NATIONAL BANK OF THE REPUBLIC OF KAZAKHSTAN

DIGITAL TENGE

PUBLIC DISCUSSION REPORT

MAY 2021

ABBREVIATIONS

AML (CLI/FT)	Anti-Money Laundering, Counteraction of Legitimization of Incomes and Financing of Terrorism
BIS	Bank for International Settlements
CB	Central Bank
CBDC	Central Bank Digital Currency
CLT	Centralized ledger technology
DC	Digital Currency
DLT	Distributed ledger technology
ICBDC	Central Bank Digital Currency with an indirect approach to architecture implementation
IMF	International Monetary Fund
KYC	Know Your Customer or Know Your Client
multi-CBDC	Digital currency of several central banks
NBK	National Bank of the Republic of Kazakhstan
RK	Republic of Kazakhstan
WB	World Bank

CONTENT

SUMMARY

A digital tenge will be a new form of digital money issued by the National Bank of the Republic of Kazakhstan (hereinafter - the NBK). The digital tenge will have the same legal status as physical cash and its non-cash form and be fully fungible with them. It will exist alongside cash and bank deposits, rather than replacing them. The implementation of digital tenge aims to ensure the further development of the National Payment System and reduce the dependence on cash payments for a number of unique technological characteristics.

Currently, the NBK is conducting a comprehensive study of the potential benefits and challenges related to CBDC implementation. It is exploring the CBDC issuance and design tasks that should be solved, their emission, and distribution method, questions related to technology, payment systems — as well as financial stability, legal foundations and regulation. For this work the NBK is cooperating with financial market participants, the expert community, and international partners, thus enhancing mutual awareness of CBDC prospects.

As part of the study, the NBK plans to implement a pilot project on retail digital currency, conduct a series of studies to assess the impact of the digital tenge, and several sessions with market participants and international partners to discuss the questions related to digital tenge.

The NBK will decide on whether to introduce the digital tenge in Kazakhstan by defining the requirements for technological infrastructure and regulation of issues related to the national digital currency, as well as consumer protection aspects based on the results of this work.

DEFINITION, MOTIVES FOR IMPLEMENTING DIGITAL CURRENCY

1.1 Nature and definition of digital tenge

According to basic economic concepts, money performs 3 main functions. They can act as a medium of exchange, a store of value as well as a unit of account. At the fundamental level, the money serve as "IOU" (I owe you) note.

The source of this trust has changed with the evolution of market relations, economic needs, and the development of scientific and technological progress. In a modern economy, all money is fiat, which means it is accepted in exchange for goods and services because people trust the central bank and its monetary system to keep the value of money stable over time.

In the Republic of Kazakhstan (hereinafter - RK), fiat money exists in two forms - cash and non-cash. Cash is issued in the form of banknotes and coins, and non-cash money is issued in the form of a record on bank accounts. The NBK is now considering a third form of national currency – digital tenge.

The digital tenge will be another representation of NBK's obligation, which has all the properties and functions of money. At the same time, it will combine a number of properties of cash and non-cash money, as well as reveal new functionalities for business participants and government institutions. The digital tenge is not intended to replace cash or non-cash money, it will coexist as an additional form of money.

The NBK will issue the digital tenge. The new form of the national currency will be available for all economic entities to make payments and settlements. The digital tenge will be issued in the format of a unique digital sequence, which is recorded in individual electronic wallets and can be transferred between them. The NBK will also consider other options for the technological implementation of the digital platform.

At the same time, some technological approaches to implementation enable the exchange of digital tenge without the Internet. Moreover, digital tenge can be used for online transactions.

Thus, the digital tenge will be central bank digital currency (hereinafter referred to as the CBDC).

1.1 Nature and definition of digital tenge

Monetary and payment properties of digital tenge

Source: NBK

Despite a significant increase of central banks' interest towards the CBDCs, there is no generally accepted definition of this term yet.

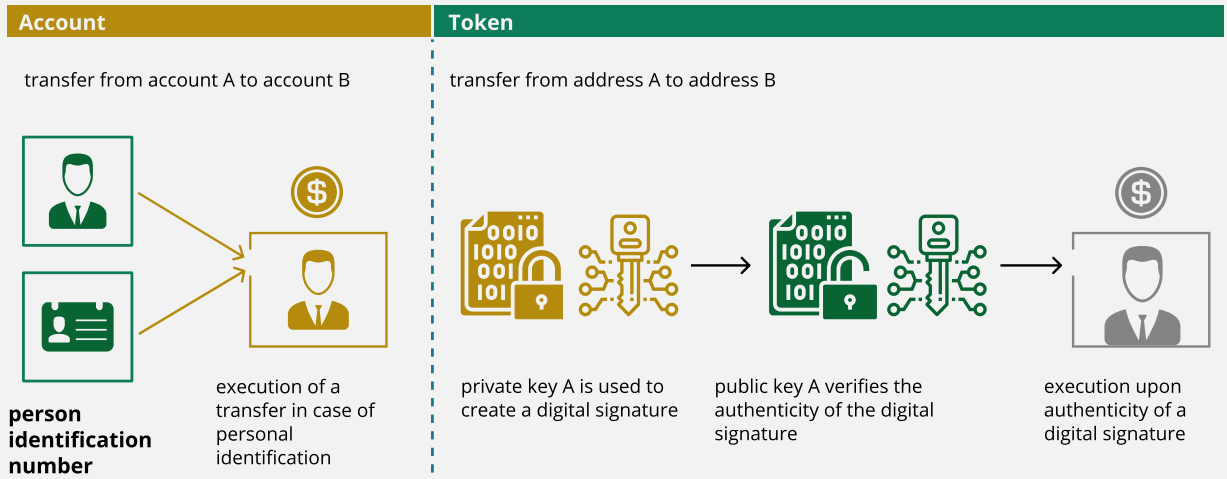
1.1 Nature and definition of digital tenge

The BIS determines the CBDC according to 4 parameters: the institution of issue (central bank or not), form (digital or physical), accessibility (for all or only authorized participants) and technology (centralized or decentralized settlements).

According to the BIS definition, the CBDC is a digital publicly available token (digital entry in the register) or an individual account opened directly in the central bank system and is its obligation.

There are many differences between a token and an account, but the main thing is the organization of access to the currency itself. Namely: is access related to identity verification, as is done with bank accounts, or to the validity of the object of trade, like cash, that is, access based on tokens. In other words, on the basis of the account, it goes: "This is me, therefore I own", and here the requirements for the digital currency are presented in the database with a link to the identity. In the case of access to currency based on a token, it goes: “I know, therefore I own”, in this case, the user of the digital currency confirms his knowledge of the object, for example, with the help of individual electronic signatures.

Account and token



Source: BIS Quarterly Review "The technology of retail central bank digital Currency", March 2020

1.1 Nature and definition of digital tenge

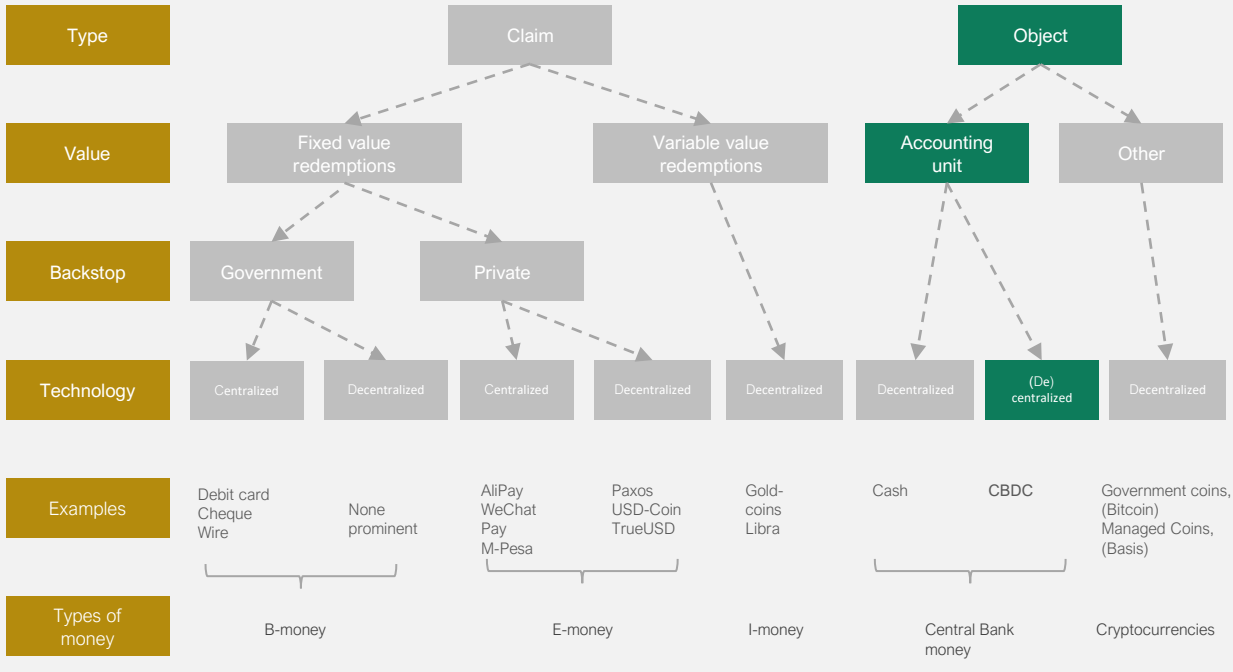
Definition of digital currency according to the BIS

CBDC	Digital form	Widely accessible	CB issued	Token-based
Cash		✓	✓	✓
Bank deposits	✓	✓		
CB reserves and settlement accounts	✓		✓	
CB accounts (general purpose)	✓	✓	✓	
CB digital tokens (general purpose)	✓	✓	✓	✓
CB digital tokens (wholesale only)	✓		✓	✓
Private digital tokens (wholesale only)	✓			✓
Private digital tokens (general purpose)	✓	✓		✓

Source: BIS Report "Central bank digital currencies", March 2018

The IMF also defines a new form of money in the context of 4 parameters, according to which the digital currency is considered as unit account based on centralized or decentralized technology and is issued by the central bank.

Definition of digital currency according to the IMF



Source: IMF report "The rise of digital money", July 2019

1.1 Nature and definition of digital tenge

It is important to note the significant differences between digital tenge and electronic money. Digital tenge will become an additional form of money issued by the NBK, while electronic money exists only within the infrastructure of a specific payment system and can be issued also by private organizations. In other words, electronic money performs its functions within the framework of one payment system and is an obligation of the owner of this system.

In addition, “cryptocurrencies” and “stablecoins” have recently gained considerable attention, digital tenge may be mistakenly assigned to this class of digital assets. Despite partly similar technological approaches, “cryptocurrencies” and “stablecoins” are not money, since they cannot ensure the sustainable performance of all functions of money. These assets cannot be used as a universal and unconditional payment means, and cannot be used as a full-fledged unit of account and a medium of exchange due to the volatile value expressed in official monetary units. In turn, the national currency (digital tenge) wil be issued by the State, which ensures its stable functioning in the interests of all participants of the payment system.

1.2 An overview of the international research discourse on digital currencies

Researchers' interest in CBDC is rapidly shifting from theoretical discussions to pilot projects around the world. Thus, according to the BIS survey, in 2021, out of 65 central banks that participated in the survey, 86% are studying the CBDCs. At the same time, 60% are already at the stage of technology experimentation, 14% are implementing pilot projects.

Kazakhstan is also among the countries involved in the study of digital currency. In November 2020, the NBK announced the start of a research project on digital currency implementation.

For the central banks the common motivations for exploring a CBDC are increasing the availability of financial services, improving the efficiency of payments, and developing cross-border payment systems. Developing economies, on average, estimate the likelihood of full-fledged introduction of digital currencies higher than developed markets.

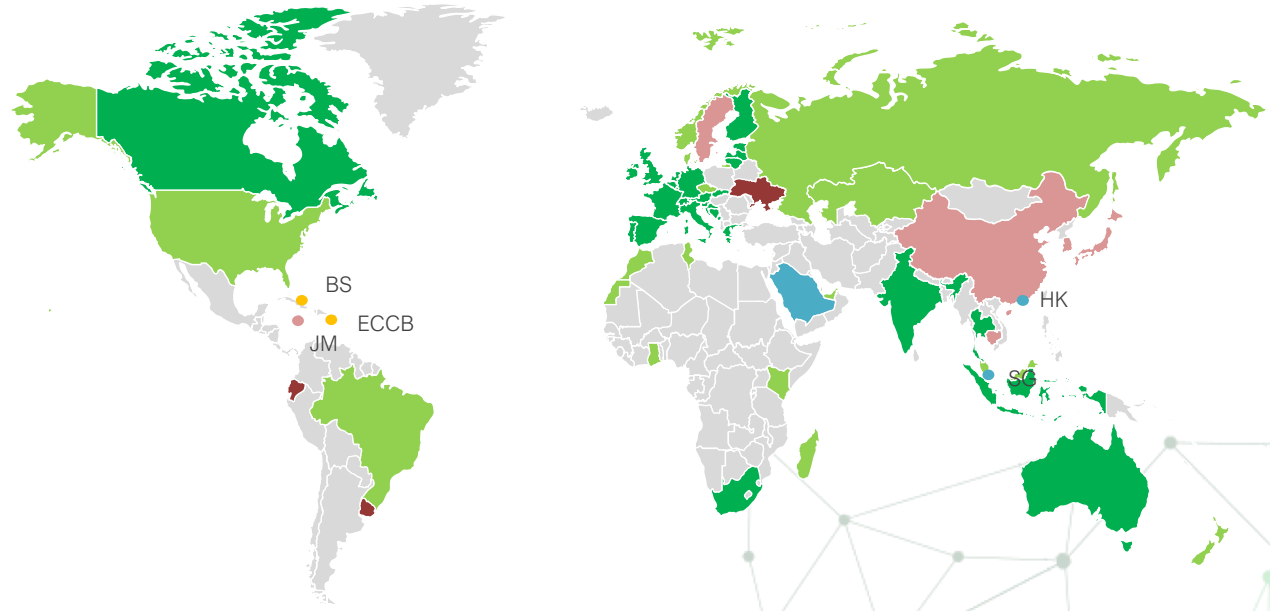
Nevertheless, in all states, the question of the full-scale issue of the national digital currency remains open.

Status map of countries, which study, pilot digital currencies

86%
are exploring the issue of introducing digital currency

60%
are at the stage of experimentation

14%
have implemented or are implementing pilot projects



BS - Bahamas
ECCB - Eastern Caribbean Central Bank
SG - Singapore
HK - Hong Kong

JM - Jamaica

Source: BIS Working Paper 880 "Rise of the central bank digital currencies: drivers, approaches and technologies", August 2020, updated as of April 2021

1.2 An overview of the international research discourse on digital currencies

Governments in several countries are experimenting with digital currencies in order to improve the competitiveness and efficiency of payments within the economy, as well as to reduce the turnover of cash, as revealed by the analysis of individual projects.

In addition, it should be emphasized that the digital currency models are different, and while regulators are exploring possible options, they are not giving preference to particular one.

Overview of the main motives behind the introduction of retail digital currency *

Central banks	Digital currency	Announcement date	Status	Motivation for implementation	DLT-based technology	Technology Provider / Protocol
People's Bank of China	DC/EP	2017	Active pilot stage	Competitive payments / Decrease in cash turnover	Potentially hybrid	
Central Bank of Sweden	e-Krona	2017	Completion of the pilot project		Surveying DLT	R3 Corda
Central Bank of Russia	Digital Ruble	2020	Publication of the Concept of the Digital Ruble	Competitive payments / Decrease in cash turnover Efficiency of payments Financial inclusion	Potentially hybrid/ DLT	
Central Bank of Uruguay	e-Peso	2017	Completion of the pilot project	Efficiency of payments Financial inclusion	No	Antel telecom, RGC system provider, IBM storage
National Bank of Ukraine	e-Hryvnia	2017	Completion of the pilot project	Competitive payments / Decrease in cash turnover Efficiency of payments Financial inclusion	Surveying DLT	Attic Lab, pilot used Stellar
Central Bank of the Bahamas	Sand Dollar	2018	Pilot to national use	Efficiency of payments Financial inclusion		NZIA
Eastern Caribbean Central Bank	DXCD	2019	Pilot to national use		Agnostic	Bitt

*incomplete list of projects

1.2 An overview of the international research discourse on digital currencies

Central Banks / Organizations	Project name	Announcement date	Status	Motivation for implementation	DLT-based technology	Technology Provider / Protocol
Monetary Authority of Singapore	Ubin	2016	Completion of the pilot project	Competitive payments / Decrease in cash turnover Efficiency of payments	DLT technology tested	Hyperledger Fabric, Quorum, Chain
Bank of Canada	Jasper	2017	Completion of the pilot project		DLT technology tested	R3 Corda
European Central Bank	Stella	2017	Completion of the pilot project		DLT technology tested	Hyperledger Fabric
Bank of Japan						R3 Corda
Bank of Thailand	Inthanon/ LionRock		Completion of the pilot project		DLT technology tested	R3 Corda
Hong Kong Monetary Authority						

Source: KPMG report "A Global Look at Central Bank Digital Currencies", August 2020, updated as of April 2021

CBDC's retail initiatives are active in emerging market economies, where financial inclusion and digitalization are key drivers. Projects in the Bahamas and Cambodia are currently two projects underway that have moved from the pilot to the stage of national use. The prerequisites for the implementation of this tool are related to the national characteristics of the countries. The fact is that the target audience considers the level of provision of banking services to be insufficient. The digitalization initiative is expected to reduce the cost of providing financial services and improve the efficiency of transactions.

Also, emphasis needs to be put on the digital yuan project for retail digital currency. The digital yuan is planned to full-scale circulation in 2022 for the next Winter Olympics in Beijing.

In wholesale digital currencies, cross-border projects are being implemented between the following countries: Hong Kong - Thailand, Singapore - Canada, Europe - Japan, United Arab Emirates - Saudi Arabia. Most advanced interbank / wholesale projects are exploring the expansion of interconnection testing capabilities with other interbank projects or the interconnection potential with retail projects.

1.2 An overview of the international research discourse on digital currencies

China

The People's Bank of China is at the forefront of the global digital currency agenda, actively developing and testing the Digital Currency Electronic Payment (DC/EP) platform. Since April 2020, the digital yuan has been tested in four major cities of China.

Features of the digital currency design:

- a tokenized digital currency operating on the basis of distributed ledger technologies and a digital wallet that provides storage and end-to-end exchange of a digital token;
- the token is issued in a 1 : 1 ratio to the current fiat currency and is intended to replace cash (M0);
- the platform does not imply that users have a bank account, but requires passing KYC (identity authentication) procedures;
- the platform suggest the technical ability to track transactions in specific cases - the Bank of China calls this approach "managed anonymity";
- the main functions of payment systems, in which interaction between users is expected, will be provided by commercial banks and fintech companies.

DCEP will be issued at two levels:

1. Transactions between the People's Bank of China and higher-order intermediaries. The list includes banks in China - Construction, Agricultural, Industrial and Commercial, as well as trusted companies - Alibaba, Tencent, UnionPay.
2. All kinds of companies, shops and individuals. Any citizen of China will be able to receive the digital yuan, use it for settlements and distribute it in the retail ecosystem.

Current status of the project

The infrastructure for China's digital currency is ready, and the server infrastructure is well-functioning. Testing of new parameters and functions, research of further potential continues.

No official start date has been announced. It is most likely planned to start during the Olympic Games in 2022. Testing is ongoing in several provinces where the digital yuan is distributed through a lottery.

Source: Based on information from open sources and public conferences of the People's Bank of China

1.2 An overview of the international research discourse on digital currencies

Russia

The Central Bank of Russia is actively studying the introduction of a digital ruble. In October 2020, the Central Bank presented the concept of the digital ruble and proposed it for the expert community and market discussions. In 2021, the Central Bank determined the format of the digital ruble in a pilot project.

Features of the digital currency design:

- a digital retail currency wallet will be based on a hybrid architecture, a combination of distributed ledgers and centralized components;
- the digital ruble will be credited as a result of the corresponding write-off of non-cash funds in a 1: 1 ratio;
- a client will open only one wallet in digital rubles;
- client wallets in digital rubles will be placed on the digital ruble platform and will not be reflected on the balance sheet of financial institutions;
- the digital rubles placed in the wallets will not accrue interest income on the balance;
- in case of bankruptcy of financial institutions, the funds on the wallet will be available to the client through any other financial institution where he/she will be served.

Thus, in the two-tier retail model the Central Bank of Russia will isuue the digital ruble and be the operator of the platform. Financial organizations will open wallets in digital rubles for clients and carry out transactions on the digital ruble platform.

Current status of the project

It is assumed that testing of the prototype of the digital ruble platform will be carried out jointly with financial market participants throughout 2022. An implementation roadmap will be formed based on the test results.

Source: Based on information from open sources and public conferences of the Central Bank of Russia

2.1 Classification of digital currencies of central banks

The unique features of CBDCs are based on a variety of design options for the underlying technology and infrastructure. There are different approaches for the design classification of the CBDCs. The key criteria are accessibility for consumers, access technology design, approach to organizing technological infrastructure, and approach to architecture implementation.

1. Accessibility for consumers:

retail - digital currency available to a wide range of users, including individuals and non-financial organizations;

wholesale - digital currency available to a limited number of users, primarily second-tier banks and other professional participants in the financial and money markets.

2. Access technology design:

token - technologically, digital currencies are issued in the form of a digital code, the use of such tokens depends on the ability of the beneficiary to verify the validity of the payment object;

account - technologically, digital currencies are issued in the form of an account, and its use depends on the possibility of identification and authentication of the account holder.

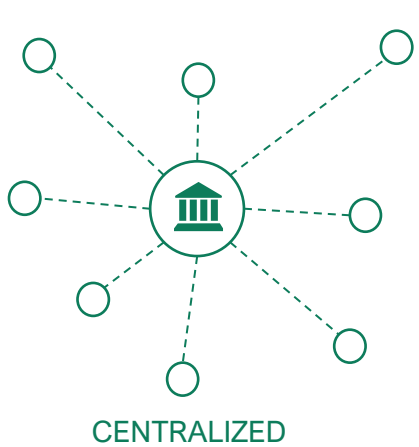
3. Approach to organizing technological infrastructure:

DLT – issuing of currency is implemented on the basis of decentralized network technology using distributed ledgers;

CLT - issuing of currency is implemented on the basis of a centralized system.

It should be noted that, as a rule, a combination of approaches is used for different functional tasks.

Technological infrastructure organization approaches



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Source: BIS Quarterly Review "The technology of retail central bank digital Currency", March 2020

2.1 Classification of digital currencies of central banks

4. Implementing approach

Indirect. It is an indirect distribution order of digital currencies through financial intermediaries. This model is characterized by the term "two-tier", similar to the usual two-tier banking system. In this scheme, intermediaries secure all of the central bank's liabilities to various customers through assets in de facto CBDC or other funds deposited with the central bank.

Intermediaries oversee interactions with retail customers, online payments, and messaging to other intermediaries, and send bulk payment compliance regulations to the central bank. The system participants are independently responsible for resolving disputes, conducting identity authentication procedures and related services. Intermediaries keep records of individual demands, and the central bank only registers wholesale demands. Therefore, it cannot satisfy consumer demands without information from the intermediary.

Direct. In this scheme, only the central bank provides payment services. According to the version of this system, all accounts are managed by the central bank. A group of private companies can synthesize variants based on tokens, or "digital banknotes". Under such a system, KYC procedures and customer due to diligence tasks can be handled by the private sector, as well as the central bank, or other government agencies.

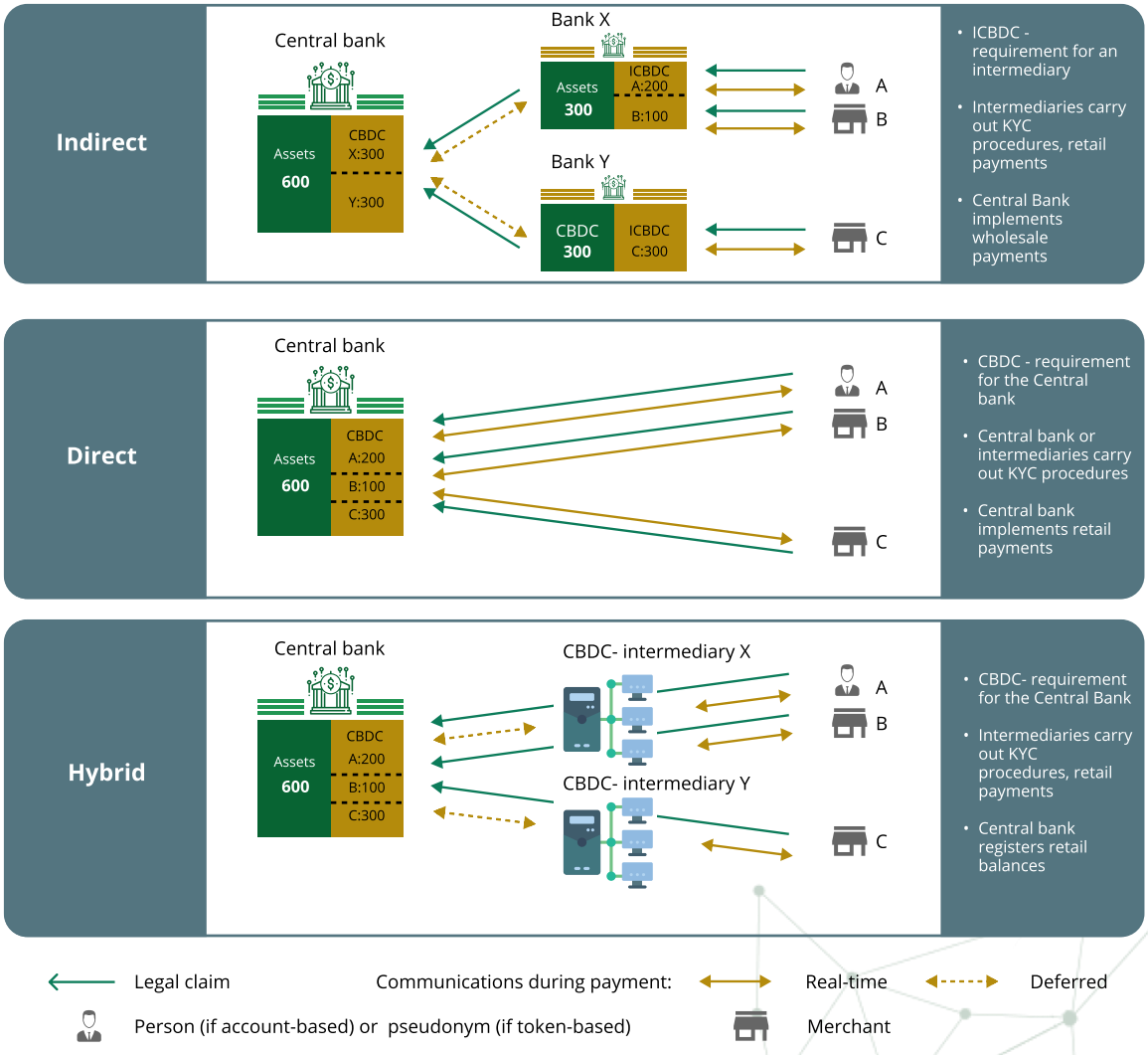
A direct approach to system architecture is attractive with its simplicity since it eliminates dependence on intermediaries. However, private-sector have mobility and better specialization in building and exploiting the technological capacity of payment services. Electronic payments should eliminate disruptions and minimize offline payments, which are still well managed by intermediaries using KYC procedures. The implementation of KYC procedures and the solution of retail client verification tasks are outside the existing mandate of the NBK.

Hybrid. With this approach, intermediary banks are engaged in retail payments. The central bank maintains a register of transactions and manages the reserve technical infrastructure, determines the possibility of restarting the payment system in the event of an intermediary failure. In this scheme, the distribution of digital currency is possible, both by the central bank and by intermediary banks that open wallets at the central bank. One of the main features of the hybrid architecture will be a legal framework that underpins claims, keeps them segregated from the balance sheets of the intermediary, and allows for portability. That is, in the event of an intermediary's failure, the legal framework will enable the central bank to transfer the retail customer contract to another supplier of services.

2.1 Classification of digital currencies of central banks

Another important element is the technical ability to ensure the transfer of assets. In case of technical difficulties of the intermediary the central bank is obliged to ensure the continuity of the payment process. This means that the financial institution should be able to restore the balance of a retail client. This allows the bank to maintain a copy of the retail client's CBDC assets, as well as transfer assets from one intermediary to another in the event of a technical failure. For a balanced interim solution, from a central bank's point of view, such a system may have better stress tolerance than indirect CBDCs but may be more complex in terms of infrastructure management.

Architectural implementation approaches



Source: BIS Quarterly Review "The technology of retail central bank digital Currency", March 2020

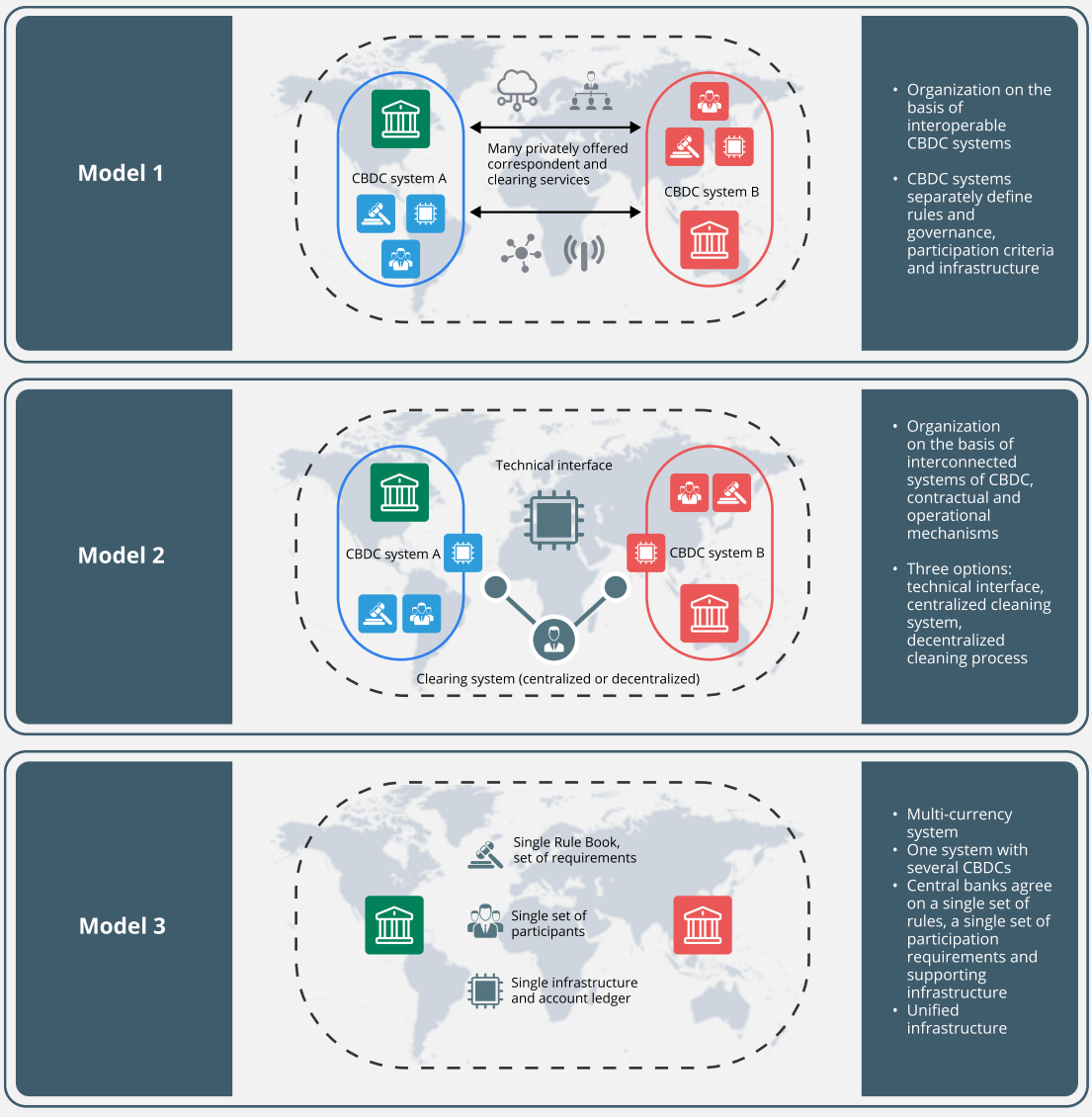
The development options of the digital tenge infrastructure and its classification in the context of the described criteria will be based on the NBK's further study and the upcoming pilot project results. As part of this study, the other central banks' experience will be investigated and systematic work will be performed in collaboration with international working groups on the CBDC cross-border payments.

2.1 Classification of digital currencies of central banks

Cross-border payments

CBDCs have significant potential to reduce the cost and speed of cross-border transactions. Currently, 3 potential options for organizing cross-border payments with the help of the CBDC are being considered:

1. Based on compatible CBDC systems: with compatible standards (for example, similar regulatory frameworks, market practices, message formats and data requirements).
2. Based on interconnected CBDC systems: interconnection of systems through technical interfaces, common clearing mechanisms, or related schemes.
3. Based on a unified multicurrency CBDC system: creation of a unified multicurrency payment system.



Source: BIS Working Paper 115, "Multi-CBDC arrangements and the future of cross-border payments", March 2021

2.2 Principles of implementing digital tenge and requirements for its infrastructure

A further study and potential digital currency introduction in Kazakhstan will be implemented in accordance with an established international practice. In 2020, the BIS, together with a group of central banks from different countries, identified 3 fundamental principles necessary for digital currency issuance.

New forms of money should continue supporting the achievement of public policy objectives and not hinder the central bank from fulfilling its monetary and financial stability functions.

The different types of central bank money - new (CBDC) and existing (cash, reserve or current accounts) - should complement each other and contribute to the achievement of public policy objectives. The NBK will continue to provide cash as long as there is sufficient demand for it.

The payment ecosystem is made up of government agencies, in particular the central bank, and private agents - commercial banks and payment service providers. All participants in this ecosystem have a role in providing payment services to create a safe, efficient, and accessible environment. Private agents should generally be free to choose the means of payment for their transactions.

Fundamental principles of implementing digital tenge

1. SHOULD NOT THREAT MONETARY OR FINANCIAL STABILITY
2. MUST COEXIST WITH OTHER MONEY FORMS
3. SHOULD INCREASE PAYMENT EFFICIENCY AND PROMOTE INNOVATION

DIGITAL TENGE

- ✓ the impact of the digital tenge introduction on monetary policy will be controlled
- ✓ will not replace cash as long as there is demand for it
- ✓ will contribute to the innovation of payment systems of the Republic of Kazakhstan

Source: NBK

In accordance with the above principles, a potential CBDC in Kazakhstan must meet the following characteristics:

1. Payment attributes

– Convertibility
The national currency should ensure the mutual conversion of digital and other forms of money.

2.2 Principles of implementing digital tenge and requirements for its infrastructure

- Convenience and accessibility
  Payments using the national digital currency should be available through existing infrastructure elements.
- Low entry threshold
  The introduction of a digital currency should create minimal capital costs for market participants.

2. System Attributes

- Reliability
  The system must be fault-tolerant.
- Availability
  The system should be available to end users in a 365/24/7 format.
- Interoperability
  The system should provide mechanisms for interaction with other payment infrastructures, as well as with other distributed ledgers for the prospective organization of cross-border payments.
- Safety
  The principle of "security by design" must be ensured both in relation to cyber attacks and in the direction of AML.
- Scalability
  The system should be capable of processing a large volume of transactions, comparable to the current republican level.
- Confidentiality
  The system must ensure the confidentiality of users' personal data and the anonymity of transactions.
- Flexibility
  The system must be able to flexibly and quickly reconfigure, as well as scalability if necessary.
- Instant
  Transactions must be done in near real time.

3. Institutional Attributes

- Legal Certainty
  It is necessary to create a regulatory framework for the full functioning of the currency, in particular, to ensure the opportunities offered by technology.
- Standardization
  All participants in the digital currency infrastructure must comply with approved regulatory standards.

2.2 Principles of implementing digital tenge and requirements for its infrastructure

Digital tenge infrastructure requirements

PAYMENT ATTRIBUTES

Convertibility

The national currency must be kept indivisible and provide an opportunity for mutual conversion of digital and other forms of money

Convenience

Payments should be made available through existing infrastructure or public equipment (smartphones)

Availability

The introduction of a digital currency should cause minimal capital costs for market participants

INSTITUTIONAL ATTRIBUTES

Legal certainty

It is necessary to create a regulatory framework for the full functioning of the digital currency, for example, in terms of the opportunities offered by technology

Standartization

All participants in the infrastructure of the CBDC must comply with the approved regulatory standards

TECHNOLOGY REQUIREMENTS

24/7/365

Reliability and availability

- **Interoperability**
- **Confidentiality**
- **Safety**
- **Flexibility**
- **Scalability**
- **Instant**

Information Security

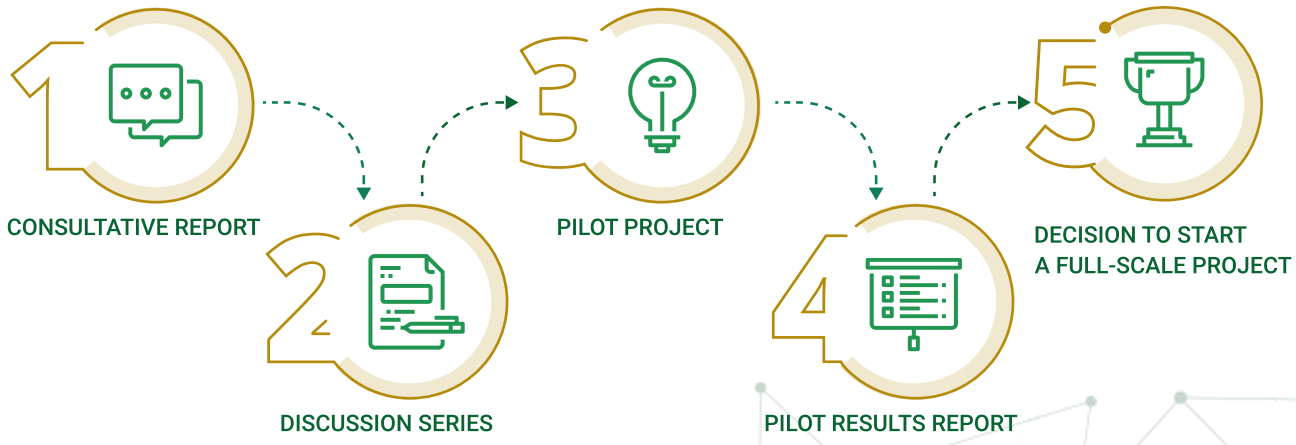
Source: NBK

2.3 NBK's digital tenge implementation approach

NBK is exploring the CBDC issuance and design tasks that should be solved, their emission, and distribution method, questions related to technology, payment systems — as well as financial stability and legal foundations and regulation. The comprehensive study of the advantages and risks of CBDC covers 5 main streams:

1. A report for public discussions on technology and potential application scenarios in the Republic of Kazakhstan.
2. A series of discussions with the international expert community and market participants (with the participation of the IMF, BIS and other central banks).
3. A pilot project to assess the basic functionality of the payment infrastructure and some payment scenarios using block chain technology (DLT).
4. A report on the results of the pilot project with recommendations for further scaling and development of cross-border payments.
5. An analytical report with a recommended decision on launching a full-scale project, development of a roadmap.

Digital tenge roadmap for 2021



Source: NBK

2.4 Planned pilot project description for implementing digital tenge

There are various options for developing digital tenge infrastructure. Implementation models will be determined by the criteria described above: accessibility to consumers, access technology design, approach to organizing technological infrastructure, and approach to architecture implementation. Note, regardless of the choice of model, the platform must comply with the principles of introducing digital tenge and the requirements for technology in Kazakhstan.

For the pilot project, the NBK will develop a digital tenge platform, which, if approved, will be scaled up for industrial use. It is important to take into account that choosing a digital tenge infrastructure design in a pilot project requires the consideration of parameters most applicable in terms of the potential benefits for Kazakhstan.

Description of design parameters of digital tenge pilot project

Design selection criteria	Choice for a pilot project in the RK	Description
Accessibility to consumers	Retail currency	One of the goals of the Program for the Development of the National Payment System until 2025 is to expand the penetration of non-cash payments across the country, and to increase the availability of payment services. In this regard, the creation of a retail digital currency in the Republic of Kazakhstan is optimal from the point of view of a wider range of use in comparison with wholesale currencies. Also, the payment infrastructure of the retail digital tenge is capable of providing effective and widespread digital payments without the use of cash with a wide coverage of the entire population, including without an Internet connection.
Access technology design	Token	A pilot project on a social wallet is being implemented in Kazakhstan, which is essentially technologically similar to digital currency based on electronic wallets. As a result of this project, an analysis will be conducted on the potential benefits and risks of digital currency based on electronic wallets. A study of the use of tokens as a form of tenge in a pilot project will provide the most complete picture of the opportunities and risks of different approaches to access design.
Technological infrastructure organization approach	Combination of centralized and decentralized systems	Thanks to active research on the topic of digital currencies in open sources, the risks and benefits of various architectures and technologies for digital currencies of central banks are already detailed. When designing pilot projects, central banks considered infrastructure options based on both a decentralized system and a centralized system. Based on the results of pilot projects and an international assessment of the technological capabilities of blockchain technology (DLT) and centralized systems, a choice can be made in favor of a combination of two separate options.
Architecture implementation approach	Hybrid	The NBK plans to implement a hybrid approach to organizing the architecture of the digital tenge, which is also called a two-tier architecture. In contrast to the direct and indirect approaches, the hybrid architecture does not change the functions of the central bank and second-tier banks (see section 2.1).

Source: NBK

2.4 Planned pilot project description for implementing digital tenge

Thus, within the framework of the pilot project, a retail digital currency in a ratio of 1 token : 1 cash / non-cash tenge will be developed and a combination of decentralized and centralized systems based on a two-tier architecture of the payment system will be used .

The main goal of the pilot project in Kazakhstan is to assess the technological feasibility of the digital tenge platform in accordance with the requirements described in section 2.2.

Also, the pilot project will provide an opportunity to assess potential technological risks and identify ways to mitigate these risks. To be more precise, the objectives of the experiment are as follows.

1. Assessing the potential of using blockchain technology (DLT) for creating a basic payment infrastructure:
   - issuing / destroying / controlling the use of tokens;
   - distribution of tokens through payment interfaces;
   - AML (partially);
   - exchange of tokens for other forms of money.
2. Assessing technological feasibility and development of recommendations when scaling for the unique attributes of the digital currency:
   - online transactions using tokens;
   - offline transactions using tokens;
   - modeling various business scenarios of using digital currency for payments with government participation.

Particular attention will be put on cybersecurity and confidentiality of transactions within the pilot project, as well as the functioning of AML mechanisms.

An analytical assessment of alternative approaches to the implementation of the digital currency platform wil be performed based on the results of the pilot project.

POTENTIAL EFFECTS OF IMPLEMENTING DIGITAL CURRENCY IN KAZAKHSTAN

It is important to note that one of the priorities of the National Payment System Development Program before 2025 is to increase competition between participants in the payment market, as well as a general increase in the competitiveness of the financial market in the context of convergence of industries.

Competition in the financial market

The hybrid (two-tier) architecture enhances the role of financial market participants in the digital currency ecosystem. One of the goals of NBK in the digital tenge implementation is to facilitate a safe, efficient, and evolving competitive payment system. It aims to stimulate competition in the market and minimize the influence of the NBK on market payment relationships. In other words, the NBK does not intend to provide payment services to end-users or compete with existing market players.

The introduction of digital tenge will ensure the creation of new payment services by market participants using the mechanism of "smart contracts". This will lead to an increase in supply in the payment services market, opening up significant opportunities for the domestic fintech market and stimulating the qualitative and quantitative growth of competition.

Competitiveness of the financial market

Market participants will have access to modern digital financial infrastructure in accordance with the planned initiatives of the Concept for the Development of Financial Technologies and Innovations for 2020-2025. For example, further development of remote biometric identification and “smart contracts” technology will make it possible to create a whole range of services related to “invisible payments”, provided that a number of conditions are met by the parties to the transaction. In addition, seamless integration of digital tenge with other digital platforms can provide the creation of fundamentally new payment and financial products (for example, settlement of transactions in the “delivery versus payment” mode). Access to such infrastructure will allow financial market participants to remain competitive with players from different sectors of the economy.

Growth of penetration of non-cash payments

Despite a significant increase in the share of non-cash payments up to 67.4% in 2020 over the country, the trend is not widespread across regions. This is due to the uneven population density, different economic activity of regions, development, and access to telecommunication lines and the Internet, insufficient level of financial and computer literacy of the population. Digital tenge can become one of the key tools for bridging the digital divide between regions due to the possibility of payments without an Internet connection.

POTENTIAL EFFECTS OF IMPLEMENTING DIGITAL CURRENCY IN KAZAKHSTAN

Sustainable functioning of the National Payment System

Digital tenge will also be available for payment through current infrastructure elements, including POS terminals, QR codes, biometric technologies and other transaction channels. It should be emphasized that in the case of critical scenarios in which private organizations will not have the ability to sustainably operate, the digital tenge will ensure the uninterrupted functioning of the National Payment System.

Efficiency of government payments

The significant potential of the digital tenge in increasing the efficiency of government payments is obvious. In particular, the technology of "smart-contracts" enables the increase of the efficiency of the public procurement system, and provides mechanisms for fiscal stimulation of the economy. One of the possible scenarios for using the digital tenge can be a digital social wallet, which will ensure the prompt payment of social obligations of the state or the expenditure control within the framework of social payments. In addition, the digital tenge can significantly increase the transparency of budget spending. At the same time, the ability to track digital tenge in government payments does not imply tracing every issued tenge: the confidentiality of payments remains a priority for the functioning of the National Payment System and will be regulated by the relevant AML legislation. It is important to specify that all these functions aimed to improve the efficiency of government payments can be provided through additional services developed by government institutions.

Making a decision to launch digital tenge is a complex task requiring active analysis and debate. The NBK will take into account all potential risks. Despite the abundance of scientific publications on the topic, several questions remain unanswered. In particular, central banks have identified possible risks from the introduction of digital currency, but the question of the potential consequences remains open.

The NBK will pay special attention to the study of macroeconomic and regulatory risks.

According to the BIS research, the implementation of the CBDC affects the impact of digital currency on commercial banks, the financial stability of the economy. At the same time, it is important to note the issue of public confidence in the new digital currency.

POTENTIAL EFFECTS OF IMPLEMENTING DIGITAL CURRENCY IN KAZAKHSTAN

Impact on financial and monetary stability

The international expert community concerns that the widely available CBDC could provide outflows of funds from commercial banks at an unprecedented speed and scale, including cross-border flows. In some cases, hypothetically, a mass withdrawal of bank deposits could occur, given the advantages of digital currency technology. In addition, in some critical scenarios of the economy, the digital currency of the NBK may be less risky compared to deposits in second-tier banks, which will contribute to the so-called “bank run” - a massive transfer of household and business savings to the CBDC. In turn, in the face of financial turmoil, the regulator may limit the maximum possible amount of digital tenge ownership by one account or introduce negative rates on the CBDC balances, as well as apply other regulatory restrictions to maintain balance and stability in the financial market.

At the same time, there is also a risk of an outflow of funds from the banking sector to CBDCs due to potential interest payments, which, in turn, may put pressure on the stability of the financial system. Meanwhile, in the absence of interest payments on digital currency, the demand of economic agents for the currency will be based on the efficiency and liquidity features of payment means. In this regard, the implementation of the non-interest-bearing CBDC is the most preferred choice, which minimizes the significant impact of the issue of the CBDC on the financial stability and the mechanisms of the NBK's monetary policy.

It is also important to note that the issue of digital tenge does not technically mean a direct expansion of the money supply, but implies the exchange of its fixed issued volume for the NBK's liabilities (cash and reserves) at a fixed rate of 1 to 1 (at intrinsic value). Under these conditions, the impact of the introduction of the digital tenge on the aggregate demand in the economy will be limited. Therefore, the influence on the inflation processes will also be limited and controlled by the monetary regulator.

Moreover, other potential macroeconomic effects of CBDC will be studied and specific mitigating mechanisms associated with them will be proposed.

In line with these considerations, the NBK excludes the option of developing interest-bearing digital currency.

POTENTIAL EFFECTS OF IMPLEMENTING DIGITAL CURRENCY IN KAZAKHSTAN

Public credibility

Building and maintaining public confidence in the CBDC will be essential to a well-functioning, reliable and resilient new monetary system. The general public should have confidence in the digital tenge as a reliable means of payment. The NBK will cooperate with all stakeholders of the digital tenge ecosystem to achieve this goal.

It is planned to develop standards, rules, guidelines for risk management for the digital tenge system. The technology will meet the highest cybersecurity standards. In addition, the manual will specifically outline the roles and responsibilities of digital tenge operators, service providers and other participants. The work will involve all stakeholders and maintain public relations to raise awareness, user acceptance and build trust.

Particular attention will be paid to issues of consumer protection and preserving the confidentiality of consumers of payment services in digital tenge. Detailed technological mechanisms and regulatory approaches for the establishment of user data security and financial privacy will be developed and proposed as a result of the pilot project.

POTENTIAL EFFECTS OF IMPLEMENTING DIGITAL CURRENCY IN KAZAKHSTAN

Legal and regulatory aspects of digital tenge implement

One of the main issues in implementing digital currency of the NBK (Article 1 of the Law of the Republic of Kazakhstan "On the National Bank of the Republic of Kazakhstan") (CBDC) will be the issue of its legal status. According to paragraph 1 of Art. 127 of the Civil Code of the Republic of Kazakhstan, the monetary unit of the republic is tenge. Monetary emission is carried out exclusively by the NBK. Therefore, the digital currency issued by the central bank will be an official monetary unit, an obligatory universal means of payment, regardless of individual issues of the technical implementation of the issue at the initial stage.

In addition, the digital tenge will be an obligation of the NBK, and the holder will have the right to demand its exchange for both cash and non-cash tenge, also by increasing the balance on accounts opened with second-tier banks. The implementation of the NBK's digital currency will require revision, first of all, in the Civil Code of the Republic of Kazakhstan. This means the digital tenge should be specified in the list of objects of civil rights to establish the possibility of making payments in digital currency. Such information will need to be added in the general provision settlements, including the Laws of the Republic of Kazakhstan – "On Payments and Payment Systems" and "On the National Bank of the Republic of Kazakhstan" - in terms of expanding the functions of the NBK and determining the issuing and exchanging rules of digital currency. A detailed list of legal acts, which need to be revised, will be determined based on the results of the pilot project. Since some questions related to the digital tenge regulations require practical modeling.

It is also important to resolve the legal issues of using digital currency. The technological and operational infrastructure will be created by the NBK with the involvement of second-tier banks and, possibly, other financial intermediaries. Here, the establishment and identification of the responsibilities of players for the stability and sustainable performance of the digital currency information system are particularly important.

1 DIGITAL TENGE

- THIRD FORM OF NATIONAL CURRENCY
- OBLIGATION OF THE NBK
- LEGAL TENDER

2 PRINCIPLES OF IMPLEMENTING DIGITAL TENGE

Digital tenge should not affect monetary or financial stability	Should complement existing forms of money	Should improve the efficiency of payments and promote innovation

3 DIGITAL TENGE INFRASTRUCTURE REQUIREMENTS

PAYMENT ATTRIBUTES

- Convertibility
- Convenience
- Availability

INSTITUTIONAL ATTRIBUTES

- Legal certainty
- Standardization

TECHNOLOGY REQUIREMENTS

24/7/365

Reliability and availability

- Interoperability
- Safety
- Scalability
- Confidentiality
- Flexibility
- Instant

4 ROAD MAP

1. CONSULTATIVE REPORT
2. DISCUSSION SERIES
3. PILOT PROJECT
4. PILOT PROJECT RESULTS REPORT
5. DECISION TO START A FULL-SCALE PROJECT

5 DESCRIPTION OF THE PILOT PROJECT IN THE RK

- RETAIL DIGITAL CURRENCY
- TOKEN AND TENGE – 1 : 1
- TWO-TIER ARCHITECTURE
- COMBINATION OF DECENTRALIZED AND CENTRALIZED INFRASTRUCTURE SYSTEMS

Source: NBK

CONCLUSION

The decision to issue digital tenge requires a comprehensive analysis of all potential benefits and risks for economic agents, as well as the study of monetary policy, and financial stability questions. International observations reveal that many unanswered questions regarding the benefits and risks of digital currency implementation can not be reliably answered analytically. Different formats of digital currency infrastructure design identify potential benefits and risks. In this connection, the basic task in determining the design parameters of the digital currency concept is to find a balanced approach that optimizes the benefits and risks.

The most preferred approach to solving this problem is to test various scenarios for the use of digital tenge as part of a pilot project. An analysis of benefits and costs, as well as a vision on a roadmap for the implementation of the initiative, will be prepared based on the pilot project results, analytical investigations, and relevant international discussions.

This approach will enable to see a big picture and minimize subsequent risks and costs, allowing to determine the best strategy of digital tenge implementation for all market participant.

GLOSSARY

ACCOUNT	A digital form of currency expression in the form of an account, the use of which depends on the ability to identify and authenticate the identity of the account holder.
AML	A set of measures aimed at preventing the use of a country's financial system or a specific financial institution for money laundering or terrorist financing.
CENTRALIZED LEDGER TECHNOLOGY OR CLT	Centralized ledger technology. In this case, the data is stored in one central location, bound to the control.
CRYPTOCURRENCY	An unregulated virtual currency, the accounting of internal units of which is provided by a decentralized system that operates in an automatic mode.
DISTRIBUTED LEDGER TECHNOLOGY OR DLT	Distributed ledger technology that allows data to be recorded and shared between multiple network nodes or devices.
ELECTRONIC WALLET	Channel for access to money, software that allows you to make transactions of replenishment, storage and transfer of electronic money.
EMISSION	Issuing money into circulation.
INTEROPERABILITY	Functional compatibility, the ability of a product or system whose interfaces are fully open, to interact and function with other products or systems without any restrictions on access and implementation.
KYC	The principle of activity of financial institutions, obliging them to identify the identity of the counterparty before carrying out a financial transaction.
SMART-CONTRACT	A computer protocol, a programmed contract, the terms of which are written in the program code and which is automatically executed using the block chain.
STABLCOINS	The general name for cryptocurrencies pegged to stocks of common currencies or physical goods (gold, oil).
TOKEN	The digital form of currency expression (digital character of value) in the form of a digital code, the use of which depends on the ability of the payee to verify the validity of the payment object.

REFERENCES

1. Bank of Canada, ECB, Bank of Japan, Sverigse Riksbank, Swiss national bank, Bank of England, Board of Governors of the Federal Reserve System and BIS, Central Bank Digital Currencies, *Foundational Principles and Core Features*, Report No. 1 in a series of collaborations from a group of central banks, 2020
2. Ryan Todd, Ryan Todd, *A Global Look at Central Bank Digital Currencies*, The Block Research Whitepaper, August 2020
3. Ousmène Jacques Mandeng, John Velissarios, *The Revolution of money II: Blockchain Empowered Central Bank Digital Currencies*, Accenture, 2019
4. Raphael Auer, Rainer Böhme, *The technology of retail central bank digital currency*, BIS Quarterly Review, March 2020
5. Sarah Allen, Srdjan Capkun, Ittay Eyal, Giulia Fanti, Bryan Ford, James Grimmelmann, Ari Juels, Kari Kostiainen, Sarah Meiklejohn, Andrew Miller, Eswar Prasad, Karl Wüst, and Fan Zhang, *Design choices for Central Bank Digital Currency: Policy and technical considerations*, Global Economy & Development Working Paper 140, July 2020
6. Raphael Auer, Giulio Cornelli and Jon Frost, *Rise of the central bank digital currencies: drivers, approaches and technologies*, BIS Working Paper No 880, August 2020
7. Massimo Cirasino, Jose Antonio Garcia, *Measuring payment system development*, The World Bank Financial Infrastructure Series, Payment systems policy and research, Working Paper, 2008
8. World Economic Forum, *Central Bank Digital Currency Policy-Maker Toolkit*, Insight Report, January 2020
9. Itai Agur, Anil Ari and Giovanni Dell'Ariccia, *Designing Central Bank Digital Currencies*, IMF Working Paper WP/19/252, November 2019
10. Wouter Bossu, Masaru Itatani, Catalina Margulis, Arthur Rossi, Hans Weenink and Akihiro Yoshinaga, *Legal Aspects of Central Bank Digital Currency: Central Bank and Monetary Law Considerations*, IMF Working Paper WP/20/254, November 2020
11. Raphael Auer, Giulio Cornelli, Jon Frost, *Rise of the central bank digital currencies: drivers, approaches and technologies*, BIS working paper, No 880, August 2020
12. David Andolfatto, *Assessing the impact of central bank digital currency on private banks*, FRB St. Louis Working Paper, 2018
13. Chiu, Jonathan, Davoodalhosseini, S. Mohammad R., Jiang, Janet Hua and Zhu, Yu, *Bank Market Power and Central Bank Digital Currency: Theory and Quantitative Assessment*, Staff Working Papers, Bank of Canada, 2019

14. Markus K. Brunnermeier, Dirk Niepelt, *On the equivalence of private and public money*, Journal of Monetary Economics, Volume 106, 2019
15. Jesus Fernandez-Villaverde, Daniel Sanches, Linda Schilling and Harald Uhlig, *Central bank digital currency: Central banking for all?* Working Paper no. 26753, National Bureau of Economic Research, 2020
16. Jesus Fernandez-Villaverde, Daniel Sanches, Linda Schilling and Harald Uhlig, *Central bank digital currency: When price and bank stability collide*, Technical report 2020
17. Todd Keister, Cyril Monnet, *Central bank digital currency: Stability and information*, Working Paper, 2020
18. Todd Keister, Daniel R. Sanches, *Should central banks issue digital currency?* Technical report, 2019
19. John Barrdear, Michael Kumhof, *The macroeconomics of central bank issued digital currencies*, Staff Working Paper no. 605, Bank of England 2016
20. Stephen Williamson,*Central bank digital currency: Welfare and policy implications*, Technical report 2019
21. Tobias Adrian, Tommaso Mancini Griffoli, *The Rise of Digital Money*, FinTech Notes No. 19/001. International Monetary Fund, 2019
22. BIS, *General Guidance for. National Payment System Development*, January 2006