



# Electronic hryvnia Pilot TASCOMBANK

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# I. The foreword of Sergiy Kholod, the First Deputy Chairman of the Board

Today's growing challenges encourage us to focus on continuous improvement and development, both at the level of banks and the entire financial system. The rapid penetration of virtual assets into areas from everyday life to the economy drives our strategy to explore and apply the benefits of distributed ledger technologies and create related banking products. In particular, the JSC "TASCOMBANK" team actively worked on implementing the first platform in Ukraine for issuing and turnover electronic money based on blockchain technology integrated with banking systems.



As part of a pilot project with technology partners, we explored a new way of issuing and managing electronic money. These are payment instruments of a new generation for all citizens and organizations of Ukraine, their employees and clients, government institutions, and international organizations. Within the framework of this platform, we combine a fast, cheap, reliable, and transparent decentralized system of electronic money transfer and accounting on the Stellar blockchain and the reliability of storage and regulatory comfort for clients of JSC "TASCOMBANK."

The results of the Pilot project confirmed the readiness of the bank's infrastructure to integrate with blockchain solutions and provide an appropriate level of financial services using virtual assets, taking into account all regulatory requirements. The use cases studied during the pilot provide an opportunity to develop various business models based on blockchain technology, which can act as one of the drivers of the transformation of the financial landscape in Ukraine. In particular, transparent and reliable payment solutions on the blockchain can serve as one of the priority channels for providing financial assistance and special purpose payments from state budgets and enterprises.

## II. The commentary of Valeriy Danylenko, the Deputy Chairman of the Board

Until February 24, 2022, it was always necessary to introduce new services for customers to stay in the market. Nevertheless, new challenges and circumstances have forced us to change the banking system. Nowadays, more is needed to be on trend or to study global practices. It is time to act and create our own, something that here and now can be helpful to our country and society, that will help our citizens in everyday life and the government in financial management. Therefore, even before the war, the bank investigated blockchain technology in the banking sector on the regulatory basis of electronic money.



Continuing the pilot after the war's start, we used the e-money model and a mirror copy of the Automated Banking System to obtain and consolidate the results.

With transaction results in hand and the customer journey from account opening to payments to merchants, we could simplify accounting by taking advantage of blockchain. Given today's requirements for customer identification when opening an e-wallet, there is no need to limit it to the scope of e-money. With this depth of customer research, allowing customers to use open accounts without restriction is rational. That is why we transformed the idea of launching electronic money on the blockchain into understanding the need to integrate the blockchain solution as a master system into the bank's back-end systems and reflect non-cash customers' funds. This conclusion allows us to talk about the possibility of quickly launching a blockchain-based cashless system with all the advantages of the technology. This approach already enables us to start servicing payments, for which transparency, publicity, and control over intended use are advantageous.

Imagine that tomorrow, all public servants will start receiving their payroll via blockchain technology - no one hides even a single thing, zero tolerance for corruption. Payment purpose information between budgets and individuals would be publicly available. Turning imagination into reality is our task in 2023, together with all financial market participants and the regulator.



### III. The commentary of Oleksii Shaban, Deputy Governor of the National Bank of Ukraine

Research into digital currencies is taking place in many countries around the world. Discussions are ongoing regarding the expediency and possible application areas of central bank digital currencies (CBDCs).

However, the evolution of the global payment infrastructure has accelerated. The high level of digitalization of the economy is a powerful driver of change. One consequence is the significant spread of cashless payments, a decrease in cost, and increased transparency. Experiments with digital currencies help to test hypotheses related to different aspects of digital money turnover at all stages – from their issuance to repayment, including their intrinsic characteristics, such as programmability.

Thus, the National Bank of Ukraine is interested in studying the outcomes of pilot projects carried out by payment market parties under Ukrainian legislation.

Since the first day of the Russian Federation's full-scale invasion of Ukraine, the National Bank of Ukraine has prohibited commercial banks from issuing new electronic money. Therefore, conditions this year made the task much more difficult for JSC "Tascombank," as the bank had based its first pilot on electronic money.

Nevertheless, the bank succeeded in integrating a "traditional" Automated Banking System (ABS) with Distributed Ledger Technology (DLT). Of course, some functions overlapped due to the necessity of meeting regulations.



On the other hand, because this pilot project goes beyond the e-money format, the bank opened up new research directions for using DLT in banking. In our view, the DLT's inherent transparency and the impossibility of changing closed data blocks may become factors in increasing the cost-effectiveness of accounting and control functions. We do not exclude the possibility that the bank will decide to test hypotheses that may become the basis for possible changes in accounting rules.

In its pilot project report, the bank touched on CBDCs. One of the questions considered by central banks when discussing the design of CBDCs is who will be the subject performing onboarding, Know-Your-Customer, interaction, etc. This question remains unanswered today and is closely related to another one. Whether the demand for CBDCs in a wallet opened in a commercial bank (the so-called two-level model) will be sufficient compared to that envisaged in the concept of "digital cash" – digital money as a direct claim to a central bank (the one-level model). In other words, is there a niche within which the role of a commercial intermediary becomes economically viable?

The bank should consider this before selecting hypotheses for future pilot projects.

## IV. The commentary of Oleksandr Borniakov, Deputy Minister of Digital Transformation of Ukraine on IT-sphere Development

Despite Russian military aggression, Ukraine's banking sector continues to innovate and develop.

Today, I believe that it is very important for the government and businesses to focus on developing services and products that will help Ukrainians and satisfy their current needs. One outstanding example is JCS "TASCOMBANK's" Pilot project implemented with support from the Ministry for Digital Transformation and the National Bank of Ukraine.



The project aims to create a blockchain-based e-money system. Within the pilot's framework, the bank integrated blockchain technology with traditional banking procedures. Using e-money, customers could open digital wallets and make payments and purchases. In the blockchain network, all transactions are executed and accounted for.

As a result of the pilot, the key advantages of blockchain were demonstrated. Particularly fast and cost-effective processing of transactions, accountability and transparency of the system, and simplified access to financial services.

JSC "TASCOMBANK" and the Ministry for Digital Transformation are examining ways to introduce blockchain-based payment instruments to the market. In the future, this pilot may become an essential element of the digital economy by enabling the National Bank of Ukraine to study the options for digital hryvnia usage.

## V. The commentary of Denelle Dixon, CEO and Executive Director, Stellar Development Foundation

Stellar is an open-source blockchain network optimized for the issuance of digital assets. It is the backbone of the Stellar network that allows entities to create digital representations of assets and configure them to meet their needs.

Stellar is built for payments and the movement of value – with asset issuance as a core component of that design. TASCOMBANK designed a pilot that demonstrates how new forms of digital money can be issued and distributed in a secure, affordable way. It was complemented by Stellar’s built-in programmatic functions for asset control, which include the ability to limit how the asset is used and who can hold it by setting different configuration flags.

The findings of this pilot are a testament to the value and utility that this technology delivers to new levels of transparency and accountability. It is also a testament to the dedication of TASCOMBANK to persevere in impossible circumstances as the war in Ukraine took hold throughout the pilot’s duration. The pilot’s recommendations are invaluable to other entities, both the public and private sectors, for a roadmap on how to build a digital asset ecosystem that provides real world value to businesses, governments, and citizens.



# 1. Digital money and CBDC — new horizons of the financial system

## 1.1. Insights: CBDC as understood by the regulatory authorities

Insights: CBDC as understood by the regulatory authorities:

- ECB: a digital form of fiat money that is publicly available, issued by the state, and has the status of legal tender
- BIS: an electronic form of a national currency unit issued by a central bank that is responsible for its backing
- IMF: a digital form of existing fiat money that is issued by a central bank and serves as legal tender

Despite the difficult macroeconomic conditions in the global economy and the geopolitical threats caused by the aggression of the Russian Federation against Ukraine, the development of the virtual assets market in 2022 preserved positive dynamics in terms of the implementation of new projects and technologies. In particular, the digital currencies of central banks (hereinafter referred to as “CBDC” or “Central Bank Digital Currency”) have become increasingly widespread. Today, according to the statistics of the Bank for International Settlements (BIS), there are three fully operational CBDCs and at least 28 pilot projects that are at various stages of implementation in the world. Another 68 central banks have publicly announced the start of their work on CBDC<sup>1</sup>.

Overall, more than 80% of the central banks that participated in the BIS survey are considering or have already taken steps to launch CBDC projects. Digital currencies are already used as legal tender in the Bahamas and Nigeria, while Jamaica and the Eastern Caribbean countries are on their way. The People’s Bank of China started its move toward the digital yuan in 2014. The country is currently conducting large-scale testing in selected cities, and during the 2022 Olympic Games, e-CNY was one of only three available payment methods offered to visitors.

In February 2022, India's finance minister promised to launch a virtual version of the rupee by the end of this year, and the Philippines announced its own CBDC implementation pilot in the following month<sup>2,3</sup>.

The Central Bank of Nigeria (CBN) launched e-Naira in October 2021. The digital currency is expected to support the country's goal of increasing financial inclusion from 64% to 95%. By integrating the e-Naira platform into the country's financial ecosystem, the CBN hopes to create new uses for the digital currency in the private sector to introduce and adopt the CBDC. According to the country's President, a properly implemented e-Naira can add over USD 29 billion to Nigeria's GDP over the next ten years<sup>4</sup>.

In March 2022, the US Administration placed the highest urgency on the research and development efforts into the potential design and deployment options of a US CBDC. The Executive Order highlights the many benefits of the CBDC, such as fostering greater access to the financial system, facilitating low-cost transactions, and supporting the continued centrality of the US within the international financial system. The Administration expects to receive a joint research assessment of the effects of CBDC from regulatory authorities as early as this fall<sup>5</sup>.

The European Commission plans to propose a bill in early 2023 to determine the status and create a legal framework for the legalization of the digital euro<sup>6</sup>. In his speech in March 2022, Fabio Panetta, Member of the Executive Board in European Central Bank, emphasized that the digital euro project aims to provide access to the Central Bank's money in digital form for daily transactions and allow users to enjoy the high privacy standards provided by the CBDC<sup>7</sup>.

While it is the ECB's Governing Council that will make the final say on whether a digital euro is needed, policymakers within the Commission and across Europe are already convinced of the positive development. Therefore, Germany and France urged the ECB last year to speed up their consideration of the CBDC issue amid fears that the Eurozone could get left behind while others carry out the digitalization of the financial system<sup>7</sup>.

All virtual assets, whether issued privately or publicly, can be tracked and controlled. This is one of the main advantages of this technology, which can be applied in different cases depending on the goals and principles of the state control of the financial sector.



Violations in the financial spheres are possible with any form of money, so the mechanisms of the control and prevention of such cases should be a prerogative of building a payment infrastructure based on CBDC — the more transparent and simple mechanisms would be preferable<sup>8</sup>.

More generally, facilitating faster and less costly money circulation is one of the main benefits of digital currencies that undoubtedly provides grounds for central banks to prioritize research in this area. However, while CBDCs provide a great opportunity to improve the financial system, the format and principles of their application will be ultimately motivated by the decisions and strategy of each specific government and may differ from country to country.

Based on the research conducted by the National Bank of Ukraine, the study of international experience, and the survey of financial market experts, the following options for using CBDC were identified:

- E-hryvnia for retail non-cash payments with the possible functionality of programmable money and ability to make targeted social payments;
- E-hryvnia for cross-border payments;
- E-hryvnia for use in the area related to the circulation of virtual assets (for example, for exchange, securing the issue and other transactions with virtual assets).

<sup>1</sup> BIS, Rise of the central bank digital currencies: drivers, approaches and technologies, BIS working paper, No 880, August 2020 (updated January 2022), Auer, R, G Cornelli and J Frost

<sup>2</sup> Government of India, Budget 2022-2023 (1 February 2022), Nirmala Sitharaman, Minister of Finance

<sup>3</sup> Bangko Sentral ng Pilipinas, Governor Benjamin E. Diokno for the Joint BSP-AFI Knowledge Exchange Program on Central Bank Digital Currency (28 February 2022)

<sup>4</sup> Aso Rock Villa, Official Launch of the eNaira (1 October 2021), President Buhari

<sup>5</sup> The White House, Executive Order on Ensuring Responsible Development of Digital Assets (9 March 2022)

<sup>6,7</sup> POLITICO, Digital euro bill due early 2023 (9 February 2022), Bjarke Smith-Meyer

<sup>7,8</sup> ECB, A digital euro that serves the needs of the public: striking the right balance, (30 March 2022), Fabio Panetta

<sup>8</sup> PwC Global CBDC Index and Stablecoin Overview 2022



## 1.2. Blockchain and commercial banks

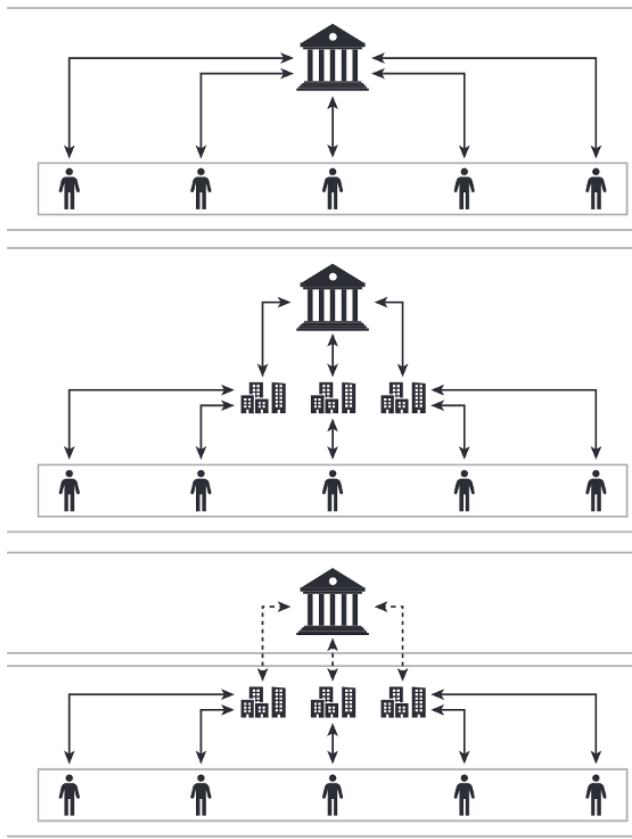
One of the areas in which TASCOMBANK JSC sees significant prospects for the market and customers is the development of electronic money using distributed ledger technologies (blockchain).

In this regard, the Bank carried out an experimental issue of hryvnia in the form of electronic money based on the blockchain network (hereinafter referred to as “Electronic money” and the “Pilot project”). Such a form, method of issuance, distribution, and circulation will have all of the features and functions of Electronic money, thereby complying with the valid Regulation on Electronic Money of the National Bank of Ukraine.

With technical support from the non-profit organization Stellar Development Foundation (SDF), which supports the development of the Stellar open blockchain network and supplier and integrator of currency management systems for national and commercial banks (hereinafter referred to as the “Technology Partner”), the Bank plans to further study practical business models of the application and features of issuance, accounting, and circulation of Electronic money using blockchain technology.

At the same time, the Bank is investigating the use of such Electronic money as a tool for retail non-cash payments.

At present, the International Monetary Fund distinguishes three operational models for CBDC implementation.



1. The central bank issues CBDCs and supports all functions necessary for their circulation (including direct interaction with users).
2. The central bank issues CBDCs, but it delegates the functions of interaction with end users to commercial banks or other intermediaries.
3. CBDCs are issued by private institutions (commercial banks and financial companies) and the issue is secured by the assets of the central bank.

The experience gained in the pilot project and discussed below can be applied within the framework of the second CBDC operating model and contribute to the role of TASCOMBANK JSC as an infrastructure and payment partner for servicing E-hryvnia.

In our opinion, distributed ledger technologies (blockchain) have two key aspects in the context of their application for the issuance and circulation of the electronic currency unit.

- Firstly, tokenization signifies that money is a physical token, which makes it impossible for two people to own the same token. This means that the ownership of the money is easy to determine (without complex or time-consuming reconciliation) and easy to understand for consumers familiar with cash.
- Secondly, decentralization means that money exists in a distributed infrastructure that is efficient, fault-tolerant, and resilient to single points of failure. Proven consensus algorithms and modern cryptography ensure that the entire network agrees on a single transaction history, and that money cannot be stolen or manipulated.

These unique features create a number of important advantages.

- End-to-end settlements in real time. Settlement can be done in real time, instead of the hours or days needed with some other payment methods.
- Significant reduction in the cost of maintaining the transaction network and cost of transactions for users, including the cost of merchants acceptance.
- Promotion of financial inclusion. Using a digital wallet is generally easier than opting for a full-fledged banking service, which means that it should be cheaper and easier for individuals to deposit and use such money, especially in rural areas outside the banking service area. This could help give access to vital digital financial services to those who are unbanked.
- The possibility to simplify cross-border transactions in the future. The decentralized infrastructure for Electronic or digital money is global — this means that transactions are efficient regardless of the location of the sender and recipients. Potential refusal from the chain of correspondent banks.
- The possibility of using such Electronic money in circulation with virtual assets in the future.
- Programmable money. The possibility to target the distribution of the currency to achieve set policy goals, including social payments, emergency cash, and relief programs.

In general, blockchain technology reduces the need for intermediaries and centralized processes in the offering of financial services. Decentralizing a system also limits the reliance on any authority that increases risks due to internal reasons such as the malfunctioning of part of the system or external reasons such as a cyberattack. Open blockchain networks provide the possibility to develop an ecosystem where regulators, policymakers, financial entities, developers, monetary policies, governance strategies, and reward systems all interact to foster innovation and competition.

An open network allows for innovation and competition that fosters financial inclusion. Anyone can participate and build applications in an open network. This creates a free-entry market that enables competition. Furthermore, rules are set and maintained by the validators of the system, not by a coalition of companies or other large market participants.

An open system could provide instant real-time payments in central bank money so that payees could receive funds instantly. It could ensure that any CBDC account would be able to pay any other CBDC account, regardless of the financial entity associated with each account. This creates prerequisites for intraoperability and interoperability between CBDC and any other currencies, in particular for cross-border payments. Open networks also enable financial services and products built on them to connect with each other and with solutions designed in the current payment system.

The degrees of decentralization allowed by blockchain technology vary from open systems that are accessible to all users to closed systems where a limited consortium of users is able to read and/or write to a ledger. Open decentralized approaches to privacy protection allow a middle ground between transparency and privacy, and foster trust. The design of blockchain technology offers a number of options to address privacy for users and transparency for regulatory authorities. One feasible option is to design a CBDC in a way that transactions are transparent and fully visible to authorities — central banks, anti-money laundering regulators, tax collection authorities, and others. On the other extreme, a CBDC could be designed providing full privacy replicating the structure of a cash transaction today. A balance between these two approaches should be struck.

Open networks provide the possibility for all personally identifiable information to be stored in a private database that only the financial entities building solutions and offering financial services, such as commercial banks or digital wallets, or external KYC providers could access. Access is configurable in order to provide further intermediaries permission to access information related to the portion of the program that they administer. Transactional data on balances and payment amounts are public, but they are not associated with names or any other identifying information. Having access to this publicly available data would allow central banks to analyze insights to mitigate AML and CFT risks and for monetary policy and macroeconomic purposes.

Blockchain provides the possibility of creating programmable money. TASCOMBANK JSC plans to explore this function in the future on the basis of technologies implemented in this Pilot project.

An example would be automatically initiated payments on the confirmed receipt of goods or routing tax payments directly to the tax authorities at the point of sale of goods or services. Traditional payment systems have significantly limited technical capabilities to integrate such a function into payment processes. Other cases of using programmable money can be:

- AML/CFT related features. Therefore, money could be programmed with smart contracts to prevent the execution of transactions with sanctioned parties, or automatically block transactions that meet certain regulatory criteria, such as amount thresholds.
- Monetary policy tools A feature could be programmed to encourage saving or spending throughout the national economy. For instance, a fee could be imposed in the event that money is spent in a certain time frame or with a specific purpose. Similarly, a fee could be applied to positive balances after the account is idle for some time. These could complement the current monetary policy tools that central banks usually utilize.
- Emergency cash transfer relief. This feature would allow stimulus payments to targeted groups, in particular in the framework of economic recovery and humanitarian support. The use of blockchain-based payments could foster transparency of such expenditures.

As part of the further studying possibilities of implementing blockchain technologies, TASCOMBANK JSC plans to consider the possibilities of integration with a software complex Automated Banking System (ABS) and available products of the Bank as well as further use of smart contracts. In particular, it is planned to monitor the capabilities of the Stellar blockchain-based smart contract platform that has been openly tested since the beginning of 2022 as part of the Soroban project (<https://soroban.stellar.org/docs>). This open smart contract system can be integrated with any blockchain and provides users with the tools to program their own smart contracts for any token operations or other purposes, which, among other things, enables you to use the platform to customize the rules for issuing and circulating CBDCs.

## 2. Purpose and objectives of the Pilot project of TASCOMBANK JSC

I. Implementation of distributed ledger technology (blockchain) as a tool to ensure the issuance and circulation of Electronic money

II. Confirmation in practice of the key advantages of blockchain:

- transparency and accountability;
- protection;
- low transaction costs;
- control of cash flows and programming their intended use.

III. Explore the practical application of blockchain-based products for banking transactions, such as payments and transfers:

- ability to integrate with a reliable blockchain platform;
- building the process of transactions circulation between the ABS software complex and blockchain, developing an integration scheme;
- creation and testing in practice an accounting model of Electronic money based on the blockchain;
- development of appropriate front and back interfaces (improvement of ABS software complex, mobile application, and wallets);
- ensuring accountability, transparency, and compliance of Electronic money with the regulatory standards;
- bringing Electronic money transactions in line with the current KYC and AML procedures;
- proving product hypotheses and testing use cases;
- exploration of business models for the Bank.

### 3. Legal grounds for issuing Electronic money based on blockchain technology

The world practice of regulating virtual assets identifies the regulatory environment of Electronic money as one of the main frameworks for the functioning of cryptocurrencies issued by private players and backed by fiat money<sup>9</sup>.

As part of the Pilot project, TASCOMBANK JSC issued Electronic money based on the blockchain technology platform. The issuance of Electronic money makes it possible to research blockchain technology within the existing legal framework.

Regardless of the technological platform, basic operating principles of interaction between participants of the "classic" Electronic money system, their accounting, control, and display remain unchanged and are based on the relevant existing practices agreed with the regulatory authorities. It should be noted that the form, method of issuance, distribution, and circulation of Electronic money based on blockchain technology have all of the features and functions required by the Regulation on Electronic Money No. 481 of the National Bank of Ukraine as well as Resolution of the Board of the National Bank of Ukraine dated September 29, 2022 No. 210 "On approval of the Regulation on issuing electronic money and carrying out payment transactions with it".

The existing technical implementation of blockchain-based Electronic money issue enables the issuing Bank to fully comply with all the requirements of the current legislation and, in particular, to ensure the following measures:

- organizational and procedural measures as well as the use of technical means to detect, prevent, prevent, and counteract fraud;
- information security system, which should provide continuous protection of information during the issuance, use, and redemption of Electronic money at all stages of its formation, processing, transmission, and storage



- control over the Electronic money transactions carried out exclusively within the territory of Ukraine;
- measures on the prevention and counteraction to legalization (laundering) of proceeds from crime, financing of terrorism, and financing of the proliferation of weapons of mass destruction in accordance with the legislation of Ukraine (hereinafter referred to as AML/CFT measures);
- control over the proper verification of the user before creating an Electronic wallet in accordance with the procedure established by the AML/CFT legislation;
- support of transactions with the use of Electronic money, information about the payer (initiator of the transfer) and the recipient of funds in accordance with the AML/CFT legislation.

Therefore, the Pilot project of TASCOMBANK JSC on the issue of Electronic money based on blockchain technology fully complies with the existing regulatory requirements, in particular Regulation No. 481 on Electronic Money by the National Bank of Ukraine, has a similar scheme of interaction between the system participants in the architectural aspect, and ensures an appropriate level of accountability and control.

Taking into account the current restrictions on using Electronic money (Resolution No. 18 by the National Bank of Ukraine Board “On the Operation of the Banking System Under Martial Law” dated February 24, 2022 (as amended)), we should consider the commercialization of Electronic money, if and when these restrictions are lifted.

Now, TASCOMBANK JSC is considering the possibility of using blockchain technology within the framework of traditional payment schemes on the basis of customers’ current accounts opened in the bank, making transactions through processing centers that in this case are used for accountability and confirmation of the blockchain transactions.

<sup>9</sup> EBA (2019), “Report with advice for the European Commission on crypto-assets”, January 9.

## 4. Principles and architecture of the Pilot project

### 4.1. Assumptions for testing

The following assumptions were made during the testing of Electronic money pursuant to the purpose and objectives of the Pilot project.

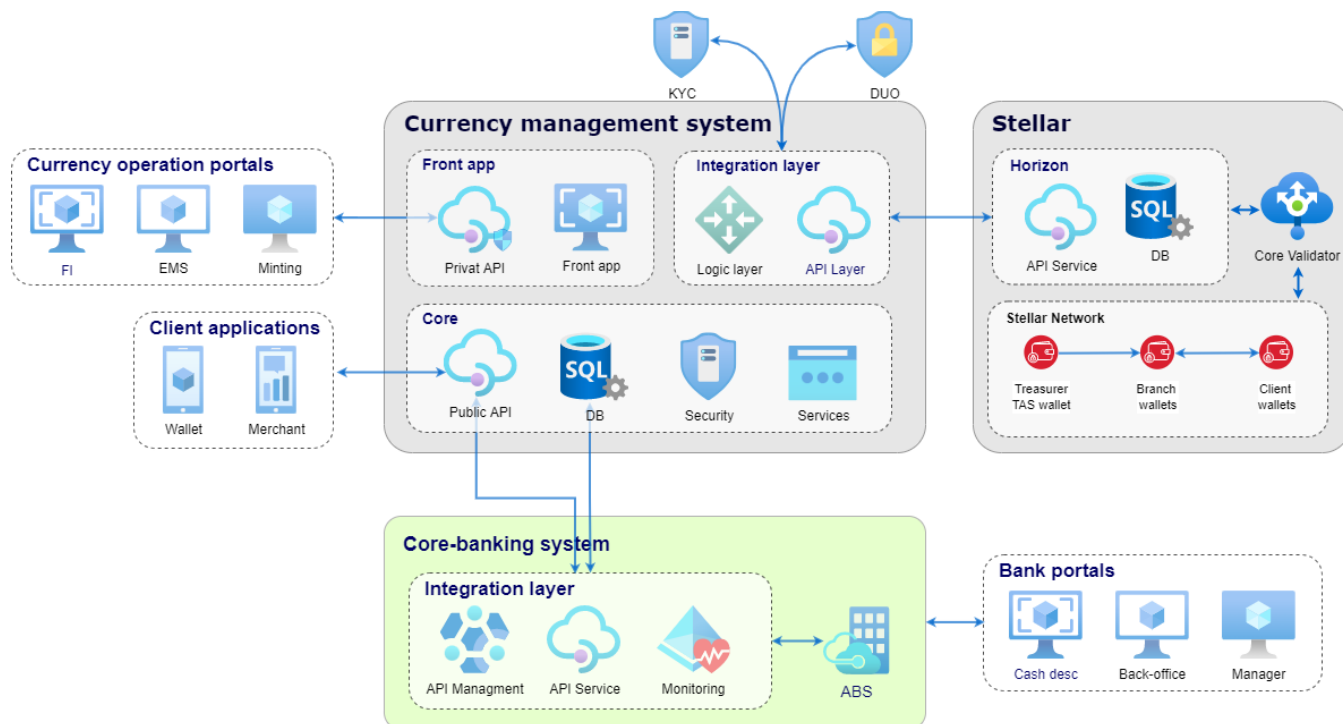
- Due to the current restrictions on the issuance of Electronic money at the time of the Pilot project, only test versions of the systems can be tested.
- The fullest implementation of Electronic money accounting tools in ABS.
- Incomprehensive/partial integration of the Platform systems is allowed. It is also allowed to manually perform some operations, but only if they will be automated when developing an online integration scheme.
- All of the test participants (users of Electronic money) must be fully identified according to the Ukrainian legislation and either be existing customers of TASCOMBANK JSC or pass onboarding through the existing channels.

### 4.2. Testing platform

Taking into account the above assumptions, the electronic currency management platform (hereinafter referred to as "Platform") was implemented for pilot testing. It included the following main systems.

- Automated banking system Sr-Bank of Tascombank JSC (hereinafter referred to as "ABS").
- The test version of the odb108 system was used for the pilot.
- CMS test system of currency management and related subsystems (hereinafter referred to as "CMS").
- Stellar public transaction network based on distributed ledger/blockchain technology (hereinafter referred to as "Stellar").
- Additional subsystems:
  - KYC — ALM/KYC system.
  - DUO — one-time password generator system for the 2-factor authorization of employees.

### 4.2.1. Integration scheme of the Platform systems interaction:



### 4.2.2. Stellar

Stellar is an open-source decentralized blockchain network that was designed with central bank digital currencies (CBDCs) in mind. Developer: Stellar Development Foundation (SDF).

To ensure the integrity and security of transactions, the Stellar blockchain network uses its own decentralized consensus protocol (Stellar Consensus Protocol SCP). The description of the protocol can be found here:

<https://www.stellar.org/papers/stellar-consensus-protocol?locale=en>

Comparison of Stellar Consensus Protocol with other consensus algorithms:

	<b>Decentralized control</b>	<b>Low delay</b>	<b>Flexibility of confidence</b>	<b>Safety</b>
<b>Proof of work</b>	YES	-	-	-
<b>Proof of stake</b>	YES	PARTIALLY	-	PARTIALLY
<b>Byzantine agreement</b>	-	YES	YES	YES
<b>Tendermint</b>	YES	YES	-	YES
<b>Stellar Consensus Protocol</b>	YES	YES (3-4 SEC)	YES	YES

The main difference between SCP and Proof-of-Work (POW) or Proof-of-Stake (POS) protocols is that nodes in the Stellar network are not anonymous. It is required that each organization that manages a node publishes a special document (so-called toml file) in a public network controlled by that organization. This ensures the transparency of the organizations that manage the nodes of Stellar.

SCP also allows entities to choose who to include in their pool for consideration when reviewing transactions, i.e. to create consensus trust groups.

Stellar has a well described API package (Horizon) that provides an HTML interface to the network data.

- <https://developers.stellar.org/api>

Stellar Development Foundation (SDF) operates two Horizon servers:

- <https://horizon.stellar.org/> to interact with the public network;
- <https://horizon-testnet.stellar.org/> to interact with the test network.

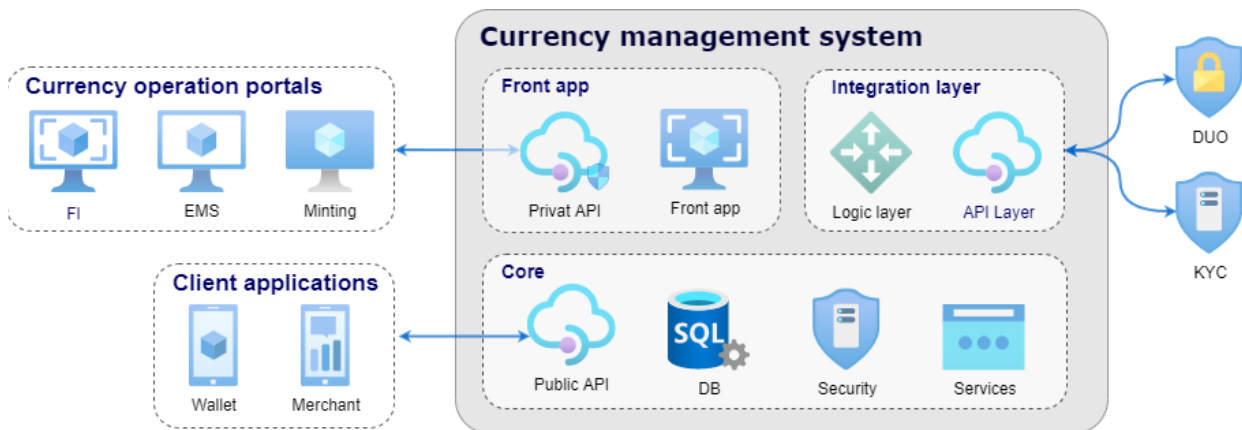
The public version of the network was used for testing.

It is also possible to deploy Horizon on your own servers to increase the throughput.

### 4.2.3. CMS

CMS is a currency management system that provides tools for the full use, management, and issuance of Electronic money. Supplier and developer: Technical Partner.

Schematic diagram of the CMS system:



Main components of the CMS system

A. Core — provides basic algorithms of the system and integration with other systems.

B. Integration layer is an intermediate layer between the Stellar network and the Currency management system, which ensures the application of business rules that are set by the issuer for performing the onboarding of customers and transactions.

C. Client mobile applications for users to work with electronic wallets:

- “Wallet” — an application for retail clients;
- “Merchant” — an application for merchants.

D. Portals and integrated systems for issuer and financial institution employees for wallet management, e-money issuance, and customer service.

### 4.3. Accounting scheme in ABS

An accounting model was developed for accounting of electronic money transactions in ABS. On the basis of this accounting model, the necessary objects (contracts, operations, macros) were developed and implemented in ABS to ensure the performance of accounting.

Accounting of electronic money in ABS is based on the creation of new client contracts (agreements) "Electronic money" and accounts 2904 in the form of IBAN for each user of the wallet.

The use of personal accounts 2904 is carried out within the framework of the current requirements of the legislation of Ukraine regarding electronic money at the time of testing, and meets the requirements of the banking services of financial monitoring and accounting. This scheme allows, after synchronization of transactions on the blockchain with bank accounting systems, to display the movement of electronic money in users' wallets and to ensure the formation of appropriate statistical reporting, account statements and other client forms in ABS.

The use of individual accounts for accounting of electronic money on the blockchain essentially complicates and creates prerequisites for duplicating the functions of the two systems, since the primary source of information on the state of accounts and transactions is the blockchain, while the display of this data at the level of ABS and individual accounts creates an additional burden on the bank's accounting systems and may negatively affect the time of execution of regulatory operations in the ABS. Also, with such implementation of accounting, all the main advantages of the blockchain are leveraged, namely transparency, controllability and accessibility.

## 5. Progress of the Pilot project implementation

Within the framework of the Pilot project, a Working group was formed consisting of 15 representatives from TASCOMBANK JSC subdivisions who performed the following roles:

Users (owners of electronic wallets)

- User (natural person)
- Merchant (legal entity)

Employees of the Issuer and financial institution

- Treasurer
- System administrator
- System administrator of the Electronic money issue (minting)

Employees of the financial institution

- Treasurer
- Cashier
- Branch manager
- Financial monitoring
- Back office

The functions of Electronic money, which were investigated at the stage of the Pilot project, correspond to the basic operations of cashless payments, namely:

- issue/redemption/destruction of Electronic money by the Issuer;
- creation of an electronic wallet for the Bank's client (onboarding);
- management of access to the wallet;
- crediting Electronic money to the client's wallet after depositing cash to the bank's cash desk;
- crediting Electronic money to the client's wallet after non-cash replenishment;
- review of the balance and history of transactions;
- transfers between the wallets of clients;
- write-off/redemption of Electronic money with cash withdrawal at the bank's cash desk



- write-off/redemption of Electronic money with a transfer to the current account;
- creation of an electronic wallet for a Merchant;
- viewing the history of transactions with Electronic money in mobile applications;
- issuing an invoice by the Merchant;
- purchase of the Merchant's goods by the User for Electronic money;
- full/partial reimbursement by the Merchant;
- redemption of Electronic money by the Merchant and receipt of hryvnia funds to an account;
- execution of the relevant accounting entries and reporting in the bank's ABS;
- blocking wallets;
- closing wallets.

## 6. Conclusions and suggestions

Within the framework of the Pilot project of TASCOMBANK JSC on the issuance of Electronic money based on blockchain technology, the possibility of integrating the distributed ledger technology and the bank's ABS to ensure the issuance, circulation, and control of the use of Electronic money, as well as the formation of proper accounting entries and statistical reports, was confirmed in practice.

In particular, cases of using such Electronic money in everyday settlements between customers and merchants were tested after implementing the issue of this payment instrument. To provide such functionality, a set of technologies, which was developed by the bank's Technology Partner on the basis of the blockchain platform and a set of software components that ensure the issuance and circulation of Electronic money, including mobile applications and interfaces of the issuing bank, was used.

In the process of preparing the Pilot project, a schematic diagram of the integration of the bank's ABS and blockchain platform was developed and implemented, an appropriate accounting model was created, and integration methods were prepared while taking into account the several possible levels of automation.

In order to ensure the proper level of control, Electronic money transactions were conducted in full compliance with the current KYC and AML procedures. A separate module for controlling transactions developed within the framework of the technological platform was used in the Pilot project. In particular, a full online identification of the customers that participated in the Pilot project was carried out using the existing tools of remote identification. Therefore, all of the interaction with the client takes place exclusively online, which makes this tool more accessible and convenient to use.

In the process of conducting operations and testing, the advantages of blockchain technology, such as transparency and accountability at all stages of circulation and among all the participants in transactions, security and confidentiality of client data, low transaction costs, and high throughput of the blockchain platform, were confirmed.

The use of open networks also has a number of advantages related to supporting competition and innovation as well as the technological prerequisites for the interoperability of electronic money instruments with other currencies and payment systems.

The legal basis for the issue of Electronic money based on the blockchain was the existing legal framework of Ukraine on the regulation of classical Electronic money. As Electronic money operations are still suspended by the regulatory authorities at the time of this report, the transition to the commercialization of this product is possible after these restrictions are lifted.

Currently, TASCOMBANK JSC is considering the possibility of using blockchain technology within the framework of traditional payment schemes on the basis of customers' current accounts opened in the bank, making transactions through processing centers that in this case are used for accountability and confirmation of the blockchain transactions.

We consider it expedient to bring to the National Bank of Ukraine consideration the possibility of introducing legislative changes in terms of requirements for accounting for electronic money, in particular, to use a simplified accounting model in ABS based on aggregated master accounts, without using personal accounts of clients. Thus, the duplication of functions of two accounting systems (blockchain and ABS) will be eliminated, the load on the bank's server capacity will be reduced, and electronic money accounting will be simplified in general.

With this scheme of using master accounts, tools of the CMS system or any other third-party tools that are compatible and can be integrated with the CMS can be used to control and review transactions - this will provide the necessary level of transparency and accountability due to the use of the basic principles of building a blockchain system.

The scheme of Electronic money circulation proposed for the Pilot project creates an economically feasible business model for the use of blockchain technologies. The possibility of applying such a solution in the context of scaling up the network for receiving, making humanitarian payments, and cross-border settlements in a consortium with international or local financial institutions requires further analysis.

In addition, we consider it advisable to further analyze the application of the technology tested in the Pilot project within the two-tier model of issuing E-hryvnia, in which the central bank issues CBDCs, but delegates the functions of interaction with end users to commercial banks or other intermediaries. In this option, an open network can provide the infrastructure to build CBDCs, combining the proper control and safeguards of a centralized system with the ability to innovate in a competitive environment that benefits consumers.

Further use of such a payment instrument, which requires a separate study, is also possible in the context of interaction with virtual asset markets for the exchange, issue, and other transactions with virtual assets. Taking into account the possibility of using smart contracts and creating programmable parameters of Electronic money based on blockchain technology, the proposed platform can also be used as a monetary policy tool when issuing a digital currency of the National Bank based on this platform.

Taking into account the obtained results, we consider the Pilot project successful and promising in terms of further development of the product and its industrial implementation.

**Prepared by:**

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