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LEGAL REGULATION OF THE MECHANISM OF APPLYING BLOCKCHAIN TECHNOLOGY IN THE MODERN CONDITIONS OF DIGITALIZATION OF THE ECONOMY OF UKRAINE

ABSTRACT

The purpose of the article is to study the theoretical foundations and practical aspects of legal regulation of the mechanism of applying blockchain technology in the modern conditions of digitalization of the economy of Ukraine. The results of the conducted research give reasons to state that the legal regulation of the mechanism of applying blockchain technology in the modern conditions of digitalization of the economy of Ukraine is too weak and needs to be revised and improved. The article defines the essence of blockchain technology, which is understood as a decentralized database formed by participants and provides conditions for preventing actions related to the falsification of data due to their chronological recording and public confirmation by all participants of the transaction network. On the basis of a detailed study of the outlined issues, significant problematic aspects of the use of blockchain technology at the global, national and regional levels have been identified, the most acute of which at the current stage is the imperfection of the legal mechanism of applying blockchain technology in the modern conditions of digitalization of the economy. The results of empirical studies have proved the dependence of the development of blockchain technology on the level of development of the country and the state of the digitalization process of the national economy. It has been established that the highest share of the use of blockchain technologies in today's conditions is observed in the USA (40%) and Great Britain (17%). In order to solve problematic issues, the main areas of improving the legal regulation of the mechanism of applying blockchain technology in Ukraine are proposed, among which the need for the development and adoption of the Law of Ukraine "On Virtual Assets" is justified, as well as the need for the implementation of international and European law in the field of digitalization and regulation of the development of digital technologies in the national legislation of Ukraine.

Keywords: legal regulation, blockchain, digitalization, innovative technologies, national economy, digital assets, databases, information support

JEL Classification: E44, G01, G18, L86

INTRODUCTION

The strengthening of the globalization processes necessitates the reformatting of the existing world economic order, which significantly affects the processes of transformation of international and national economies, the existing state of which is characterized by the intensification of the digitalization phenomenon and its paradigmatic progress in attracting innovations. It is obvious that the digitalization of the economy is a conditioned requirement of modernity, taking into account the intensification of the development of information technologies. On the other hand, the development of the digital economy requires the formation of effective economic and legal mechanisms for achieving the desired results, which requires a qualitatively new approach to the study of the outlined issues. At the current stage, the process of digitalization of the economy is built on four main drivers of its transformational restructuring, including (1) the Internet of Things; (2) big data analysis technologies; (3) artificial intelligence; (4) blockchain technologies, which together with quantum computing and robotics have a sig-

nificant impact on business models at various levels of economic development and require effective economic and legal regulation at the global, national and regional levels. The existing challenges and dangers of modern times have significantly actualized the problem of improving the efficiency of access to financial services, strengthening competition in the market of payment services, and intensified the process of finding additional incentives to attract investments. Taking into account the outlined trends, the issue of legal regulation of the mechanism of applying blockchain technology in the modern conditions of the digitalization of the economy of Ukraine acquires special acuteness and urgency and requires in-depth study.

LITERATURE REVIEW

The intensification of the processes of information and technological progress, and the development of the latest technologies and tools on a global scale caused the widespread of IT technologies in various spheres of the socio-economic life of the country. The problems of involving innovative developments in the country's economy have become particularly acute since the digital transformations have spread to processes and phenomena of an economic nature. Under such circumstances, the digitalization of the economy moves to the forefront, and the problems of its development are the subject of active scientific discussions. At the same time, in today's conditions, the issues of researching blockchain technology, the main aspects of its application and legal regulation are gaining particular relevance. Considering the innovative nature of this scientific category, there are different scientific approaches to the interpretation of its essence. In particular, S. Lehomiova and T. Kochura [1, p. 260] consider the blockchain as a distributed database consisting of a kind of chain of blocks, in which the block storage devices are not connected to a central server, and the database makes it possible to track and control the authenticity of the transactions taking place without the supervision of the relevant financial regulators. At the same time, scientists insist that the blockchain is a decentralized database formed by participants and creates conditions under which it is impossible to commit actions related to data falsification due to their chronological record and public confirmation by all participants of the transaction network, and the main feature of the blockchain is highlighted in the application of mathematical calculation algorithms and provision of conditions under which the influence of the human factor in decision-making by the system is completely excluded.

V. Vorobets [2, p. 49] considers the blockchain to be a decentralized system of accounting and data storage, which widely extends to the financial sphere of the national economy and forms the basis for the functioning of cryptocurrencies. However, according to the scientist, with whom we fully agree, in the current conditions of economic development, the economic and legal regulation of this innovative technology is too weak and requires the development and adoption of additional legislative and regulatory acts capable of effectively counteracting internal and external threats without violating at the same time, the interests, rights and obligations of all subjects.

The essence of blockchain technology P. Latkovskiy [3, p. 16–17] interprets from the point of view of the implementation of the data storage mechanism through the growing number of single "blocks" that are interconnected and protected by cryptography, and the spread of the blockchain, according to the scientist, is due to the intensification of the processes of using bitcoin as a means of payment, which is one of the most common cryptocurrencies.

On the other hand, C. Zhou, Y. Li, H. Yu and X. Dong [4] claim that the use of blockchain technology is due to transactions with cryptocurrencies. At the same time, scientists insist that both scientific categories closely interact with each other, and blockchain functions have spread to the field of digitalization of the entire economy.

A similar opinion is held by B. Sakiz and A. Gencer [5], who consider blockchain technologies as a radically innovative way of carrying out transactions using a virtual environment, and the emergence of bitcoin and blockchain is associated with global changes in the world financial system. Z. Mukhammedova [6] and E. Muminova, G. Honkeldiyeva, K. Kyrpayanidi, S. Akhunova and S. Hamdamova [7] fully agree with the position of the scientists, thoroughly researching the basic principles of the blockchain and identifying certain problems of its application in the conditions of digitalization of the economy.

G. Sigley and W. Powell [8] consider blockchain technologies to be a priority direction of the country's development and prove the possibility of their application in all spheres of the economy. However, they believe that the use of blockchain technologies is not clearly regulated at the international level, which creates significant obstacles to their legal regulation at the national and regional levels. The insufficient level of maturity of normative and legal regulation of blockchain technologies is proved by their own empirical studies of Y. Yang, Y. Shi and T. Wang [9], who claim that their feasibility is fully proved by modern requirements, and in the conditions of digitalization of economic processes, blockchain is one of the main tools for achieving the desired effect.

The problems of insufficient legal regulation of blockchain technology in the context of the development of the digital economy were set by G. Shvachych, O. Kholod and V. Busygin [10, p. 47], who established that at this stage there are no standards and legal relations regarding the use of the specified technology. At the same time, scientists believe that there is still no single unified definition of blockchain, and most scientists interpret it as a multifunctional information system designed to record various types of assets.

As for the legal provision of the process of regulating the mechanism of applying blockchain technology in the modern conditions of digitalization of the economy of Ukraine, I. Doronin [11, p. 30] rightly believes that domestic legislation on the regulation of the organizational and legal foundations of the development of the digital economy and innovative technologies does not meet international and European standards and is not able to adequately protect the rights and interests of participants.

I. Abdullaeva, R. Parpieva and N. Norboyeva [12] singled out the main advantages of blockchain technology, among the most important of which are: (1) transparency; (2) anonymity; (3) decentralization and (4) integrity. At the same time, scientists managed to find out that large-scale integration of blockchain at this stage is impossible due to the presence of significant technical, socio-economic, legal and regulatory barriers, however, they investigated its feasibility and effectiveness in the financial and banking sector, in relation to land registration and transactions with real estate, in education and medicine. Moreover, scientists insist that blockchain technologies are able to solve such problems of a financial nature as establishing control over the economy, reducing costs and speeding up international transactions, ensuring transparency in the functioning of the financial system, reducing the level of corruption and increasing public trust in the state and the financial system.

In addition, W. Su [13] proves the need to introduce blockchain technology not only at the global, national, and regional levels, but also convinces of its feasibility at the level of entrepreneurship, because this technology allows for effective risk assessment and risk management. In this context, it becomes obvious that blockchain technologies are an innovative direction of economic development in terms of its digitalization and modernization. Therefore, their research from the point of view of the development of Industry 4.0 and future digital technologies is carried out by M. Javaid, A. Haleem, R.P. Singh, S. Khan, and R. Suman [14], who state that blockchain technologies contribute to increasing the level of security, transparency and data privacy and insist on their feasibility in the activities of small, medium and large businesses because they allow improving the production environment and supply chains. However, as noted by W. Shi and Q. Huang [15], the use of blockchain technologies at the level of entrepreneurship should correlate with the trends of their application at the level of the national economy.

The conducted studies of existing scientific views in the outlined direction allow us to state that blockchain technology is one of the most effective tools that can be used to avoid mediation in transactions, protect information resources, increase the trust of counterparties, and reduce the level of falsification. Therefore, this technology should be actively applied in modern conditions of digitalization of the economy of Ukraine and, at the same time, requires legal regulation at various levels of social relations.

AIMS AND OBJECTIVES

The purpose of the article is to study the theoretical foundations and practical aspects of legal regulation of the mechanism of applying blockchain technology in the modern conditions of digitalization of the economy of Ukraine. Achieving the set goal requires solving the tasks related to clarifying the essence of blockchain technology and identifying problematic aspects of the legal regulation of its application mechanism in the modern conditions of digitalization of the Ukrainian economy; analysis of the current state and trends of legal regulation of the mechanism of applying blockchain technology in the modern conditions of digitalization of the economy of Ukraine, research of features, advantages and disadvantages of blockchain technology, assessment of the state and trends of changes in the multidimensional digitization index in certain countries of the world and in Ukraine; determination of priority directions for the development of blockchain technology in a strategic perspective.

METHODS

The methodological base of the research is built on fundamental scientific developments and general scientific and special methods of economic analysis, in particular, the clarification of the essence of blockchain technology was carried out using the method of synthesis, system analysis, scientific abstraction and observation; applied studies of the main parameters of blockchain technology were conducted on the basis of the method of comparison and statistical analysis; identification

of the problems of legal regulation of the mechanism of applying blockchain technology in modern conditions of digitalization of the economy of Ukraine was carried out using a comparative analysis and a functional-systemic approach; the formulation of conclusions and formation of the results of the conducted research is based on the method of generalization and systematization.

RESULTS

The processes of globalization and intensification of the development of the digital economy increase the value of available information resources, which gradually stimulates the development of digital transformations and causes the start of a new economic system, which significantly depends on the development of digital infrastructure and on the main vectors of global policy in the field of digital transformations. It is obvious that in modern conditions there is a need to process large registers and information systems in which a significant number of transactions are carried out every day, and the need to reduce the costs of processing financial transactions is becoming urgent. Blockchain technology is able to satisfy such requests and is considered an effective tool for achieving the desired effect.

The conducted studies of the main scientific views and approaches in the field of blockchain technologies allow us to single out their certain features and indisputable advantages, the detailed characteristics of which are shown in Figure 1.

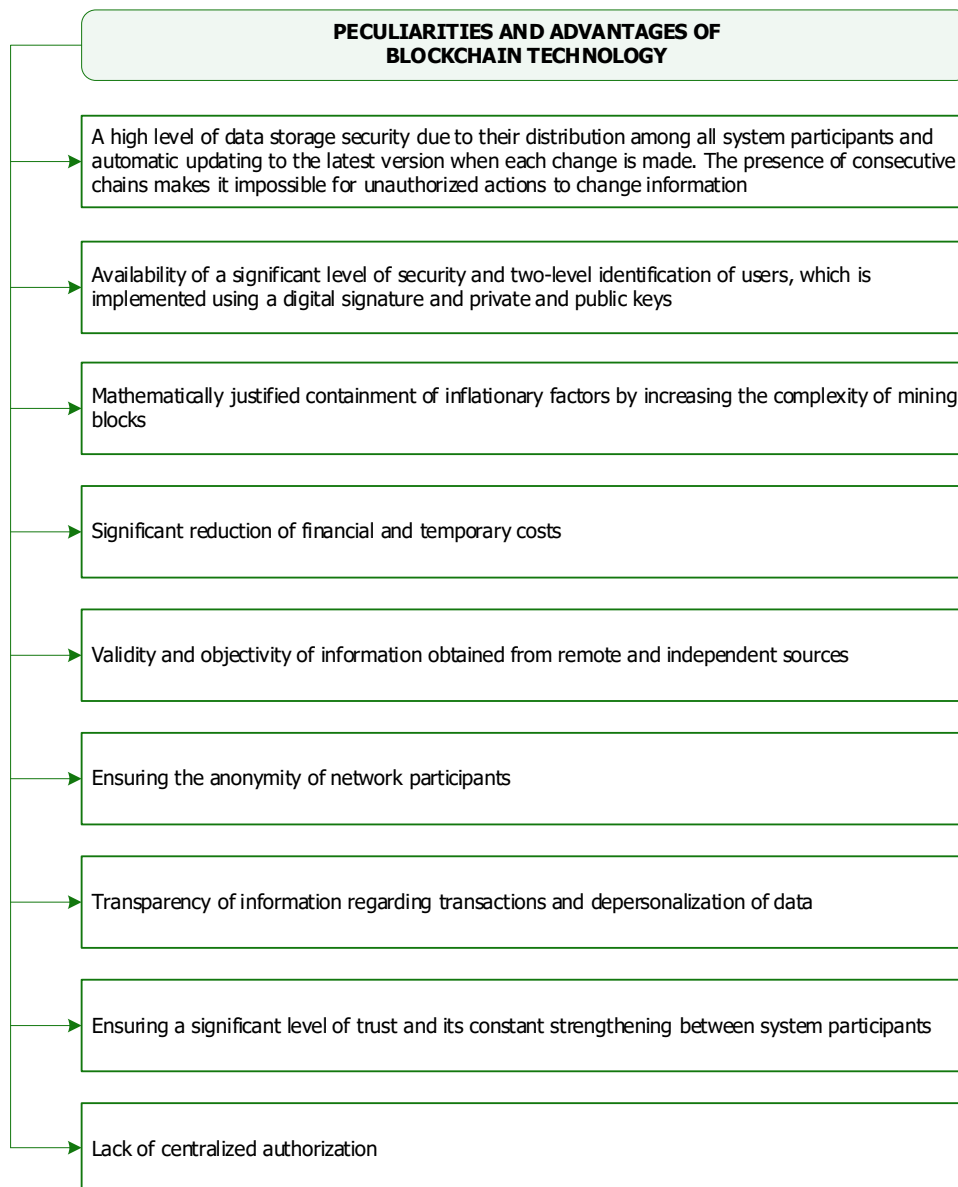


Figure 1. Peculiarities and advantages of blockchain technology.

At the same time, we should note that the most significant advantages of blockchain technology are a high level of security, confidentiality and security of operations carried out in the economy and in the financial sphere, in particular. However, it should be recognized that the use of blockchain technology has a number of disadvantages and problematic aspects, among the most significant of which are:

- an increase in the risks of committing cybercrimes, since the blockchain market is at the stage of formation, and security tools are not always effective, as a result of which there are frequent cases of theft of funds, hacking of crypto exchanges and trading platforms;
- a weak level of normative and legal, as well as legislative regulation of the main aspects of blockchain technology, which leads to a low level of user trust in it;
- lack of transaction cancellation tools after its confirmation by system users;
- the anonymity of transactions causes criminals to create criminal trading platforms;
- lack of a transaction acceleration mechanism due to the need for its confirmation.

The presence or absence of certain problems with the use of blockchain technology in the economy of the countries of the world depends significantly on the level of digitalization in these countries. Conducted research in this direction allows us to identify certain trends regarding the ability of countries to provide access to the worldwide Internet and to information and communication technologies, as well as their introduction into economic processes and other spheres of economy and society. As evidenced by the results of the analysis of the state and trends of changes in the multidimensional digitalization index in individual countries of the world in 2017–2022 (Figure 2), among the countries selected for evaluation, there are those with higher digitalization parameters, in particular in the USA (0.92–0.98), Great Britain (0.80–0.97), Germany (0.78–0.88), Japan (0.80–0.88), Canada (0.78–0.81) and Estonia (0.76–0.83), but there are those in which they are too low, namely in Ukraine (0.22–0.48), Hungary (0.47–0.52), Slovakia (0.46–0.55), Romania (0.43–0.60) and Latvia (0.55–0.59).

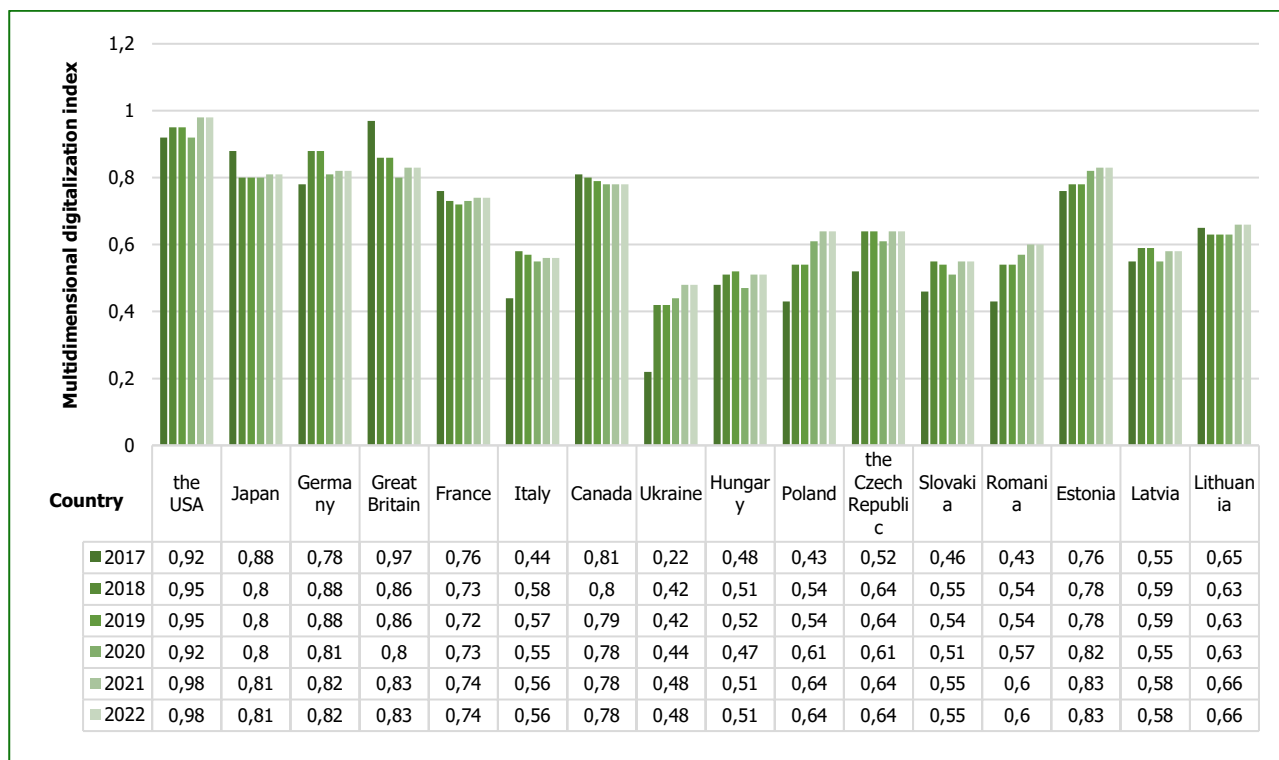


Figure 2. State and trends of changes in the multidimensional digitalization index in individual countries of the world in 2017–2022.
 (Source: calculated on the basis of: [16–21])

The conducted research made it possible to establish that the most critical situation among the selected countries was in Ukraine, where the value of the multidimensional index of digitalization is the lowest throughout the entire analyzed period (Figure 3), which indicates the presence of significant problems of digitalization of the country's economy and the inability of the domestic system to effectively counteract risks and threats.

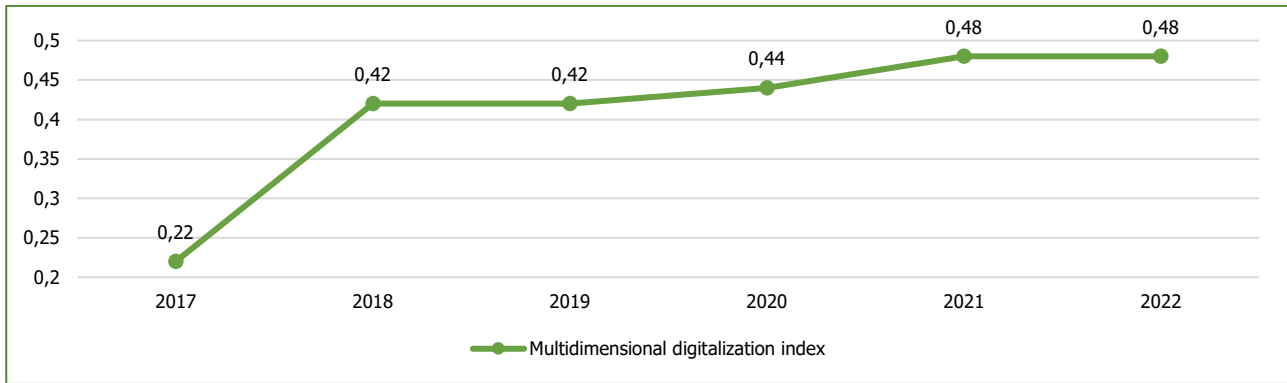


Figure 3. State and trends of changes in the multidimensional digitalization index in Ukraine in 2017–2022. (Source: calculated on the basis of: [16–21])

It becomes obvious that the existing trends of digitalization of the economy in each of the countries are characterized by their ability to ensure a certain level of use of modern information technologies, access to them by the population and skills in their productive use.

In order to identify the common and distinctive features of countries' provision of access to information and communication technologies, communication infrastructure, provision of modern content of digital technologies and strategic priorities for the development of the network economy and such new technological trends as artificial intelligence and the Internet of Things, we consider it expedient to group the selected countries according to the indicator of the multidimensional index of digitalization in 2017 and in 2022. The necessary calculations will be carried out using the technology of cluster analysis based on the k-means method, and the obtained results will be systematized in the Table 1.

Table 1. Grouping of individual countries of the world according to the indicator of the multidimensional digitalization index in 2017 and in 2022. (Source: calculated on the basis of: [16–21])

№	2017			2022		
	Country	Cluster number	Euclidean distance	Country	Cluster number	Euclidean distance
1.	USA	1	0.080	USA	1	0.138
2.	Japan		0.040	Japan		0.032
3.	Germany		0.060	Germany		0.022
4.	Great Britain		0.130	Great Britain		0.012
5.	France		0.080	Canada		0.062
6.	Canada		0.030	Estonia		0.012
7.	Estonia		0.080	France		0.070
8.	Czech Republic	2	0.053	Poland	2	0.030
9.	Latvia		0.023	Czech Republic		0.030
10.	Lithuania		0.077	Lithuania		0.010
11.	Italy	3	0.030	Italy	3	0.013
12.	Ukraine		0.190	Ukraine		0.067
13.	Hungary		0.070	Hungary		0.037
14.	Poland		0.020	Slovakia		0.003
15.	Slovakia		0.05	Romania		0.053
16.	Romania		0.020	Latvia		0.033

The results of the clustering allow us to distinguish three groups of countries that have common signs of digitalization of the economy: highly developed countries, countries with an average level of development, and countries of the transitive type. The first group in 2017 included the USA, Japan, Germany, Great Britain, France, Canada and Estonia, which are characterized as highly developed countries and are able to ensure high rates of digitalization of financial and economic processes at all levels of social relations. The second group consists of the Czech Republic, Latvia and Lithuania, in which the indicators of digitalization of the economy are average, and financial and economic processes are gradually and steadily moving to a new level of functioning. The third group includes Italy, Ukraine, Hungary, Poland, Slovakia and Romania,

where sufficiently low values of the multidimensional index of digitalization were recorded, which requires an increased study of the problems of functioning innovative information and technical systems and the search for ways out of crisis situations arising in the field of digitalization.

Compared to 2017, in 2022 the main trends regarding the grouping of the specified countries have changed somewhat. In particular, France left the first group and moved to the second cluster. Instead, thanks to the improvement of its own indicators of digitalization of the economy, Estonia moved into the first cluster. Poland slightly improved its position, which in 2017 was in the third cluster, and in 2022 managed to take a place in the second. Other countries remained unchanged in the third cluster. It is worth paying special attention to the position of Latvia, which fell from the second cluster to the third in the conditions of 2022, which indicates that over the past five years, this country did not pay due attention to the problems of regulating the digitalization of the economy. In this context, it is important to conduct research on the Global Network Readiness Index (Figure 4), which allows us to identify the main problems of harmonizing the needs of the economy and society with the possibilities of scientific and technical progress in the field of digitalization. Studies of the main trends in the spread of digital technologies in the modern network world reveal that highly developed countries are able to provide more favourable conditions for this than countries of the transitive type.

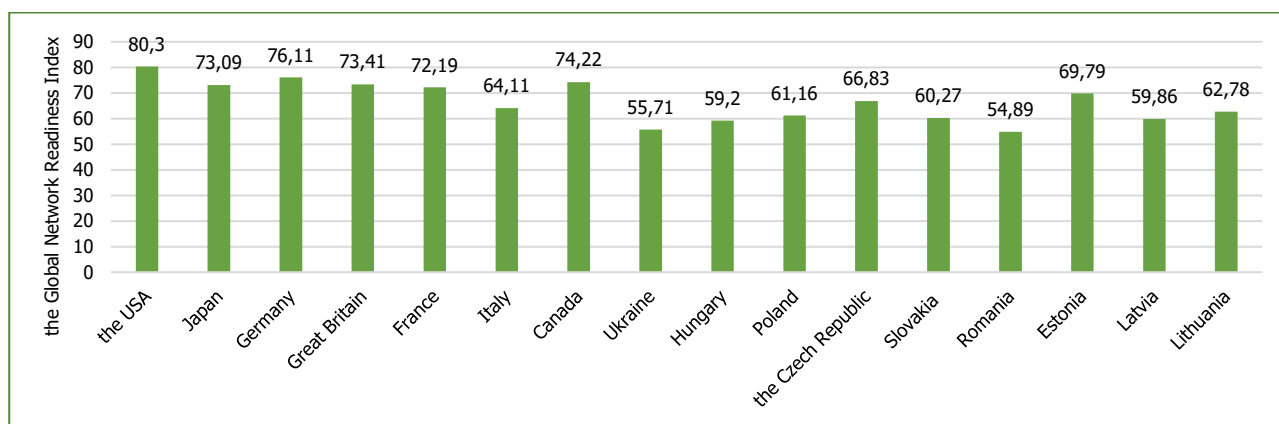


Figure 4. State and trends of changes in the Global Network Readiness Index in individual countries of the world in 2022. (Source: calculated on the basis of: [22, p. 32])

Accordingly, our preliminary research is confirmed by the results of the assessment of the state and trends of changes in the Global Network Readiness Index in certain countries of the world in 2022, which testify to the fact that such countries as the USA, Japan, Germany, Great Britain, Canada and Estonia position higher opportunities for the introduction of modern digital technologies and tools in the economy and society, and their national systems are more ready for the challenges of modernity. It is obvious that in such countries blockchain technologies are introduced much faster and more efficiently than in developing countries, in particular, Ukraine, Hungary, Slovakia, Romania and Latvia. This thesis is confirmed by studies of the structure of the use of blockchain technology in the countries of the world in 2021-2022 (Figure 5), where it is clearly stated that the world leaders are the USA (40%) and Great Britain (17%).

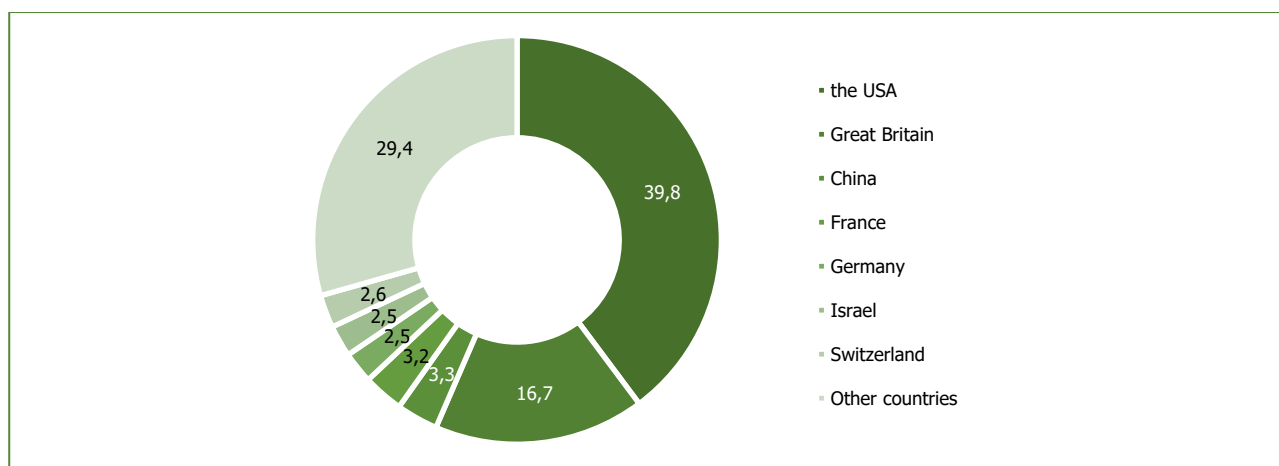


Figure 5. The structure of the use of blockchain technologies in the countries of the world in 2021–2022. (Source: calculated on the basis of: [23–24])

At the same time, the problem of legal regulation of the mechanism of applying blockchain technology in the modern conditions of digitalization of the economy of Ukraine, which affects not only the countries of the transitive type but reaches the global level, is particularly acute. It is necessary to admit that the existing tools of legal regulation of blockchain technology are too weak and imperfect, as a result of which various inconsistencies and conflict situations arise between the participants. It is obvious that solving this problem requires the involvement of the international community because the formation of a set of measures at the level of one country has no meaning.

The problem of resolving problematic aspects regarding the distribution and scope of digital tools in the modern world has become actualized under the influence of the need to recognize blockchain technology, financial documents, smart contracts and blockchain transactions. It is worth noting that certain developments in the outlined direction have already been made, in particular, we should note the significant progress in this issue in the USA, where since 2018 work has been actively carried out on the development of relevant legislative acts and the Law "On Blockchain Technology" has already been adopted, in France the "Regulation on Blockchain" has been adopted, however, the tasks regarding the legal regulation of the implementation of blockchain technology, still remains unresolved, namely: (1) there is no procedure for entering data and transferring them via blockchain; (2) imperfection of the data protection mechanism; (3) lack of a clearly regulated legal algorithm for error correction; (4) lack of dispute resolution procedure; (5) imperfection of the procedure of mutual recognition of documents; (5) absence of a centralized supervisory body; (6) irregularity of the electronic signature recognition procedure.

As for Ukraine, it is worth recognizing the significant weakness and imperfection of domestic legislation regarding the regulation of the mechanism of applying blockchain technology in modern conditions of digitalization. However, certain positive developments have also been made. It is worth noting the successful testing of the electronic signature, which allows its recognition in the countries of the European Union. In addition, in 2022, the National Bank of Ukraine, through the adoption of the resolution of the NBU Board dated 07.07.2022 No. 140 "On recognition of foreign qualified electronic trust services in the banking system of Ukraine and during the transfer of funds" [25] settled the issue of recognition of qualified electronic trust services provided in the European Union and in the banking system of Ukraine during the transfer of funds [26, p. 36–37].

It becomes obvious that the specified normative and legal, as well as legislative acts, are insufficient to solve the problems of using blockchain technology in Ukraine, even with the successful implementation of international and European legal norms [27]. Therefore, we propose to develop and adopt the Law of Ukraine "On Virtual Assets", which will normalize the organizational and legal mechanism for regulating legal relations in the field of using blockchain technology in the modern conditions of digitalization of the national economy.

DISCUSSION

The conducted studies of the problematic aspects of the legal regulation of the mechanism of applying blockchain technology in the modern conditions of digitalization of the economy of Ukraine allow us to reveal that this direction of development of digital tools and their application in international and national economies is innovative and under-researched, and blockchain technologies themselves are at the stage of formation and active development. Therefore, at the current stage, both their advantages and disadvantages are highlighted. The most significant advantages include:

- ensuring a high level of data storage security;
- availability of a significant level of security and two-level identification of users;
- mathematically justified containment of inflationary factors;
- the possibility of significantly reducing financial and temporary costs;
- ensuring the anonymity of network participants.

The most significant disadvantages include:

- increasing risks of committing cybercrimes;
- low level of effectiveness of security tools for protection against unauthorized third-party intervention;
- imperfect normative and legal, as well as legislative regulation of the main aspects of the use of blockchain technology;
- low level of user trust in blockchain technology;
- lack of tools for speeding up and cancelling the transaction after its confirmation by system users.

The presence of disadvantages and problematic issues in the use of blockchain technology in the modern conditions of digitalization of the economy of Ukraine necessitates the search for effective methods to ensure the achievement of the desired indicators and results. In this context, the development and adoption of the Law of Ukraine "On Virtual Assets", as a comprehensive legislative act capable of regulating legal relations in the defined area, becomes particularly relevant. In addition, national legislation needs constant implementation with the norms of international and European law, since the development of blockchain technologies cannot take place only within one country.

CONCLUSIONS

Thus, the results of the study of the legal regulation of the mechanism of applying blockchain technology in the modern conditions of digitalization of the economy of Ukraine give grounds for forming certain conclusions. In particular, on the basis of a comprehensive analysis of the main scientific approaches to determining the essence of blockchain technology, it was established that the majority of domestic and foreign scientists interpret it as a decentralized database that is formed by participants and provides conditions for preventing actions related to falsification of data due to their chronological record and public confirmation by all participants of the transaction network. Significant problems with the use of blockchain technology at the global, national and regional levels have been identified, the most significant of which is the imperfection of the legal mechanism for applying blockchain technology in the modern conditions of digitalization of the economy. The interdependence of the development of blockchain technologies on the level of development of the countries of the world and the digitalization of their national economies has been established, which is confirmed by the activation of their use in countries such as the USA (40%) and Great Britain (17%). Significant advantages of using blockchain technology in the modern conditions of digitalization of the economy are proved, however, some of their disadvantages are also outlined. Directions for improving the legal regulation of the blockchain technology application mechanism in the modern conditions of digitalization of the Ukrainian economy are proposed, among which the need for the development and adoption of the Law of Ukraine "On Virtual Assets" is substantiated, as well as the need to implement international and European law in the field of digitalization and regulation of the development of digital technologies into national legislation of Ukraine.

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ПРАВОВЕ РЕГУЛЮВАННЯ МЕХАНІЗМУ ЗАСТОСУВАННЯ ТЕХНОЛОГІЇ БЛОКЧЕЙН У СУЧАСНИХ УМОВАХ ЦИФРОВІЗАЦІЇ ЕКОНОМІКИ УКРАЇНИ

Метою статті є дослідження теоретичних засад та практичних аспектів правового регулювання механізму застосування технології блокчейн у сучасних умовах цифровізації економіки України. Результати проведеного дослідження дають підстави констатувати, що правове регулювання механізму застосування технології блокчейн у сучасних умовах цифровізації економіки України є надто слабким та потребує перегляду й удосконалення. У статті визначено сутність технології блокчейн, яка ідентифікується як децентралізована база даних, що сформована учасниками та забезпечує умови попередження й унеможливлення вчинення дій щодо фальсифікації даних завдяки їх хронологічному запису та публічному підтвердженню зі сторони всіх членів мережі транзакцій. На підставі детального дослідження окресленої проблематики виявлено вагомні проблемні аспекти використання технології блокчейн на глобальному, національному та регіональному рівнях, найбільш гострою серед яких на сучасному етапі є недосконалість правового механізму застосування технології блокчейн у сучасних умовах цифровізації економіки. Результатами емпіричних досліджень доведено залежність розвитку технології блокчейн від рівня розвитку країни та стану процесу цифровізації національної економіки. Установлено, що найвища питома вага використання технологій блокчейн в умовах сьогодення спостерігається в США (40%) та Великобританії (17%). Із метою вирішення проблемних питань запропоновано основні напрями вдосконалення правового регулювання механізму застосування технології блокчейн в Україні, серед яких обґрунтовано необхідність розроблення й прийняття Закону України «Про віртуальні активи», а також потреба імплементації міжнародного та європейського права у сфері цифровізації й регулювання розвитку цифрових технологій у національне законодавство України.

Ключові слова: правове регулювання, блокчейн, цифровізація, інноваційні технології, національна економіка, цифрові активи, бази даних, інформаційне забезпечення

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