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Central Banks Digital Currencies Issuance: Development Directions and Key Risks

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ABSTRACT

Currently, many central banks have begun to develop, study and introduce central bank digital currencies (CBDC). Due to the lack of sufficient experience, potential problems and risks' research that can stimulate such financial innovations is relevant. The paper analyzes the projects for the creation of CBDC. The **purpose** of the paper is to identify unresolved aspects of the application of CBDC, and specific tasks include identifying the problems of the marketing of retail CBDC and the identification of the risks generated by them. The authors use general and special research **methods**, including comparative analysis and systematization. The article examines the prospects for digital ruble circulation in the Russian Federation. The use of CBDCs opens up enormous opportunities for the development of the digital economy, but their actual deployment is replete with risk. The article identifies the risks of the third form of national currency: technological (including environmental), economic, financial, social and legal. The authors consider that the widespread use of CBDC implies a transformation of the activities of national central banks, including a change in the role and functions of the national central bank, and provide several possible scenarios. The authors include among the unresolved problems that require solutions for the widespread practical use of digital securities: lack of understanding of the mechanism for transferring ownership during transfers from one user to another, clear prudential regulation, and effective management of big data analytics. Furthermore, the scope of regulation of the financial intermediation sector with regard to fintech innovations has not been defined; there is no system for exchanging data between different government agencies for a timely and more accurate assessment of potential risks; and the required number of specialists is not sufficient. The research can be important for both digital money consumers and authorities when the initiative to issue digital money in Russia is implemented.

Keywords: central bank; central bank digital currencies; digital ruble; financial innovations; development of the payment system

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INTRODUCTION

National regulators initiated transforming the legal regulation of financial activity by improving various prudential requirements (Basel III) and operating standards for licensed financial institutions in response to the flaws and difficulties indicated by the global financial crisis (2007–2009). Similarly, this resulted in a decrease in their provision of financial services and products to economic organizations, and the freed-up market niche was rapidly occupied by "newcomers" — fintech and bigtech businesses. Their increased market activity, on the one hand, and demand for digital products and services by households, on the other, have contributed to the formation of new branches of financial intermediation.

In turn, the response to the indicated trends on the part of central banks (further — CB) has been a study of the opportunities, benefits and potential risks of issuing central bank digital currencies (further — CBDC) since the mid-2010s. However, in the period prior to the COVID-19 pandemic, only individual CBs (e.g. China, the UK, Uruguay) participated in the development of various CBDC projects, including bilateral and multilateral research projects[1]. The rate of digitization payments and settlements, as well as the provision of additional banking and financial products, have risen significantly during the pandemic. This showed two opposite trends: on the one hand — the "retreat" of economic entities from using cash in settlements (in 2020, by 26% in the Russian Federation and 39% in China), and on the other, an increase in demand for cash as a result of "precautionary" measures[2].

Many governments are considering the growth of digital payment infrastructure as an integral component of their industrial policies, assuming that promoting the adoption of innovative payment methods will improve the ability to regulate both inside and outside cash flows, recharge, and budgetary expenditures in order to preserve internal financial stability. Since the end of the 2010s, a number of payment methods based on innovative infrastructure, such as national card systems (e.g. the Troy systems in Turkey, Mir in Russia, Elo and Pix in Brazil), fast payment systems, and others, have grown significantly due to the focused efforts of governments and central banks[3]. Innovative upgrading of the payment sector has transformed it into a catalyst for reducing transaction costs for all operators, a stimulator of economic growth and a catalyst for the transition to the digital economy.

Over the past three years, CB has seen a so-called "race" to develop, study and introduce CBDCs. According to SWIFT, as of December 2022, the respective projects had implemented 105 CB. According to https://cbdctracker.org/ for July 2022–97 (*Fig. 1*). Individual CBs simultaneously explore the benefits and risks of different CBDC projects, such as retail or wholesale, multi-currency, technology-based, centralized or decentralized distribution and other options.

The supranational financial institutions' representatives made it evident that every country is open to expressing its own "for" and "against" opinions and preferences regarding the CBDC design. Each CB operates appropriately on its own, focusing on the goal of resolving any issues that may arise.

Due to the limited number of CBs that have implemented their retail CBDC[4], initiatives on

[1] See: Project Jura. Cross-border settlement using wholesale CBDC. Banque de France, Bank for International Settlements, Swiss National Bank, 2021. URL: https://www.bis.org/publ/othp44.pdf (accessed on 05.02.2023).

[2] Covid-19 accelerated the digitalisation of payments. BIS, Committee on Payments and Market Infrastructure. URL: https://www.bis.org/statistics/payment_stats/commentary2112.pdf (accessed on 15.01.2023).

[3] According to the Committee on Payment and Market Infrastructure, more than 60 fast payment systems operated under BIS as of December 2021. For example: Developments in retail fast payments and implications for RTGS systems. Committee on Payments and Market Infrastructures. URL: https://www.bis.org/cpmi/publ/d201.pdf (accessed on 25.01.2023).

[4] Retail CBDCs (sand dollars) first issued by the Bahamas in 2020. Nigeria introduced eNaira in 2021, while the East Caribbean (DCash) and China (e-CNY) initiated extensive pilot programs.

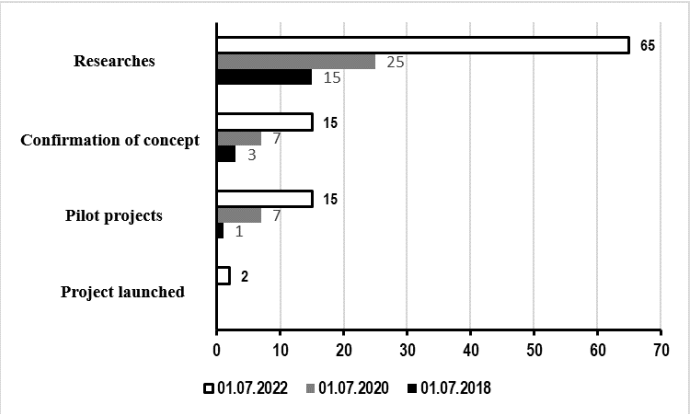

Fig. 1. **Evolution of Central Banks' Activities on the Development, Study and Introduction of the CBDC, 2018–2022**

Source: A. Stanley [1].

a large scale, any potential problems and risks that could lead to these financial innovations are still relevant because there is a lack of empirical experience. The usage of CBDCs in domestic and cross-border settlements presents a number of possible problems and risks, which are analyzed and explored in this paper. Because of technology limitations, any domestic application of a national CBDC may have significant cross-border implications.

DISCUSSION OF THE BENEFITS/LIMITS AND REFINEMENT OF CBDC' ISSUANCE

In recent years, the international flow of publications on the potential benefits (possible motives) of national CBDCs has been extensive. The most detailed CBDC typology is presented in the report of the Center for Research in Financial Technologies and the Digital Economy of Skolkovo-RES [2]. Some publications focused exclusively on listing the benefits that could be obtained from the introduction of CBDC [3][5]. In addition to discussing the potential benefits and advantages of the CBDC problem, additional materials also focus on the problems that must be resolved before their full release [4–6]. The third direction of the publications is devoted to the analysis of potential options for the evolution of national and international payment ecosystems under the influence of the wider spread of CBDC [7][6].

Among the **advantages** of using CBDC in payment transactions, the most frequently mentioned are:

- ability to offer businesses and households more convenient, fast, cheap and efficient methods of payment;
- opportunity to promote competition between traditional payment service providers and new players (bigtech and fintech companies);
- provide a digital asset to economic entities of trust (provided by trust to the national CB);
- consumer protection;
- increase the availability of financial services, etc.[7]

[5] For example: Digital currencies of central banks: foreign experience. Moscow: Fintex Association. 2021, December. URL: file:///C:/Users/Aser/Downloads/Analiticheskaya-zapiska.pdf (accessed on 25.01.2023).

[6] For example: The Future of Financial Services. How disruptive innovations are reshaping the way financial services are structured, provisioned and consumed. An Industry Project of the Financial Services Community. Final Report. World Economic Forum, Deloitte. 2015. URL: https://www3.weforum.org/docs/WEF_The_future__of_financial_services.pdf (accessed on 25.01.2023); Options for access to and interoperability of CBDCs for cross-border payments. Report to the G20. Committee on Payments and Market Infrastructures, BIS 2022, July. URL: https://www.bis.org/publ/othp52.pdf (accessed on 22.02.2023).

[7] Central banks and payments in the digital era. BIS Annual Economic Report. 2020. URL: https://www.bis.org/publ/arpdf/ar2020e3.pdf (accessed on 18.02.2023).

Table

Separate Arguments of Supporters and Opponents of the Implementation of CBDC

Arguments "For" the issue CBDC	Arguments "against" the issue CBDC
• Independent of the form CBDC allow CB to issue the national currency as a secure public good; • the advantages of crypto assets are completely exceeded by CBDCs, but the disadvantages are eliminated; • CBDCs will facilitate monetary policy implementation, including through the possibility of introducing negative interest rates; • the possibility of providing social support and distribution of transfers; • the use of CBDC increases the efficiency of internal settlements, thereby promoting economic activity	– The fact that money is issued by the government in the person of CB does not make it a public good; –the practice of operating the markets of cryptocurrencies and stablecoins leads to fragmentation and weakening of the financial system; — CBDC issue — an attempt by the government to retain its privileged positions and more control over citizens' funds; – the CBDC issue states that the central bank is entrusted with the functions of a fiscal agent of the government; – increases the volatility of the national payment system by increasing the vulnerability to cyber-attacks and banking panic ("runs on banks")

Source: Compiled by the authors.

Discussions on the subject are still ongoing, despite the fact that many publications recognize that the issuance of the third form of CB money is inevitable. The specific indications made by CBDC's supporters and detractors are presented in *Table*.

In general, publications pay much less attention to potential problems and risks than to the advantages of the development of the third form of money. However, since the CBDC issue relies on the innovative infrastructure of the payment participants and a large number of third-party players are involved in its creation and maintenance, the channels and ways of disseminating and using the new form of the national currency are changing, and this must inevitably be accompanied by the transformation of CB's own activities.

CHINA'S DIGITAL YUAN EXPERIENCE AND RUSSIANS BANK'S PLAN

Based on the data from the "Digital Ruble" report[8], the Bank of Russia plans to issue a retail CBDC, using a two-tier system of distribution. China implements a similar model of national CBDC[9]. The information released by the Bank of Russia on how the digital ruble will function does not reveal all the details. But, as a possible analogy, the features of the initial two-level digital yuan model, when only the largest national banks with government participation had access to the CBDC, could be considered (*Fig. 2*).

This model consolidates the existing two-tiered system of monetary issuance: the first level — CB, the second level — the system of commercial banks. The third level — is end users. CB issues a national digital currency, opens digital wallets to accredited commercial banks, distributes digital currencies in exchange for banks providing 100% coverage (e.g. in return for non-cash money) and keeps records of their transactions. After receiving the digital currency, banks can conduct interbank transactions, open digital wallets for clients (legal and natural persons), execute client orders, and keep records of transactions in digital currencies. Both levels

[8] Digital ruble. Moscow. Bank of Russia. 2020. URL: https://www.cbr.ru/StaticHtml/File/112957/Consultation_Paper_201013.pdf (accessed on 15.01.2023).

[9] Progress of Research & Development of E-CNY in China. Working Group on E-CNY Research and Development of the People's Bank of China. 2021 July. URL: http://www.pbc.gov.cn/en/3688110/3688172/4157443/4293696/2021071614584691871.pdf (accessed on 22.01.2023).

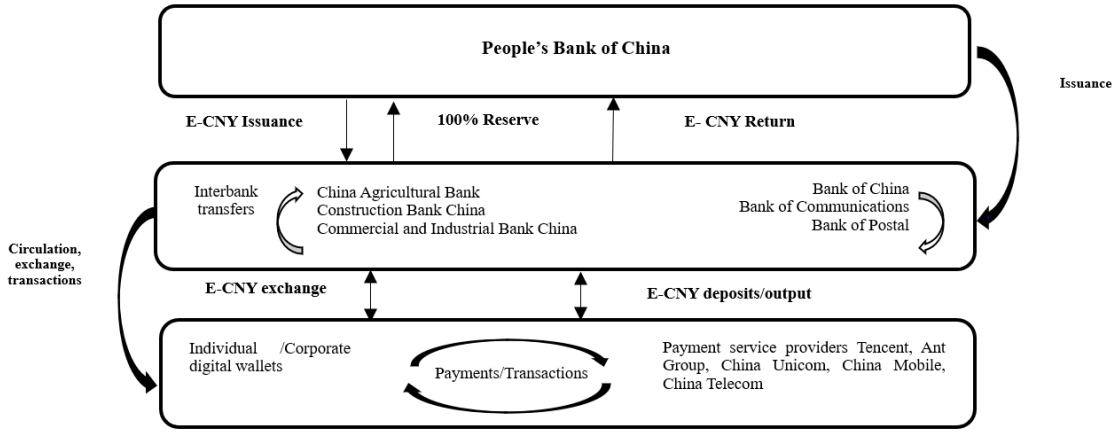

Fig. 2. **The Scheme of Functioning of the Digital Yuan**

Source: Compiled by the authors.

use centralized blockchain technology. At the same time, accredited commercial banks remain obliged to conduct due verification of clients (compliance with ALM/KYC requirements). Every level includes design elements that require advanced technological solutions, prudential consideration, and compliance supervision. For example, a number of activity areas at the CB level require significant reform (*Fig. 3*).

Even greater organizational and technological restructuring is needed at the level of commercial banks and end-users.

Large-scale preparatory work was done in China before to launch of the virtual yuan project. This work included the introduction of a system for digital evaluation of user integrity (a social credit system for individuals and legal entities), the centralization of mining, the development and approval of a unified mobile application (also known as a super API or program user interface), which allows end users to quickly access digital wallets and conduct transactions both online and offline, the identification and certification of suppliers of the necessary hardware, software, cloud storage, etc., and the implementation of numerous other preparatory measures. Furthermore, the development of a fundamental blockchain is planned to allow end users to transact with CBDC (*Fig. 4*).

The Bank of Russia is yet to release the results of its initial work. It follows that the Bank of Russia intends to establish the operational compatibility of the CBDC blockchain technology and its technical payment platform, rather than constructing a separate infrastructure for transactions with CBDC. Such a solution has its advantages (e.g. a significant reduction in initial investments) and serious constraints and risks [8]. The availability of operational compatibility between various technologies allows: a) banks and payment service providers to make payments in various systems without being direct participants in all of them; b) end users to instantly transfer money between various accounts, such as a debit card or electronic money transfer from a commercial bank account to a CBDC account.

The Bank of Russia declared in 2022 that it conducted trial projects with three significant Russian state banks[10] on the launch of the virtual ruble and its application in settlements at the start of the year. Then, 15 participating banks were added to the list. In the spring of 2023, the Bank of Russia began to test the digital ruble with clients of commercial banks[11].

[10] The digital ruble was piloted by state banks. Kommersant. 15.02.2022. URL: https://www.kommersant.ru/doc/5217447 (accessed on 28.01.2023).

[11] Central Bank intends to start testing digital ruble with clients of banks in 2023. Kommersant. 16.09.2022. URL: https://www.kommersant.ru/doc/5569335 (accessed on 15.01.2023).

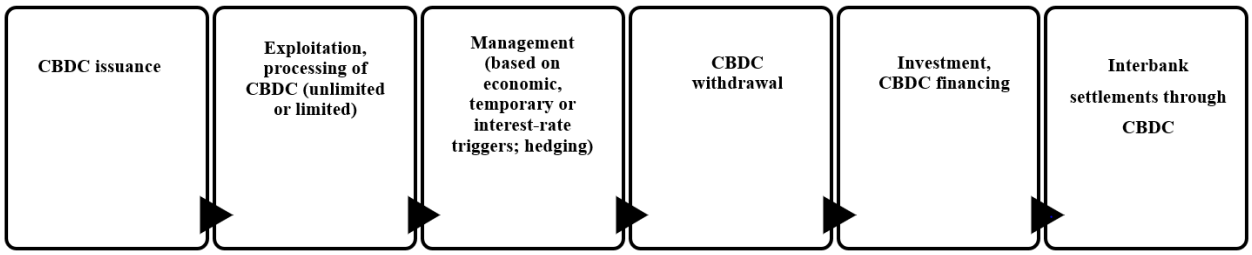

Fig. 3. **The Main Activities of the Central Banks that Require Transformation in the Introduction of the CBDC**

Source: Compiled by the authors.

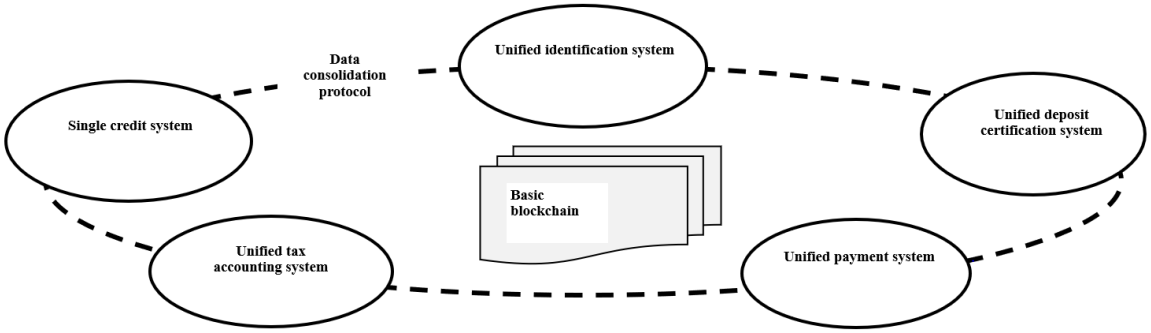

Fig. 4. **Simplified Scheme of the Basic Blockchain that Provides Transactions with the CBDC**

Source: Compiled by the authors.

CBDC' RISKS

CBDCs may result in at least a few different risk groups, including economic, financial, social, and legal risks, the ramifications of which have not yet been thoroughly investigated. These risks are in addition to the common risks associated with financial assets and technological risks (such as environmental risks) resulting from the use of innovative technologies.

Macroeconomic risks. The creation of CBDCs is a "button-click", and they can be distributed just as easily unless strict rules are set for their allocation, for example, in exchange for bank deposits, security or government bonds. In a potential case, their release may be pro-inflationary. The issuance and use of CBDCs require enormous initial and subsequent capital investments, including in the establishment and continuous upgrading of a large-scale national infrastructure. Implementation of potential mega-projects may be accompanied by an inefficient placement of capital within the national economy, which, in the context of the urgent need for modernization and development of physical infrastructure, may lead to the wasting of limited public resources.

Macro-financial risks. It is assumed that CBDCs will be a new ("third") form of modern money and will be exchanged 1:1 for current forms of money. In current circumstances, there are practical differences in exchange rates, such as non-cash to cash or on-shore to off-shore, which are exacerbated during periods of increased macroeconomic uncertainty. It is probable that CBDC rates will experience volatility in line with the volatility of private digital asset rates, albeit to a smaller degree. In this case, large-scale arbitration transactions of the game on the difference of rates, including from abroad, are possible, the consequences of which are similar to the well-known banking panics ("attacks on banks"). While various projects claim that the CBDC will be stable because they are central bank

currencies, in other words, the stability of the CDB will be determined by the economic entities' confidence in the CB as a financial institution and its policies. However, due to their immense liquidity, CBDCs may also represent serious risks to the integrity of the financial system and provide investors with refuge if operators choose to move to CBDCs in order to minimize risk in an extremely unpredictable environment. As a result, a more serious and extensive banking panic is more probable than not [9].

The introduction of CBDCs, as indicated by the Bank of England's "New Forms of Digital Money" report[12], may lead to a rise in the loan price due to a decrease in bank loans, because by acquiring CBDC in exchange for non-cash, banks are reducing the supply of the latter on the credit market, while the demand for CBDC loans may be insufficient, for example, due to the difficulties for potential borrowers to pass digital identification and more thorough verification of ALM/KYC compliance. As a result, the availability of market funding will be limited (due to low supply volumes and higher interest rates).

The introduction of CBDC increases network risks within the financial/banking systems and from third-party providers such as hardware, software, cloud storage, etc. Particularly if most financial intermediaries use the services of the same third-party providers. The high level of concentration increases the likelihood of systemic risk, including because such third parties do not disclose information and financial position data to the public.

Separate groups of macro-financial risks typical of centralized CBDC systems include cyberattacks that, even on a minor scale, can trigger a systemic financial crisis.

Social risks. The functioning of the CBDC infrastructure requires highly qualified IT and engineering professionals, which are currently lacking in the labor market. Therefore, the Central Bank can become a serious competitor as a reliable employer for other sectors of the economy. The training of the required specialists requires a fundamental restructuring of the entire education system, which also requires huge capital investments in human capital.

CBDCs could potentially be used as a tool for government supervision and control. Every transaction with CBDC is recorded and any public authority authorized to access the CBDC registry can view all transactions. By granting access to a distributed register, public authorities may be able to monitor on the transactions of operators and initiate various measures, such as prolonging the validity of their CBDCs, restricting the amount they can hold, changing interest rates based on the entity's status, banning purchases, and enforcing automatic fines. In this instance, the implementation of CBDC could make the risk of operator digital segregation more evident.

Combining digital identity and CBDC also poses a risk of digital segregation for operators. Access and addressability are necessary for digital payments, but they are different from digital identification. In the context of programmable money, digital identity can go beyond simply providing access to the CBDC holder's assets. The use of funds in the CBDC may be subject to the characteristics of the digital identity of the entity. If an entity's funds are nominated to the CBDC, the Central Bank and the Government can directly control how entities receive and spend money.

The risks that operators can fall upon when distributing CBDCs are presented in *Fig. 5*. However, there is probably a relationship between risks and operators because of the restricted practical use of CBDC and the absence of official statistics (*Fig. 5*).

CBDC AND TRANSFORMATION OF THE ROLE OF NATIONAL CENTRAL BANK

The recognition of the identified risks of the CBDC issue is reflected in the principles

[12] New forms of digital money. Bank of England. 2021. URL: https://www.bankofengland.co.uk/paper/2021/new-forms-of-digital-mone (accessed on 23.02.2023).

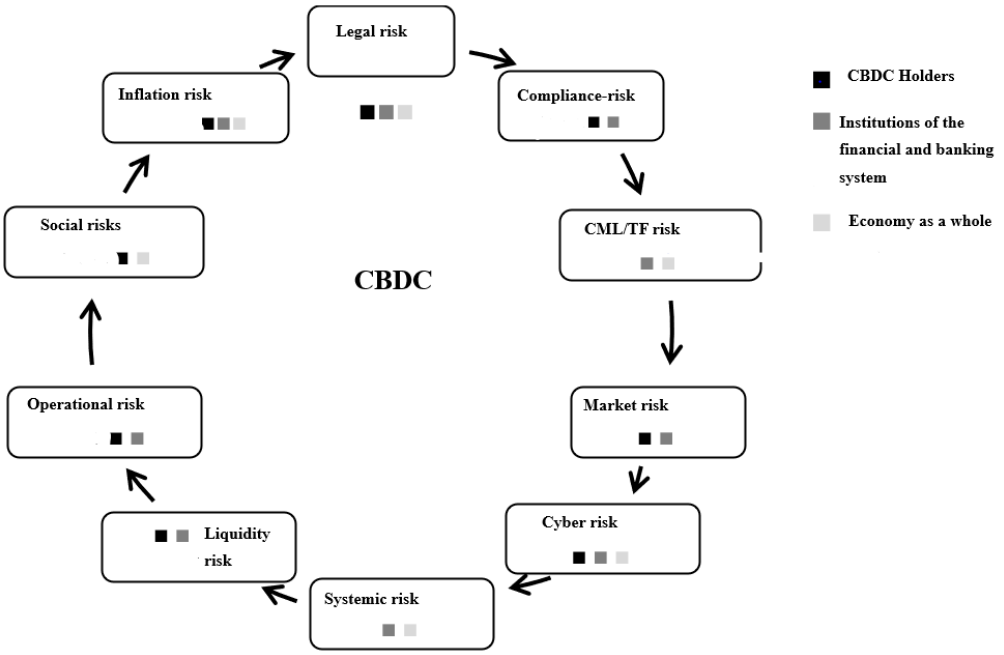

Fig. 5. **Circulation Risks CBDC for Business Entities**

Source: Compiled by the authors.

for the adjustment of digital currencies formulated by the G-7 Central Bank. The document notes that while the introduction of CBDCs will have implications for financial intermediation and financial stability that require careful consideration and analysis, they can be managed [13]. In essence, these principles represent a list of desirable characteristics of the third form of money, but do not define ways to achieve them.

As noted above, the widespread use of CBDCs entails a transformation of the activities of national central banks, which may lead to a fundamental change in the role and functions of the national central bank. There are several possible scenarios in this regard.

Scenario 1: The Central Bank is the central body for general financial regulation and control. This scenario is likely to be implemented in the case of the choice of a single-level model of CBDC issuance, in which the central bank interacts directly with economic entities without the involvement of commercial banks and non-bank financial institutions. The Central Bank's activities have changed from being the body in responsible for formulating and implementing monetary policy to a high-tech company that sets requirements and uses pre-established algorithms to monitor compliance by all economic operators. Examples of these functions concentrated within the bank's structure include a single center for the collection and analysis of data on the movement of all financial flows, including budgetary and cross-border; distributing CBDC based on the automatic evaluation of e-KYC of economic entities, their business models, and their cost structure. Such a scenario suggests that as these functions are concentrated in the structure of the Central Bank, the current system of financial intermediation and financial markets will "die off" [10].

Scenario 2: The Central Bank — is the body to protect the role and functions of

[13] Public Policy Principles for Retail Central Bank Digital Currencies (CBDCs). G7, Great Britain, 2021. URL: https://www.mof.go.jp/english/policy/international_policy/convention/g7/g7_20211013_2.pdf (accessed on 05.02.2023).

traditional financial intermediaries in an environment of increasing digitalization of financial services and products. To this end, the framework of the Central Bank focuses on regulating all types and forms of financial intermediation, including the financial areas of bigtech companies, which will be subject to the prudential requirements applicable to traditional financial intermediaries, based on the principle of a functional and proportionate approach to regulation. While centralized and relatively decentralized financial systems can coexist in this case, in decentralized finance systems, centralised decisions are shifted to different levels of the new financial infrastructure [11]. In this scenario, the central bank faces the difficult challenge of finding a balance between creating an environment that supports innovation and managing associated risks for the banking system, operators and the stability of the financial system. Overly strict or conservative regulations will discourage innovation and protect the dominant positions of big businesses (excessively high market entry costs); on the other hand, insufficient rules encourage banks and operators to take inappropriate risks, which might undermine creative solutions in the CBDC [12].

Scenario 3: The Central Bank — is the body responsible for national financial sovereignty. The issuance and use of CBDCs, as well as other digital assets, are based on Internet technologies that are inherently cross-border. Maintaining national financial sovereignty with CBDCs, private stablecoins and tokenized assets will require the centralization of the functions of most ministries and departments currently in operation. Ultimately, the financial system will be nationalized and the central budget will act as the ultimate creditor.

Currently, representatives of national central banks and supranational financial institutions are looking for a new model of conducting CB business. At the June 2022 BIS General Annual Meeting, Hyun Sun Shin, the Chief Research Officer and Economic Adviser for BIS, gave a presentation on the future monetary system. Hyun Sun Shin described it as an ecosystem based on settlements made on the central bank's balance sheet and developed in accordance with established central bank rules, with the "solid tree whose solid trunk is the central bank, supporting a rich and dynamic ecosystem of services provided by private sector institutions and mechanisms" [13]. But time will show how realistic this vision of the future model of the Central Bank will be.

UNSOLVED PROBLEMS

The practical application of CBDC needs to address several important issues:

- there is no clear and unambiguous understanding of a number of legal aspects of the use of CBDCs, in particular how to fix ownership when transferred from one user to another;
- no prudential regulation of transactions with CBDCs and crypto-assets has been developed for commercial banks[14] and non-bank financial service providers, including cross-border [14];
- there are governance and disclosure requirements for big data analytics, although it is at the heart of transformational processes in many sectors of the economy and can be a source of serious risks;
- not defined "perimeter" (types of activities) of regulation of central banks of the financial intermediation sector, taking into account fintech innovations and the speed of their spread;

[14] Only in December 2022, the Basel Committee of Banking Supervision published a new standard for regulating the exposure of banks to the risks of crypto-assets, which should fully enter into force from 01.01.2025. For example: Prudential treatment of cryptoasset exposures. Basel Committee on Banking Supervision, 2022, Dec. URL: https://www.bis.org/bcbs/publ/d545.pdf (accessed on 15.02.2023).

- there is no system for the exchange of data, including supervisory, and harmonization of regulatory requirements between different government agencies for timely, more accurate assessment of potential risks and their integration into new regulatory models;
- insufficient training of professionals with adequate skills to understand and work with financial innovations.

Alternative possible configurations of the use of digital currencies and their consequences for economic development, monetary policy implementation and financial stability are yet to be explored.

CONCLUSION

The study identifies unresolved problems that require solutions for the broad practical application of CBDCs and presents potential scenarios for the transformation of the activities of national central banks caused by their implementation. In the future, the central bank's role as a "emission center" may be supplemented by the role of "controller of national currency circulation", if the central banks will be in charge of and maintain records of the distribution of digital currency between users, as previously noted by the authors. This is because of the development of financial technology and the Central Bank's experiments with the creation of digital national currencies [15].

The article addressed the challenges and possible consequences of the introduction of CBDC into everyday circulation. Although the priorities of CBDCs in different jurisdictions vary, for many emerging and developing countries central banks, greater financial inclusion and greater efficiency of settlement transactions are at the forefront.

At the same time, the practical use of CBDC requires a special environment and infrastructure that can create new and serious risks for both consumers and institutions in the financial system and the economy as a whole. Digital currencies issued by central banks can trigger both traditional financial risks (such as systemic risk) and new specific risks, such as the risk of digital segregation. At the initial stage of the introduction of the digital ruble, the experience of issuing the digital yuan can be utilized, as such an approach is already being implemented, which allows the achievements and limitations of the large-scale use of digital yuan's to be taken into account at the phases of validation of the concept and pilot projects.

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