

DOI: 10.26794/2587-5671-2026-30-4-126-139

UDC 336(045)

JEL E41, E42, E71, G18, G40, O33

Comparative Analysis of Financial Systems of Metaverses in the Public Sector: DEFI vs CBDC

R.G. Malsagova, S.A. Efremova

Financial University under the Government of the Russian Federation, Moscow, Russian Federation

ABSTRACT

The article provides a comparative analysis of the principles behind the organization and operation of financial systems of metaverses in the public sector based on decentralized finance (DEFI) and digital currencies of central banks (CBDC). The purpose of the study is to assess the effectiveness of financial systems based on DEFI and CBDC in order to develop scientifically supported recommendations for choosing the optimal model of financial organization for the state metaverse. The objectives of the study are to systematize the characteristics of DEFI and CBDC, identify the potential opportunities and limitations of each system, and develop recommendations for selecting a metaverse financial model. The research methodology includes a comprehensive comparative analysis of these systems based on several key criteria, including centralization, legal regulations, accessibility, technological aspects, inflation control, security, scalability, and other relevant parameters. Based on the results of the study, the authors conclude that the choice between DEFI and CBDC is determined by the state's goals, level of trust in financial institutions, and readiness for digital transformation. Both systems have their own advantages and limitations, which require a tailored approach based on the national characteristics and strategic goals of each country's development plan. The practical significance of the study lies in the potential application of the developed recommendations to the formation of the country's financial strategy within the context of developing the digital economy and metaverses.

Keywords: metaverse; decentralized finance; DEFI; central bank digital currencies; CBDC; public administration; digital economy; blockchain

For citation: Malsagova R.G., Efremova S.A. Comparative analysis of financial systems of metaverses in the public sector: DEFI vs CBDC. *Finance: Theory and Practice*. 2026;30(4):126-139. (In Russ.). DOI: 10.26794/2587-5671-2026-30-4-126-139

INTRODUCTION

The rapid development of digital technologies has led to the emergence of the concept of the metaverse, an integrative ecosystem of virtual worlds that offers users an immersive and exciting experience. This new phenomenon is transforming existing systems and creating new values in terms of economics, environment, society, and culture.¹

Technically, the metaverse represents a qualitatively new stage in the evolution of media hardware and software, featuring improved touch interfaces that enhance user interaction [1].

Taking into account the advantages of using metaverses for different user groups [1–8], their implementation in public administration opens up great prospects for improving its efficiency [1, 2, 9, 10].

Despite the fact that the metaverse is still at an early stage of development, its concept in the public sector has already been implemented in countries such as the USA, China,² the UAE,³ South Korea,⁴ Singapore, Spain, etc. [11–14].

At the same time, there are different approaches to the organization of the metaverse in public administration. One of the main questions is which system of finance organization in the state metaverse would be most effective — based on decentralized finance (DEFI) or central bank digital currencies (CBDC). Both systems have their own positive and negative features, both objectively and subjectively.

DEFI VS. CBDC

To compare these two options for building a financial system for state metaverses, we will fo-

cus on several basic criteria to conduct a more detailed analysis of each one. The proposed criteria for this analysis are shown in *Fig. 1*.

The first and most important criterion for comparative analysis is centralization vs. decentralization. The essence of the DEFI system lies in its decentralized nature, which is its main advantage for certain categories of users. DEFI is a model of financial organization that does not have intermediaries, transactions are carried out automatically through distributed ledger technology (DLT), which represents a conceptually new data storage model, where users exercise direct control over their assets,⁵ and the most common type of technology used is blockchain. On its basis, metaverses and related instruments such as cryptocurrency, stablecoins and NFTs function.

Experts identify the following advantages of using decentralized finance technology (*Fig. 2*).⁶

As noted by F.-Y. Wang, R. Qin, X. Wang, B. Hu, the metaverse should not be under the control of any particular organization. The ideal scenario would involve an open space where users can fully own their assets and influence the future direction of the platform [15].

The fusion of metaverse and blockchain technologies offers new opportunities for enhancing transparency and optimizing government processes in various areas, such as public procurement, electronic voting, healthcare, education, land management, and digital identification of citizens. The metaverse based on DEFI can be used for virtual consultations with authorities, public discussions, and modeling the effects of new laws. Automated smart contracts can also be implemented to simplify and expedite the fulfillment of government obligations such as distributing subsidies and grants. Moreover, the use of blockchain and metaverse contributes to creating an open and decentralized system where citizens can monitor pro-

¹ International Telecommunications Union (ITU). Definition of metaverse 2023. URL: https://www.itu.int/dms_pub/itu-t/opb/fg/T-FG-MV-2023-PDF-E.pdf (accessed on 22.06.2025).

² Interesse G. China's Debut in the Metaverse: Trends to Watch (Updated). China Briefing. URL: <https://www.china-briefing.com/news/metaverse-in-china-trends> (accessed on 20.08.2025).

³ Dubai Future Foundation launches new report on future of the metaverse. URL: <https://www.wam.ae/en/details/1395303113683> (accessed on 10.08.2025).

⁴ Press Conference. Mayor Oh Se-hoon, a citizen of the world's first city 'Metaverse Seoul' Invitation. Seoul City Hall Website. URL: <https://opengov.seoul.go.kr/press/27671570> (accessed on 22.08.2025).

⁵ Decentralized Finance. Moscow: Bank of Russia, 2022. 51 p. URL: https://cbr.ru/Content/Document/File/141992/report_07112022.pdf (accessed on 22.06.2025).

⁶ Decentralized Finance. Moscow: Bank of Russia, 2022. 51 p. URL: https://cbr.ru/Content/Document/File/141992/report_07112022.pdf (accessed on 22.06.2025).

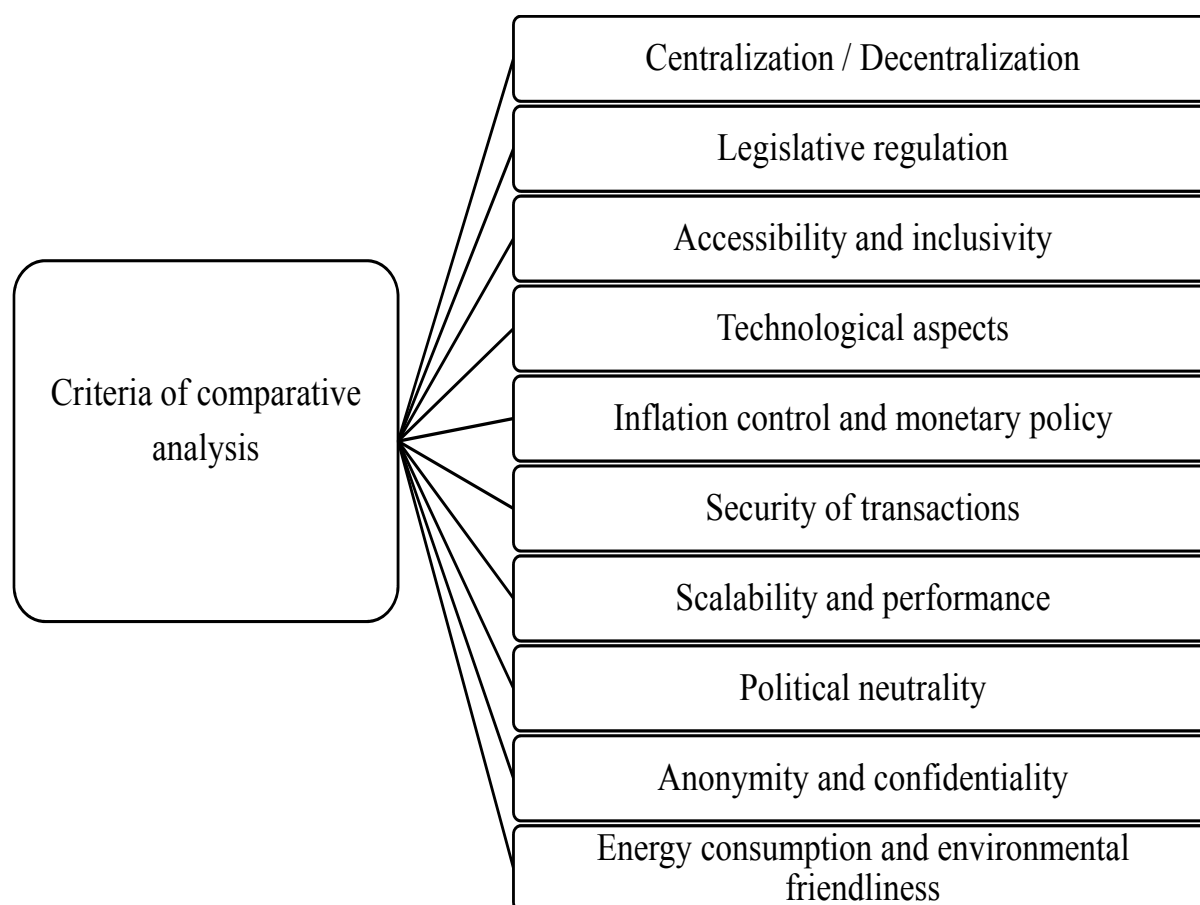


Fig. 1. Criteria for a Comparative Analysis of the Organization of Finance in the State Metaverse Based on Decentralized Finance (DEFI) or Central Bank Digital Currencies (CBDC)

Source: Compiled by the authors.

cesses in real-time, which increases trust in government institutions and makes governance more efficient and transparent [4, 16].⁷

Thus, the DEFI system operates independently of direct government control, which allows users to avoid excessive regulation. At the same time, decentralized systems offer equal access to financial services for everyone. However, this system has some weaknesses, as it is vulnerable to fraudulent projects due to lack of strict regulatory standards and centralized government control.

In turn, the digital currency of central banks — CBDC, based on its essence, is a centralized system, as it is issued by the central bank of the state and managed by government

agencies. That is, it retains elements of centralization and control by regulators, which is an advantage for some categories of users, but a disadvantage for others [5].

From the perspective of maintaining financial stability in a country, the use of CBDC provides the central bank with an opportunity to better control the management of funds movements. This helps to increase the effectiveness of monetary policy implementation. To enhance the transparency of the economy, CBDC provides government agencies with access to data on users and their digital currency transactions. This improves government control and monitoring of financial flows, making it easier to detect and prevent illegal activities. Increasing the transparency of CBDC transactions also contributes to the fight against corruption and other illegal activities such as tax and fee evasion, which

⁷ Gaurav K. The Metaverse and Blockchain Technology: What the Future Holds. Open Source. URL: <https://www.opensourceforu.com/2024/06/the-metaverse-and-blockchain-technology-what-the-future-holds/> (accessed on 15.08.2025).

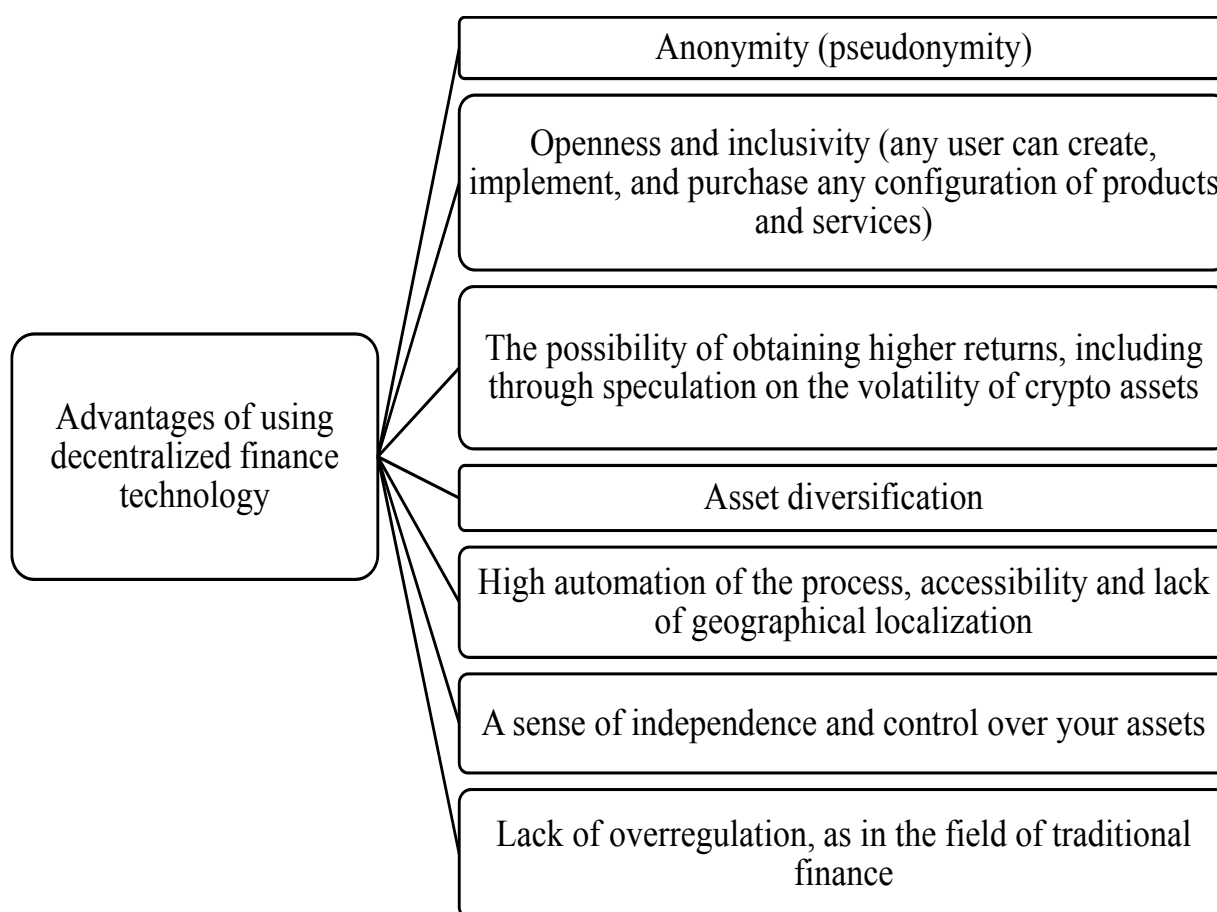


Fig. 2. Advantages of Using Decentralized Finance Technology DEFI

Source: Compiled by the authors.

increases the effectiveness of fiscal policy and the effectiveness of anti-corruption measures [17–19]. The possibility of CBDC programming opens up new horizons for the implementation of various control and management mechanisms [20].

According to experts, the introduction of a central bank digital currency allows for the use of “colouring” technology, which ensures targeted use of funds. This means that CBDC can be used to pay for specific goods and services. This measure increases government spending efficiency, especially in public procurement and government contracts. A coloured CBDC is a component of the money supply, as well as common CBDC or cash, and it is used in settlements alongside them.⁸

⁸ The main directions of the unified state monetary policy for 2023 and the period 2024 and 2025. The Bank of Russia. URL: https://www.consultant.ru/document/cons_doc_LAW_430425/ (accessed on 18.07.2025).

Using the CBDC system in the state metaverse has a number of advantages, combining the capabilities of digital technologies with the financial system (Fig. 3).⁹

Thus, a comparison of the proposed systems based on the criterion of “centralization/decentralization” leads to the following conclusion: the DEFI system provides transparency of operations and relative independence from regulatory authorities, but it carries risks of fraud and vulnerabilities in the blockchain. On the other hand, CBDC provides stability and reliability through government control, but limits user autonomy and market freedom.

The next criterion of comparison is legislative regulation.

⁹ Chernyshova E. Experts assessed the benefits of international settlements in digital rubles. Who can save money on a new form of currency and how? RBC. URL: <https://www.rbc.ru/finances/14/02/2024/65ca2d8f9a794710fcdff4e3> (accessed on 25.07.2025).

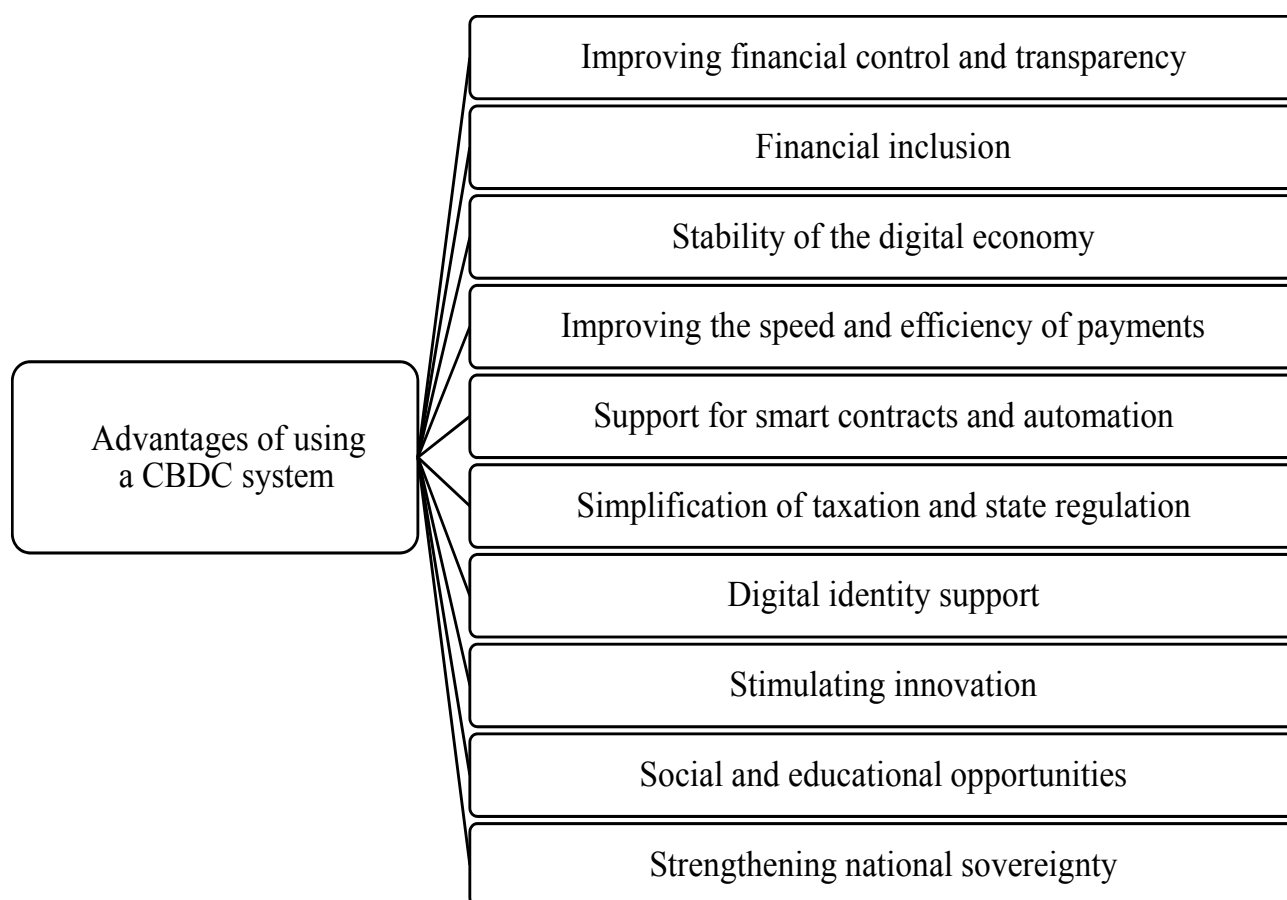


Fig. 3. Advantages of Using the CBDC System in the Financial System of the State Metaverse

Source: Compiled by the authors based on data [19–22].

The DEFI system, which operates either outside government regulation or within insufficiently effective regulation, often ignores tax obligations and international sanctions. Anonymous transactions make it difficult to identify taxpayers, while the absence of government control or its ineffectiveness, and the international nature of the transactions in the system, may lead to problems with compliance with legislation related to money laundering and terrorism financing.¹⁰

According to experts of the Bank of Russia, strengthening the relationship between traditional finance and DEFI protocols without regulatory guarantees can lead to a domino effect on investors around the world, losses of financial intermediaries, uncontrolled move-

ment of market participants into the unregulated segment, and realization of systemic risks for the entire financial market.¹¹

The CBDC system, in turn, is fully regulated by the state, integrated into the country's current financial system, and allows for capital controls, tax collection, and anti-money laundering [5].¹² China is a prime example of such successful work in the field of CBDC regulation [23].

However, there are some significant drawbacks for users: reduced financial freedom due to strict government control and excessive government interference in the economic activities of citizens.

¹⁰ Decentralized Finance. Moscow: Bank of Russia, 2022. 51 p. URL: https://cbr.ru/Content/Document/File/141992/report_07112022.pdf (accessed on 22.06.2025).

¹¹ Decentralized Finance. Moscow: Bank of Russia, 2022. 51 p. URL: https://cbr.ru/Content/Document/File/141992/report_07112022.pdf (accessed on 22.06.2025).

¹² The concept of the digital ruble. Moscow: Bank of Russia, 2021. 30 p. URL: https://cbr.ru/Content/Document/File/120075/concept_08042021.pdf (accessed on 12.07.2025).

Therefore, comparing DEFI and CBDC according to the criterion of “legislative regulation”, we can note that the absence or low level of legislative control in DEFI promotes flexibility and innovation, while making it difficult to comply with legal norms. The total legislative regulation of CBDC simplifies administration, increases user trust, but is perceived as government interference in economic activity and requires significant resources for development of a legal and regulatory infrastructure.

The next criterion for comparison is accessibility and inclusivity.

The DEFI system is open to all internet users, regardless of location, nationality or status; it minimizes barriers to entry into the financial services sector by allowing people without a bank account to use financial instruments. According to experts from the Bank for International Settlements, cross-border transactions are a particularly important aspect of metaverses, as users can potentially be located in different jurisdictions [5].¹³ However, the openness and accessibility of DEFI can create risks of abuse, when, for example, some users may intentionally act to the detriment of the protocol and other users. For example, if a group of individuals simultaneously owns more than 50% of the control tokens of two protocols, the assets of one of them may be fraudulently included in the second protocol (“pumping out the protocol”).¹⁴

The CBDC system loses in this sense, as it is mainly limited to citizens of a certain country and their level of access to banking services, even despite the fact, that due to the ready infrastructure, transparency, and (often) free of charge operations with CBDC, it ensures an increase of financial inclusion and the accessibility of financial services for citizens and businesses by providing them with access to a wider range of services based on CBDC [18, 20].

¹³ Volkova O.V. Economics of the future: metaverses. An economic conversation. URL: <https://econs.online/articles/techno/ekonomika-budushchego-metavselennye/?ysclid=lxeezlm1262032088> (accessed on 22.06.2025).

¹⁴ Decentralized Finance. Moscow: Bank of Russia, 2022. 51 p. URL: https://cbr.ru/Content/Document/File/141992/report_07112022.pdf (accessed on 22.06.2025).

It should also be noted that the diversity of CBDC creates a need for their compatibility in order to facilitate international settlements, particularly in the context of globalization and the development of digital economies. However, differences in standards, legislation, and technological solutions used by different central banks significantly complicate cross-border payment implementation, leading to fragmentation and decreased efficiency of the system [24]. In addition, the use of digital currencies by central banks faces legal and regulatory barriers. The main challenges include ensuring transparency in financial transactions, preventing money laundering and terrorist financing, and protecting personal data. These aspects often conflict with national interests, as each country has its own requirements for regulating financial flows.

To address these issues, it is essential to develop international standards and interaction protocols, as well as universal technical standards and agreed rules for integrating CBDC. It is also necessary to coordinate between countries to establish agreed legal norms for the use of CBDC, develop a global system to unite various CBDC, and ensure seamless conversion between them. Additionally, to strengthen international cooperation while taking into account national specificities is crucial. However, implementing these measures requires significant efforts, time, and consideration of the geopolitical and economic situations in the world, including the impact of economic sanctions imposed by different countries.

Overall, a CBDC has significant potential to simplify cross-border payments. This is due to the fact that traditional international transfers often take up to several days due to the need to go through many intermediaries and correspondent banks, whereas settlements using CBDC can technologically allow for instant and direct transfer of funds [24].

Consequently, according to the criterion of “accessibility and inclusivity”, the DEFI system, despite the lack of consumer protection, expands the international availability of financial services. The CBDC system also expands access

to financial services inside the country, but is usually limited by its jurisdiction.

Technological aspects are also an important issue, for which it is advisable to compare the proposed financial management systems in the state metaverse.

The DEFI system, as mentioned earlier, is based on distributed ledger technology (DLT) or blockchain, which is the most common version, and has both advantages and disadvantages. Blockchain solves a wide range of tasks in the metaverse, such as digital identity and asset management, providing secure management of user data across platforms, and simplifying the transfer of assets between virtual environments while preserving their value and ownership rights.¹⁵ Blockchain also opens up opportunities for decentralized management: with the help of this technology, users can jointly manage virtual spaces and allocate resources. The technology provides a high degree of anonymity.¹⁶ Transparency and low fees attract many enthusiasts and entrepreneurs, but the specifics of the interfaces and other technical difficulties of using the technology reduce its widespread use. However, in general, the DEFI system demonstrates a high potential for the development of innovative technologies.

The CBDC system utilizes traditional banking technologies and the infrastructure of central banks, ensuring stable network operations and low transaction fees. At the same time, it is possible to integrate with existing banking systems. Due to its simplicity and clarity, digital money is an attractive alternative for most citizens, contributing to the widespread adoption of the technology among the general public.

Therefore, according to the criteria of comparison “technological aspects” it can be concluded that the DEFI system has a high poten-

tial for developing innovative technologies, but it faces problems with productivity and sustainability. The CBDC system, on the other hand, has high reliability and compatibility with traditional financial institutions, but it is less open to technological experimentation.

Inflation control and monetary policy are the next criteria for comparison.

The system based on decentralized finance is largely independent of government policy and subject to fluctuations in the value of cryptocurrencies and market factors.¹⁷ At the same time, insufficient control over the money supply can lead to hyperinflation or deflation. Researchers argue that the transition to a fully decentralized financial system is questionable due to states’ desire to control cash flows [25].

At the same time, when using the CBDC system, the money supply is controlled by the central bank, which makes it possible to regulate inflation and maintain the stability of the national currency. The state controls the issuance and circulation of CBDC, which, on the one hand, gives it the opportunity to implement an effective monetary policy, and, on the other hand, reduces the possibility of influencing the market by other participants.

Consequently, a comparison of DEFI and CBDC systems based on the criterion of “inflation control and monetary policy” shows that DEFI promotes the development of free markets and reduces state influence on the economy, but also causes price instability and risks of inflation, whereas, the CBDC system provides economic stability and confidence in the currency, while reducing the ability of independent market participants to influence it.

The next criterion is the security of transactions. Security in the metaverse must be ensured in two different directions: data security and software security [4].

According to experts, the metaverse, which is built on distributed ledger technology, is considered as a secure environment for introducing

¹⁵ Ghatak A. Worldline Shaping the Future of Payments in the Metaverse and Beyond. DQ India. URL: <https://www.dqindia.com/interview/worldline-shaping-the-future-of-payments-in-the-metaverse-and-beyond-4755194> (accessed on 15.08.2025).

¹⁶ Gaurav K. The Metaverse and Blockchain Technology: What the Future Holds. Open Source. URL: <https://www.opensourceforu.com/2024/06/the-metaverse-and-blockchain-technology-what-the-future-holds/> (accessed on 15.08.2025).

¹⁷ Volkova O.V. Economics of the future: metaverses. An economic conversation. URL: <https://econs.online/articles/techno/ekonomika-budushchego-metavselennyye/?ysclid=lxeezlm1262032088> (accessed on 22.06.2025).

digital technologies and expanding the range of services beyond traditional online platforms. Decentralized systems securely and transparently store and manage data. Digital ledgers like the blockchain record all system transactions. After being added to the blockchain and confirmed by the nodes, the data cannot be changed or deleted [26]. The blockchain protects confidential data using a consensus mechanism that allows you to change stored data only with the consent of all nodes participating in the blockchain [4, 27]. This protects the integrity and immutability of the data. Therefore, in the blockchain network, users can safely make transactions with virtual goods, virtual real estate, virtual currency and digital money online [16].

The concept of decentralized identity, when used in conjunction with Web3, by attaching information to digital wallets, makes it possible to eliminate fake accounts, spam and bots that currently undermine people's trust in the Internet. This, in turn, helps to reduce cybercrime and financial fraud in the network, providing users with a greater sense of security and convenience [28].

At the same time, the DEFI system is based on open-source and publicly available blockchain technology, which makes it susceptible to hacking and programming errors. While transparency of transactions is undoubtedly an advantage, inadequate verification of contracts can result in significant asset losses. The current level of self-regulation in these systems does not ensure adequate risk management.¹⁸

The CBDC system ensures high transaction security and data security through centralized management and the use of proven infrastructure solutions. Government support minimizes the risks of hacking and fraud. At the same time, the novelty of the CBDC is that it provides access to completely secure assets that allow for large-scale operations without any additional encumbrances, guarantees and costs [18].

¹⁸ Decentralized Finance. Moscow: Bank of Russia, 2022. 51 p. URL: https://cbr.ru/Content/Document/File/141992/report_07112022.pdf (accessed on 22.06.2025).

CBDC's technical support makes it possible to reduce and/or eliminate a significant number of user risks. A CBDC (unlike cryptocurrency, for which the situation may vary) has the status of a legal tender [19].¹⁹

However, the centralized structure of a CBDC creates a single point of failure, making it susceptible to large-scale attacks. Additionally, data leaks can occur, as all transactions are stored in a single location. To mitigate these risks, governments should invest in developing innovative protection technologies and continuously update security systems to prevent cyber threats associated with the use of digital currencies [19].

Thus, comparing DEFI and CBDC systems in terms of "transaction security", we can see that each has its own advantages and disadvantages, due to the different technological foundations of these systems. Despite the claimed security, both systems still face the risk of cyber attacks.

Another criterion for comparison is the scalability and performance of the system. Despite its international nature and extensive cross-border capabilities, the DEFI system loses significantly, as modern blockchains have limitations on the number of transactions processed per second, which slow down the processing of large volume of payments and increase fees. Network congestion (limited bandwidth leading to delays and increased transaction costs), or, conversely, underloading due to lack of a critical mass of users (small number of nodes), leads to weakened security.²⁰ Therefore, this may become an obstacle to widespread adoption and reduce efficiency as transactions increase.

Bank of Russia experts have noted that possible failures in the infrastructure during mass (algorithmic) settlement transactions due to

¹⁹ Central bank digital currency. EDPS TechDispatch. European data protection supervisor. URL: https://www.edps.europa.eu/data-protection/our-work/publications/techdispatch/2023-03-29-techdispatch-12023-central-bank-digital-currency_en (accessed on 10.08.2025).

²⁰ Decentralized Finance. Moscow: Bank of Russia, 2022. 51 p. URL: https://cbr.ru/Content/Document/File/141992/report_07112022.pdf (accessed on 22.06.2025).

abnormal operation of large DEFI solutions or limited capacity could become a serious issue.²¹

In turn, in the CBDC system, central banks can create specialized high-performance solutions that ensure fast processing of a large number of transactions, reducing network load and increasing user convenience. However, this scalability is usually limited to a single state.

Therefore, comparing DEFI and CBDC according to the criterion of “scalability and system performance”, we can note the low degree of scalability of the CBDC system and the low level of performance and the possibility of failures of the DEFI system.

The next sign of comparing the principles of organization and functioning of financial systems in metaverses based on DEFI or CBDC is political neutrality. From this point of view, DEFI is in a better position because it is less dependent on government regulations (or even independent from them), which attracts foreign users and projects and potentially strengthens international cooperation and diversification of the economy. In contrast, CBDC, as a project of a central bank, is directly affected by the state. Any political decisions directly affect its functionality. According to experts, this causes a low level of trust in CBDC on the part of users [29].

Therefore, a comparison based on “political neutrality” demonstrates the advantages of the DEFI system over the CBDC system as the most free from the influence of political decisions.

It is also worth noting such features of comparison as anonymity and confidentiality. In this case, we can note that the DEFI system is characterized by a high degree of confidentiality and anonymity, attracting both ordinary users and intruders. This creates both privileges for users and risks to the security of the system [16].

In contrast, the CBDC system has a direct connection with the government and regulatory structures, which may cause distrust on the part of some users and organizations that fear government interference in private affairs.

Strict state control allows for increased security, but potentially limits privacy [21].

Thus, according to the criterion of “anonymity and confidentiality”, the DEFI system wins over the CBDC system, which has centralized control from the state. However, the high degree of confidentiality in the DEFI system involves many risks, as it attracts fraudsters and violators of tax and AML legislation, which was discussed above as part of a comparative analysis based on the criterion of “transaction security”.

In modern conditions of universal striving for sustainable development, it is also important to note such features for comparison as energy consumption and environmental friendliness. Decentralized finance tends to operate on blockchain platforms, such as Ethereum, which utilize various consensus mechanisms. Many blockchains, for example those based on the Proof-of-Work (PoW) algorithm, consume significant amounts of energy [27]. The high energy consumption of the blockchain has a negative impact on the environment due to significant carbon emissions associated with the use of non-renewable energy sources for mining [6]. However, the transition to more energy efficient mechanisms such as Proof-of-Stake (PoS) reduces energy consumption. In the meantime, decentralization requires maintaining multiple nodes, which also increases the overall energy consumption of the system.

The metaverse can positively impact environmental sustainability by reducing CO₂ emissions through telepresence, reducing energy consumption and waste through augmented reality features. However, the use of Industry 5.0 technologies, AI training and cloud gaming will increase greenhouse gas emissions, and the growth of electronic waste will lead to soil and water pollution [4].

In turn, central bank digital currencies are being developed to minimize energy costs. They often work on existing banking technologies where there is no need for energy-intensive consensus mechanisms, making CBDC more energy efficient than DEFI. Because of its low

²¹ Decentralized Finance. Moscow: Bank of Russia, 2022. 51 p. URL: https://cbr.ru/Content/Document/File/141992/report_07112022.pdf (accessed on 22.06.2025).

energy consumption and increased centralization, CBDC systems are less harmful to the environment. Central banks often use energy-efficient technologies and can regulate the use of sustainable energy sources in developing and maintaining CBDC. Some experts are investigating the environmental risks of digital currency circulation, while considering the volume of electricity consumption and the possibility of switching to renewable energy sources [22]. Using centralized CBDC-based solutions can reduce energy costs and minimize the carbon footprint.

From the above, we can conclude that, according to the criteria of comparison “energy consumption and environmental friendliness”, CBDC surpasses DEFI due to its centralized architecture and the lack of need for energy-intensive consensus mechanisms. Despite its decentralization, DEFI is still less effective in terms of environmental sustainability, but the technology is gradually improving this situation.

CONCLUSIONS

According to the analysis, it can be noted that the choice between DEFI and CBDC depends on the following factors:

- The objectives of the state.
- The level of trust in financial institutions.
- Readiness for digital transformation.

From the perspective of the state’s objectives, a CBDC system is suitable for a country that wants to control the financial system and maintain the stability of its national economy. This type of system allows the government to retain control over money creation, payments, and market regulation, which can help prevent the emergence of shadow banking activities and reduce the risks associated with them. Additionally, it enables the implementation of tools for transaction monitoring, increasing transparency in the financial system, and contributing to the effective fight against money laundering and financing of terrorism. The choice of DEFI system is appropriate for a state that is interested in fostering innovation and reducing regulatory burden, as decentraliza-

tion reduces reliance on traditional financial institutions and enhances the accessibility of financial services to users. This system enables the creation of a competitive marketplace among financial service providers, promoting the growth of startups and innovative solutions, while also enhancing economic freedom and minimizing bureaucracy.

From the perspective of the level of trust in financial institutions, choosing a CBDC system would be appropriate if trust in traditional banks is low. In this situation, introducing a CBDC would allow the government to rebuild trust by enhancing the transparency of transactions and reducing the risks associated with the banking system. Additionally, central banks could respond more swiftly to crisis situations thanks to centralized control over the system. Choosing a DEFI-based system would be the right choice when a high level of distrust in government agencies and the central banks makes decentralization an attractive alternative. Users prefer independent platforms that protect their assets and privacy, and the possibility of circumventing government regulation and control is attractive to those who seek to avoid government interference in their economic activities.

From the perspective of readiness for digital transformation, a CBDC system would be appropriate for countries with a high level of digitalization among the population and infrastructure. The transition to CBDC could accelerate the development of the digital economy, reduce the costs of cash circulation and increase the speed of payments. At the same time, supporting government initiatives to digitize society and businesses can contribute to growth in investments in digital technology infrastructure. The DEFI system would be a suitable choice for countries with a lower level of digitalization and weaker infrastructure, as it can help gradually introduce decentralized finance, stimulating the development of new technologies and creating conditions for competition between traditional and new financial market participants. The lack of a strong attachment to the current banking system can facilitate the adoption of decen-

tralized platforms, allowing users to manage their assets more independently. This can be beneficial for countries that are just beginning to explore the possibilities of digital finance and want to take advantage of the benefits of decentralized systems.

Each option has its own set of advantages and disadvantages. Therefore, it is essential to consider all the factors before making a decision. Based on the analysis, we believe it makes sense formulating recommendations for the implementation of a specific system for organizing the finances of the state metaverse, taking into account the level of economic development and political stability of each country.

For countries with unstable economic or political situation, where it is essential to provide strict control over financial flows, maintain macroeconomic stability, reduce the risk of criminal activity, and comply with legislation, establishing a financial system based on a centralized digital currency (CBDC) in the metaverse looks like the most effective option. This approach would provide maximum protection for the economic interests of the state, increase the efficiency of tax collection, and avoid potential abuses associated with decentralized finance (DEFI). Furthermore, this solution would strengthen the role of the central bank and integrate the new currency with the existing financial mechanisms, significantly reducing risks to the country's financial sector.

For developed countries with strong economies and stable political systems, the use of any of these systems or their combination would be acceptable, depending on the goals pursued. These countries have the necessary resources and infrastructure to support any selected scenario, providing a high level of security and stability essential for effective management of the economic situation.

Emerging economies may prefer to implement DEFI technologies, as they enable the

rapid development of innovative solutions essential for economic growth.

Countries with economies in transition are currently undergoing a shift from a centralized economic system to a market-based economy. These countries may benefit from adopting a hybrid model that combines the elements of DEFI and CBDC. This approach could take advantage of decentralization and innovation, simultaneously providing government support and regulation.

Small island states or regions with small population could also effectively utilize both approaches simultaneously to create a hybrid system that combines the security and control of CBDC with the flexibility and innovation of DEFI.

In general, hybrid systems that combine decentralization and centralized supervision have the greatest potential to improve state metaverse management efficiency. Decentralized systems as a source of innovation and inclusion and centralized digital currencies as a means of managing and ensuring legal certainty complement each other in an architecture that is consistent with the nature of public sector metaverse finance. This architecture relies on immutable ledgers and blockchains, smart contracts, colored budget funds, decentralized identities, and legal oracles that effectively integrate transparency, compliance, and auditing into its structure and processes.

A comparison of DEFI and CBDC demonstrates that the correct formulation of the question is not an "either-or" choice, but rather a range of architectural combinations and areas of application on the one hand, and specific conditions of each country and its economic goals on the other hand. The main thing here is to consider the balance between centralization and decentralization, regulation and freedom, security and innovation.

ACKNOWLEDGEMENTS

The study was carried out with the support of the Financial University under the Government of the Russian Federation under the state assignment. Financial University under the Government of the Russian Federation, Moscow, Russian Federation.

REFERENCES

1. Segal A., Savchenko A. Metaverse — how is it in Russian? About the construction of the Russian sector of the metaverse. *Iskusstvennye obshchestva = Artificial Societies*. 2021;16(4):13-15. (In Russ.). DOI: 10.18254/S207751800017910-0
2. Alabina T.A., Dzangieva H.S., Yushkovskaya A.A. The metaverse as a global economic trend. *Ekonomika. Professiya. Biznes = Economics. Profession. Business*. 2022;(1):5-12. (In Russ.). DOI: 10.14258/epb202201
3. Altynov Yu. A. Prospects for the use of metaverse tools in the field of public finance in Russia. *MIR (Modernizatsiya. Innovatsii. Razvitie) = MIR (Modernization. Innovation. Research)*. 2023;14(3):416-433. (In Russ.). DOI: 10.18184/2079-4665.2023.14.3.416-433
4. Boopathy P., Deepa N., Maddikunta P.R.K., et al. The metaverse for Industry 5.0 in NextG communications: Potential applications and future challenges. *IEEE Open Journal of the Computer Society*. 2024;6:4-24. DOI: 10.1109/OJCS.2024.3497335
5. Cantú C., Franco C., Frost J. The economic implications of services in the metaverse. *BIS Papers*. 2024;(144):83-118. DOI: 10.1007/978-3-031-54802-4_6
6. Kontogianni E., Anthopoulos L. G. Exploring the business ecosystem and the value sources of metaverse. *Sustainability*. 2024;16(8):3134. DOI: 10.3390/su16083134
7. Uddin M., Obaidat M., Manickam S., et al Exploring the convergence of metaverse, blockchain, and AI: A comprehensive survey of enabling technologies, applications, challenges, and future directions. *WIREs Data Mining and Knowledge Discovery*. 2024;14(6): e1556. DOI: 10.1002/widm.1556
8. Malsagova R. G., Efremova S.A. Study of theoretical and methodological foundations of functioning of the financial metauniverse model in the public sector. *Ekonomika stroitel'stva = Economics of Construction*. 2025;(8):437-441. (In Russ.).
9. Zhao Y., Jiang J., Chen Y., et al. Metaverse: Perspectives from graphics, interactions and visualization. *Visual Informatics*. 2022;6(1):56-67. DOI: 10.1016/j.visinf.2022.03.002
10. Malsagova R. G. Problems and prospects of using artificial intelligence, Big Data and blockchain technologies in Russian agriculture. *Mezhdunarodnyi sel'skokhozyaistvennyi zhurnal = International Agricultural Journal*. 2025;(2):220-224. (In Russ.). DOI: 10.55186/25876740_2025_68_2_220
11. Malsagova R. G. The metaverse and DeFi: A technological breakthrough between monopoly and decentralization. *Innovatsii i investitsii = Innovation & Investment*. 2025;(9):570-574. (In Russ.).
12. Malsagova R. G. Seoul's metaverse: Hallyu, Cyber-utopia or the path to Society 5.0 in South Korea? *Innovatsii i investitsii = Innovation & Investment*. 2025;(8):189-193. (In Russ.).
13. Malsagova R. G. The development of digitalization processes in Southeast Asia on the example of Singapore. *Innovatsii i investitsii = Innovation & Investment*. 2024;(12):54-62. (In Russ.).
14. Malsagova R. G., Efremova S. A., Dugaev M. V. Metaverses as the apogee of digitalization of the socio-economic sphere of the European Union on the example of Spain. *Ekonomika stroitel'stva = Economics of Construction*. 2024;(10):13-18. (In Russ.).
15. Wang F.-Y., Qin R., Wang X., Hu B. MetaSocieties in metaverse: MetaEconomics and MetaManagement for MetaEnterprises and MetaCities. *IEEE Transactions on Computational Social Systems*. 2022;9(1):2-7. DOI: 10.1109/TCSS.2022.3145165
16. Murala D. K., Panda S. K., Dash S. P., eds. Metaverse and blockchain use cases and applications. Boca Raton, FL: Auerbach Publications; 2025. 353 p.
17. Ivanujenko A. B. Digital monetary resources of Russia (digital ruble) as a means of distribution in the financial system: Legal aspects of possible application. *Teoreticheskaya i prikladnaya yurisprudentsiya = Theoretical and Applied Law*. 2024;(1):23-36. (In Russ.). DOI: 10.22394/2686-7834-2024-1-23-36
18. Bidder R., Jackson T., Rottner M. CBDC and banks: Disintermediating fast and slow. Deutsche Bundesbank. Discussion Paper. 2024;(15). URL: <https://www.bundesbank.de/resource/blob/931090/be2be8b2c5324245e4147d6306689312/472B63F073F071307366337C94F8C870/2024-04-29-dkp-15-data.pdf> (accessed on 30.07.2025).

19. Bilotta N., Botti F., eds. The near future of central bank digital currencies: Risks and opportunities for the global economy and society. Bern: Peter Lang AG, International Academic Publishers; 2021. 204 p.
20. Carapella F., Chang J.-W., Infante S., et al. Financial stability implications of CBDC. Finance and Economics Discussion Series. 2024;(021). URL: <https://www.federalreserve.gov/econres/feds/files/2024021pap.pdf>
21. Vershinina O.V., Labusheva Ja.G., Sultaniev I.S. Analysis of the opportunities and risks of introducing digital currencies of central banks on the example of the “digital ruble”. *Vestnik Rossiiskogo novogo universiteta. Seriya: Chelovek i obshchestvo = Vestnik of Russian New University. Series: Man and Society*. 2021;(1):51-60. (In Russ.). DOI: 10.25586/RNU.V9276.21.01.P.051
22. Arvidsson N., Harahap F., Urban F., Nurdawati A. Potential climate impact of retail CBDC models. Sveriges Riksbank Working Paper Series. 2024;(437). URL: <https://www.riksbank.se/globalassets/media/rapporter/working-papers/2024/no.-437-potential-climate-impact-of-retail-cbdc-models.pdf>
23. Jingwen W. The digital yuan — an official digital currency of China: A legal nature and development trends. *Elektronnoe prilozhenie k “Rossiiskomu yuridicheskomu zhurnalu” = Electronic Supplement to “Russian Juridical Journal”*. 2022;(1):72-79. (In Russ.). DOI: 10.34076/22196838_2022_1_72
24. Niyazbekova Sh.U. Increasing the availability of financial services and optimizing cross-border payments with the launch of the digital ruble in the financial market. *Finansovye rynki i banki = Financial Markets and Banks*. 2024;(5):285-289. (In Russ.).
25. Zverkova T.N. Convergence of DeFi and traditional banking: Potential, limitations and transformation scenarios. *Finance: Theory and Practice*. 2026;30(1):200-213. DOI: 10.26794/2587-5671-2026-30-1-200-213
26. Leng J., Chen Z., Huang Z., et al. Secure blockchain middleware for decentralized IIoT towards Industry 5.0: A review of architecture, enablers, challenges, and directions. *Machines*. 2022;10(10):858. DOI: 10.3390/machines10100858
27. Xu L.D., Lu Y., Li L. Embedding blockchain technology into IoT for security: A survey. *IEEE Internet of Things Journal*. 2021;8(13):10452-10473. DOI: 10.1109/JIOT.2021.3060508
28. John J. Decentralised finance: Usecases & risks for mass adoption. Berlin: dGen; 2020. 55 p. URL: https://uploads-ssl.webflow.com/60201c98c0783465694de095/602d76364a228a2f7c9d33a8_Decentralised%20Finance.pdf
29. Abramova M.A., Kunitsyna N.N., Dyudikova E.I. Prospects for the incorporation of the digital ruble into Russia’s monetary turnover: Attributes and principles for developing a trusted digital environment. *Finance: Theory and Practice*. 2023;27(4):6-16. DOI: 10.26794/2587-5671-2023-27-4-6-16

ABOUT THE AUTHORS



Radima G. Malsagova — Cand. Sci. (Econ.), Assoc. Prof., Institute of Digital Finance, Financial University under the Government of the Russian Federation, Moscow, Russian Federation

<https://orcid.org/0000-0002-8004-178X>

Corresponding author:

RGMalsagova@fa.ru



Svetlana A. Efremova — Cand. Sci. (Ped.), Assoc. Prof., Institute of Digital Finance, Financial University under the Government of the Russian Federation, Moscow, Russian Federation

<https://orcid.org/0009-0009-9374-7608>

SAEfremova@fa.ru

Conflicts of Interest Statement: The authors have no conflicts of interest to declare.

The article was submitted on 03.09.2025; revised on 15.10.2025 and accepted for publication on 27.10.2025.

The authors read and approved the final version of the manuscript.