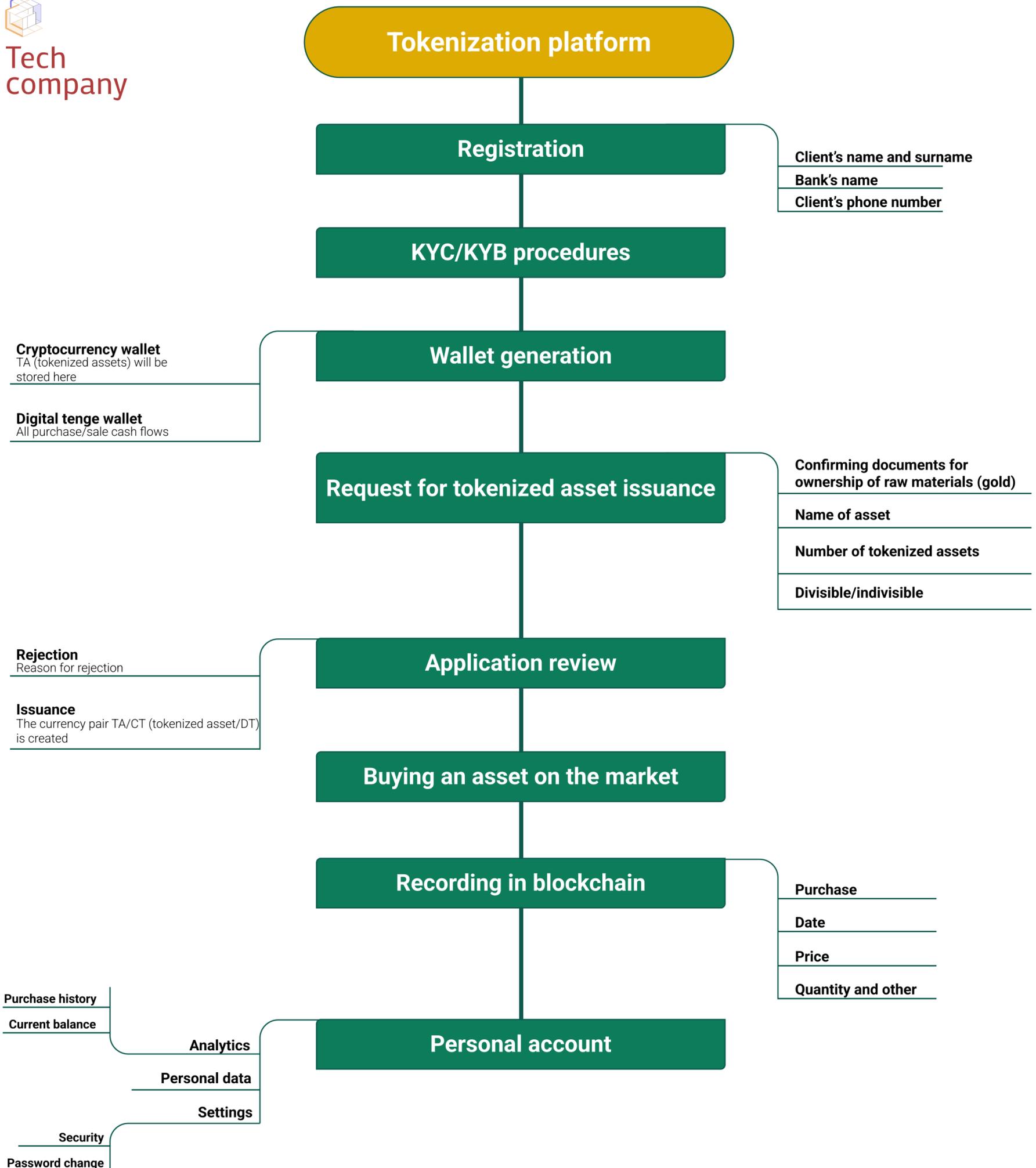
- demonstration of the platform's capabilities for building business applications
- realization of additional scenarios within the DT ecosystem building of services and products.



Scenario 1. Sale of tokenised assets

Tokenization is a tool that reflects the value of assets through digital units based on DLT technology. As a result, each digital unit represents a share of the underlying asset. The functions of tokenization are to reduce the role of intermediaries and increase the liquidity of assets.

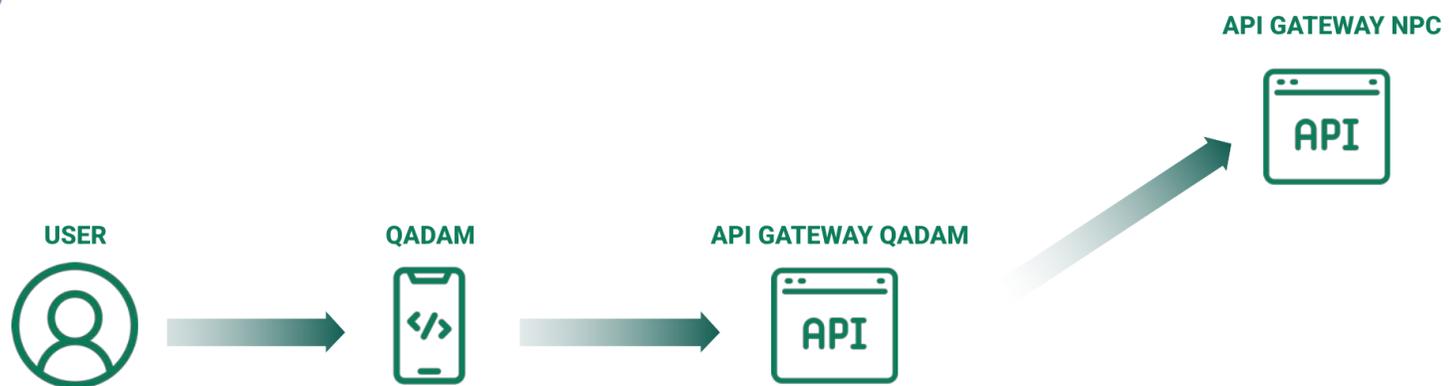
The participant team will implement a tokenization platform with the functionality of a tokenized asset exchange that includes verification of ownership and tokenization of the asset, sale, and purchase of tokenized assets in real-time. The scenario involves integration with the DT platform for real-time payment and settlements.





Scenario 2. Pedometer

The participant plans to implement an application to test the DT use to promote a healthy lifestyle. The mobile application counts the number of steps. When certain thresholds are reached, rewards in the form of the DT will be automatically distributed to the user. As a further development of the mobile application and greater population involvement, it is possible to implement additional functionality such as gamification.



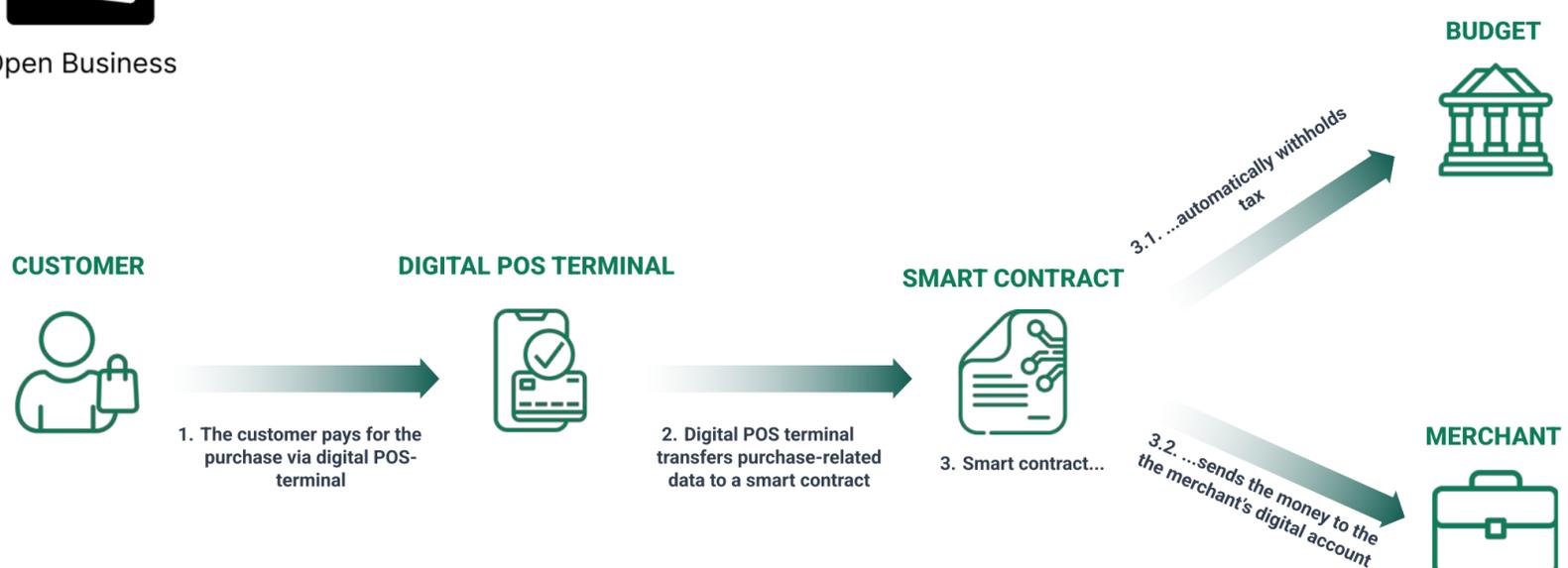
1. User downloads QADAM applications from Appstore or Google Play
2. User presses "Start", and the app starts tracking the number of steps and distance traveled. Obtained data is sent to the QADAM's API Gateway
3. In QADAM application opens a wallet linked to the DT account
4. When the threshold value is reached, the QADAM backend send the message to the NPC API, and this triggers the DT transaction to the user's wallet

Scenario 3. Value-added tax deduction

An automatic value-added tax deduction from a transaction involving the purchase of goods will be implemented with a smart contract. This scenario is intended to facilitate interaction between merchants and tax authorities.



Open Business





Joint scenario with SWIFT - cross-border payments

The DT platform creates a fundamentally new mechanism for cross-border payments by introducing a number of unique advantages.

The analysis of the implemented CBDC-based cross-border payment platforms suggests that there is no single solution that satisfies all the different aspects of CB. In turn, this gives great importance to the local specificity and original principles of each CB separately.

In 2023, the NBK joined the SWIFT Beta Testing Initiative. The objective is to test atomic PVP transactions where payment information is exchanged via the SWIFT CBDC Connector. Tokens are locked and unlocked in the participants' infrastructures, and the value transfer within the 2023 pilot is processed off-chain.

The international standard ISO 20022 is used for message transmission.

The testing includes two main stages

- 1) integration of the DT Platform with SWIFT CBDC Connector
- 2) testing the payment flow with other Central Banks involved in this initiative.

Joint scenario with the digital asset industry's market participant

The development of the digital asset industry and global trends in CBDC cannot be overlooked. All stakeholders need to adapt together to new challenges. The common interest is building an efficient, relevant, and innovative infrastructure that addresses the needs of today's dynamic environment.

DeFi is still in the early stage of industrial maturity. The primary driving force behind its development is the well-established speculative market for digital assets, including cryptocurrencies and stablecoins. Regulators face striking challenges between minimizing the risks associated with high DeFi penetration and ensuring consumer demands for affordable, fast, and innovative financial services are satisfied.

By working together, stakeholders can help to create a responsible and robust DeFi ecosystem that meets the needs of both consumers and the broader financial industry. This collaboration will be crucial in navigating this growing sector's complexities and potential pitfalls.

The potential role of a CBDC can be seen in promoting interoperability and standardization of new types of private digital money, such as tokenized bank deposits and regulated stablecoins. In this capacity, a CBDC could fulfill a function akin to settlement balances held at the CB for settling payments made using commercial bank money.

In this context, a novel type of stablecoin backed by the DT will be introduced, tested, and evaluated.

Stablecoins are digital assets that are pegged to and backed by fiat currencies. Currently, there are three stablecoins: fiat-backed stablecoins, cryptocurrency-backed stablecoins, and unbacked algorithmic stablecoins.

Trust and transparency are the key pillars of a stablecoin's use and acceptance. We aim to demonstrate a stablecoin model that significantly reduces counterparty risk through DT and provides real-time transparency to users through a real-time 'proof-of-collateral' service.

The test also includes the development of a mechanism (proof of collateral) that allows end users to independently verify that the value of the stablecoin issued does not exceed the value of the pilot DT held in a segregated wallet. Proof of collateral is a verifiable audit procedure that helps end users ensure the DT fully collateralizes their stablecoins without involving third-party auditors. This mechanism provides transparency and trust in the stablecoin ecosystem, as users can independently confirm in real-time that the appropriate assets back their holdings.



Joint scenario with the stock exchange

The participants in this scenario are the stock exchange, the owner of a tokenized securities platform, and the National Payment Corporation, the operator of the DT platform.

As part of the work in 2023, it is planned to implement the primary functionality through integration with the digital currency platform. The main objective of this scenario is to gradually organize the issuance and circulation of tokenized securities on the distributed register platform using the DT for settlements.

Wholesale CBDC is not a prerequisite for DvP in securities settlement. But wholesale CBDC can provide settlement in securities money, which reduces the requirements for risk capital, clearing facilities, and settlement liquidity.

The application of DLT has the potential to change the way digital assets are stored, recorded, and transferred and bring fundamental changes not only to the technological architecture but also to the structure of the financial market. DLT can also facilitate innovations in issuing and settling securities such as tokenizing financial assets. Having a CBDC on DLT can enable the integration of payments and securities trading, shorten the standard settlement cycle, facilitate atomic or near real-time settlement, DvP, and enable end-to-end or fully automated transaction processing in securities settlement.

Smart contracts and programmability allow for new forms of payment conditionality, requiring that a payment be made only if another payment or asset is delivered. This would improve the DvP mechanism in fast payment systems, as assessed by the BIS.

Joint scenario with government agencies for public procurement

This scenario will include government agencies, merchants, and banks. In this scenario, one government agency will pay another for services and transfer funds within the DT platform to the relevant digital account in a simulated environment. It will also test the possibility of attracting existing suppliers to realize additional sub-scenarios to involve more participants in the public procurement process. The main objectives of this scenario are to test the DT platform for public procurement and lay the foundation for further scaling up the use of digital currency for other similar projects.



Regulation and accounting of the Digital Tenge

Developing and implementing a legal and regulatory framework for the DT platform requires careful investigation due to the digital currency's complexity and interconnections with other topics in different fields. It would not be prudent to develop such a framework before the evaluation of the pilot operation's results for the following reasons:

1. It is impossible to identify technical problems, vulnerabilities, and system deficiencies that could affect the safety and reliability of the DT.
2. It will not be possible to accurately assess the risks associated with implementing the digital currency and analyze cybersecurity threats.
3. The impact of the digital currency implementation on the macroeconomy will be unclear.
4. The impact of DT usage on the business processes of participants and end users from a practical point of view will be unclear.
5. Conducting pilot operation will provide an opportunity to apply changes to the selected approach before finalizing the regulatory framework.

As the results of the pilot operation are received from the participants, the requirements for accounting for the DTs and other rules for their circulation will be formulated and detailed.



Conclusions

To sum up, the implementation of the DT has excellent potential for developing the National Payment System. It provides an opportunity to be competitive globally, considering the current trends of the financial market. The DT project has moved to a new stage of development, with the advantages of retail and wholesale CBDC being explored. Thus, the DT can bring new opportunities for the whole economy by being a general-purpose instrument.

CBDC helps to build a new-age economy based on trust, speed, and complete freedom of choice. The ability to program the DT blurs the boundaries between closed ecosystems due to the essence of CBDC money, thus leading to increasing consumption and decreasing fees.

To fully unlock the potential of DT, a comprehensive and phased implementation of a new means of payment is required.

The critical result of all works will be creating an industrial CBDC platform. In developing the target DT architecture, interoperability is a complex subject due to the large number of interactions and differences in data formats defined in existing standards. In addition, the new DT functionality, offline payments, and programmability require research in a controlled environment and the involvement of market participants in developing new scenarios to identify optimal solutions.

The implementation of the DT is a complex process. Numerous financial innovations, including digital currencies, derive much of their value from the network effect. The more people and organizations use DT, the greater its value will be brought to each user. Only if the DT is widely used will its potential benefits be obvious. In 2023, it is planned to build the DT infrastructure, test it in practice, identify problems, and assess the real benefits.

The chosen phased approach leads to the development of a targeted architecture according to the business requirements suitable for Kazakhstan and with the involvement of all participants of the DT ecosystem. The results of the above-described work of the current year will be published in the final report in December.



Frequently asked questions

What is DT?

Today, the financial sphere of Kazakhstan uses both cash and non-cash money. Cash includes banknotes and coins, while non-cash money includes money in bank accounts. The NBK is developing a third form of the national currency, the DT. The decision to launch the DT was made at the end of 2022.

The DT will be universally accepted as a legal tender and fulfill all the functions of classical money for all subjects of the economy. The DT will be issued as a unique digital sequence (tokens) or electronic records stored on special electronic wallets. Regarding payment technologies, the usual transaction options will remain available. Still, a fundamentally new payment solution will be implemented - offline payment, i.e., payment by mobile phone or other similar device without an internet connection. With the launch of the DT, cash or non-cash money will remain in circulation, and digital currency will coexist with them.

What will the implementation of DT give?

The NBK is building and developing the National Payment System so that all Republic's payment market participants can access inexpensive, fast, convenient, and secure payments. The DT infrastructure will become an additional tool for financial market participants, using which they can create innovative services.

The DT will also ensure further growth in the penetration of non-cash payments in the regions and increase the availability of financial services. In the long term, implementing the DT will also increase the efficiency of cross-border payments. The DT platform also provides the ability to program national currencies at the token level, opening up a wide range of opportunities to improve the efficiency, speed, and transparency of settlements involving the state.

A detailed description of the potential benefits and risks of implementation is available in the NBK report.

How can financial market participants participate in the project? What new opportunities will they get in this regard?

One of the leading hypotheses is the possibility for market participants to create innovative services and products on the platform provided by the NBK. Participants develop customer-driven scenarios in the 2023 pilot project by integrating projects into the digital platform. It enables participants to assess the potential of new technologies and build customer-centric products. At the same time, the NBK conducts training for market participants to realize their scenarios on the DT platform.



What prospects and opportunities does the DT offer?

The existing forms of settlements have advantages and work successfully in the existing system. However, implementing the DT opens up new perspectives and opportunities that serve not only efficiency but also the long-term development of the economy.

Innovation. The DT promotes new technology thus facilitating access to financial services and creating new opportunities for entrepreneurship and business.

Security. The DT provides high transaction security by using modern cryptographic technologies.

Availability. The DT can make financial services accessible to a broad population segment including remote and hard-to-reach regions.

Efficiency. Accelerating and facilitating settlement through the DT can reduce costs and increase the speed of financial transactions.

The DT offers unique opportunities and has advantages over other forms of settlement. It contributes to increased speed, security, and accessibility, thus enriching the financial system. The DT does not replace existing methods but offers additional options and flexibility for ordinary citizens and business entities. The implementation of the DT is being conducted considering national and the existing financial structure's participants' interests to work together for the long-term and sustainable development of the Kazakhstani economy.

Will the NBK be able to change the rules of using DT at any time?

No, the primary objective of NBK regulation is to ensure macroeconomic stability, safety, and soundness in the financial system. The NBK will not change the rules of using the DT arbitrarily.

Any potential changes will be carefully considered, investigated, and widely discussed with stakeholders. The NBK will continue to act with maximum transparency and accountability to serve the interests of all participants in the economic process.

At the same time, it is worth noting that other modes of payment (both cash and non-cash) will always be available with the DT. Consumers will be free to choose any payment method that is convenient for them.



In the DT-related context, what is the role and status of the BIS, IMF, and WB? What are the mechanisms for interaction with these organizations? And to what extent is this in line with national interests and needs?

International organizations act as independent advisors whose expertise is considered alongside independent expertise or representatives of other CBs. The interaction mechanisms with these organizations are based on transparency, cooperation, and compliance with international norms and standards.

It is important to emphasize that all decisions regarding the DT are made by the NBK, considering national interests and needs. Interaction with international organizations upholds our independence and ability to act in the interests of our people and economy.

Will the DT solve the corruption problem since corruption is about people on the ground first and foremost?

Corruption is a complex and multifaceted phenomenon with human factors at its core. However, implementing of the DT can be part of a comprehensive approach to fighting corruption. The DT's transparency, traceability, and security compliance can facilitate monitoring and prevent fraudulent behavior. It is not a replacement but a complement to broader measures to strengthen the rule of law, education, and a culture of transparency.

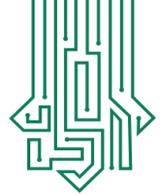
Despite the possible benefits, it is essential to emphasize that the DT is, first and foremost, a payment instrument. The DT can complement existing financial instruments and support long-term goals like fighting corruption. Still, the DT aims to improve and simplify financial transactions for citizens and businesses in Kazakhstan. Its main objective is to ensure efficiency, security, and accessibility in payment transactions.

Will the DT enable the NBK or other government agencies to monitor all transactions of citizens?

Data privacy and confidentiality are critical issues related to the DT. The NBK recognizes the significance of this issue and strictly complies with personal data protection laws.

The DT will have the necessary security measures in place to prevent unauthorized access or monitoring of transactions of individual consumers. Access to such information will be restricted, and the legislation in force will carry out all transactions.

It should be emphasized that the primary objective of the DT is to simplify and improve payments, not to monitor the transactions of individuals. The NBK is constantly working to improve security and reliability to ensure that the interests of all participants in the financial process are trusted and protected.



**Does DT have cybersecurity advantages over e-money and cryptocurrencies?
Will additional work be required on the part of banks to enhance security?
Should citizens be educated on certain specific security rules when using DT?**

Fundamental principles for implementing digital currency, particularly the DT, include data protection, operational resilience, and cybersecurity. A review of cyber-attack tests of existing central bank digital currency platforms was conducted. It should be noted that many risks depend on the design of the digital currency technology infrastructure and the configuration of different properties depending on the system requirements. The distributed ledger technology of the Corda platform was chosen for implementing the DT pilot project and for security and privacy reasons. This solution allows the management anonymity, privacy, and traceability of transactions.

One of the hypotheses successfully tested within the project is transaction security. Using tokens makes it possible to identify the issuer unambiguously, thus guaranteeing the authenticity. At the same time, the consensus mechanism excludes the possibility of double spending of tokens in the presence of an Internet connection on the participants' devices. Nevertheless, the requirements and criteria for protecting users' data containing banking secrecy and the distribution of responsibility between participants will have to be worked out in the future.

Are there common objective reasons that encourage different countries to introduce CBDC? If so, what are they?

The strategic objectives of implementing CBDC in different countries may vary depending on local specifics. Still, according to the BIS study, most countries have the following objectives:

- Diversification and increased sustainability of payment mechanisms.
- Increased financial inclusion.
- Increased efficiency of cross-border payments.
- Improved security and confidentiality of payments.
- Increased sovereignty of monetary policy at the global level.



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