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BLOCKCHAIN TECHNOLOGY AND ITS APPLICATION

Аннотация: *в статье рассмотрены основные принципы функционирования технологии блокчейн, ее плюсы и недостатки. Особое внимание уделено роли блокчейна в развитии информационного общества. Обозначены различные сферы применения данной технологии, а также особенности ее использования.*

Ключевые слова: *блокчейн, информационное общество, цифровая экономика, финансовая технология, смарт-контракты, криптовалюта, майнинг, хэширование.*

Abstract: *the article discusses the basic principles of the operation of Blockchain technology, its advantages and disadvantages. Particular attention is paid to the role of Blockchain in the development of a digital society. Various areas of application of this technology and features of use are shown.*

Keywords: *Blockchain, information society, digital economy, financial technology, smart contracts, cryptocurrency, mining, layered hashing.*

In the modern world, information plays an important role, which is a key factor in the development of mankind. New information and communication technologies are emerging that contribute to the improvement of all spheres of public life, a significant increase in the quality of life.

Blockchain technology, which appeared in the field of cryptocurrencies, but spreading in almost all spheres of human activity, is gaining immense popularity. The

increased interest in this development is explained by the numerous opportunities that open up for various organizations with the use of this technology.

Blockchain is a distributed database in which storage devices are not connected to a single server, so this database is called decentralized. It stores a list of ordered records called blocks, and they are constantly growing and increase the amount of recorded information. The sequence of blocks is distributed between participants using peer-to-peer networks, and a time stamp (hash sum) is included in each block. In the future, chains of these blocks are arranged, the sequence of which is not possible to rearrange, since the system will not accept the chain due to a mismatch between the hash sum and structure.

Several methods of protection are used to protect against timestamp changes, such as Proof-of-Stake (PoS) and Proof-of-Work (PoW).

Based on Blockchain technology, the work of the most common and documented Bitcoin system is built, which is why this process will examine the operation of the system under study.

The creation of new blocks is carried out using mining technology, the process of which is to select a certain value, which allows you to get a hash, the numerical value of which will not exceed a given number – the target level of complexity.

The use of layered hashing implies the presence of a previous hash in each block and its own unique nonce, which makes proof of work possible. Thus, the possibility of changing the contents of a block without changing the hashes of all subsequent blocks is excluded.

The scope of the Blockchain technology does not end with cryptocurrencies, since the functions that this system possesses are numerous. We list some of them: confirmation of the change, storage and recording of data; ensuring transparency between network participants; protection against inconsistent data changes; the ability to exchange data without intermediaries and at no additional cost.

Consider the most significant advantages of Blockchain technology, which make it attractive to the state and business structures.

Firstly, the Blockchain is a secure digital registry, a network of equal nodes without the participation of regulating parties, which stores not databases of property objects, but only transactions on transfer of property rights to objects [2, p. 181].

Secondly, the introduction of Blockchain technology will reduce the cost of controlling the risks associated with security, as well as the costs of maintaining intermediaries. These provisions are confirmed by the conclusions of the analysis of McLagan and Wirex companies, conducted at the operating expenses of 50 banking organizations [3, p. 50–51]:

– a reduction in financial reporting costs of 70% was identified due to increased transparency and optimization of data quality;

– expenses are reduced by 30–50% due to simplification of reconciliation of financial transactions;

– costs for centralized activities are reduced by about half due to the simplification of shared access to customer data;

– expenses for business operations are reduced by 50%.

Thirdly, the Blockchain allows you to speed up any process by replacing numerous coordination models.

Fourthly, the versatility of the Blockchain allows the creation of public databases. Smart contracts are distributed – transactions that are executed automatically if a programmed set of conditions is met.

Consider some of the shortcomings of Blockchain technology from an economic point of view [3, p. 51]:

1. Creating a Blockchain system and introducing it into any structure is very costly, despite saving on costs in the workflow in the future.

2. Blockchain is an expensive technology due to its high volatility, in particular, using the Proof-of-Work consensus algorithm with its transaction complexity.

3. The speed of transfers decreases significantly in the event of a database congestion, so scalability is a serious limitation due to the size of the public Blockchain structure.

4. Blockchain differentiation.

It is also worth highlighting technical shortcomings [3, p. 51]:

1. Impacts at the network level, which include DDoS attacks (Distributed Denial of Service), «Sibyl attack», Eclipse attack, or «information eclipse attack».

2. Impacts at the user level: botnets distributed through droppers are anonymous programs disguised as pirated versions of licensed programs. From the point of view of jurisprudence, this problem is associated with the deanonymization of market participants.

3. Impacts on the integrity of the Blockchain system: «51% attack», Double spending (double spending, implying the successful use of the same funds twice), Selfish mining (user agreement in order to increase their own income, which destroys the concept of a decentralized system).

4. Attacks applicable to all network systems: Phishing and Deface.

There are many examples in the world of both successful implementation of Blockchain technologies and suspension of projects at the testing stage without practical application.

Blockchain technology application in trade finance. Blockchain is of great interest to banks that seek to learn the capabilities of this technology. In 2015, the international consortium R3 was created with the aim of conducting Blockchain trials. In addition, the Bank of Russia, the Bank of England, the International Monetary Fund, the US Federal Reserve System are working on the distributed ledger scheme, and the results are reflected in their reports.

The implementation of the Blockchain in banking has more than a dozen areas, the main of which is trade finance. In some countries, including Russia, experiments were carried out involving the use of Blockchain technology by banking organizations in conducting commercial transactions with a letter of credit.

A number of Russian and foreign banks performed trade transactions using a letter of credit and Blockchain technology as an experiment. For the first time in 2016, the British bank Barclays made settlements on a letter of credit using a Blockchain, which was caused by huge cash and time costs for paper work, sending documents and signing signatures.

For transactions, the Wave platform was used, using the Blockchain. This platform provided all parties to the trade transaction with full visibility of documents, thereby speeding up the transfer of title documents. The issuance and transfer of the letter of credit took place in the SWIFT system, and the original documents were in electronic form on the Blockchain.

So, the Blockchain made it possible to guarantee the security of the transfer of documents without the use of intermediaries in the form of courier companies. The confidence element in this transaction was carried out by Blockchain technology without third-party verification, and the calculations were made not for the standard 7–10 days, but for four hours.

In 2016, Alfa-Bank and S7 Airlines completed a Blockchain letter of credit based on smart contracts. The purpose of interaction between the companies was to test the functioning of smart contracts and their further application to improve the quality of information transfer and optimize business processes [2, p. 186].

The smart contracts used by Alfa Bank were provided by the Ethereum platform, which is called one of the most developed «smart contracts» platforms and the most advanced in the field of Blockchain technology. To maximize the transparency of the operation and reduce the risk of errors in the code, two interconnected smart contracts were used to open a letter of credit and close it.

The entire cycle of operations was carried out automatically by the system, as a result of which the calculation speed was 23 seconds instead of the traditional 14 days.

Alfa-Bank specialists plan to continue developing automatic execution of smart contracts without including employees of the institution and transferring documents from paper to electronic documents in the transaction process. These steps will reduce transaction prices and increase transaction volume by 10–15 million US dollars.

Raiffeisenbank's team is developing a comprehensive platform for the implementation of transactions in trade finance based on smart contracts. A distinctive feature of this platform will be its modular nature, allowing it to be used to solve other business problems, where standardized conditions are used in transactions [2, p. 187].

Analyzing approaches to the use of Blockchain technology using a letter of credit, it is worth saying that the possibility of using Blockchain is undeniable and multifaceted in its options.

The development of fintech is one of the priorities of the Russian Federation and domestic banks, but this requires highly qualified personnel, a decent technical base and incentive legislation.

Application of Blockchain technology by the Russian government. There are two main elements of a block data storage system that allow us to understand the importance of introducing blockchain in government activities: smart contracts and distributed books. There are two classes of distributed books: those that rely on identifiable third parties and those that try to limit the influence of trusted third parties.

Smart contracts are rules that are created to confirm the integrity of the data storage database and are agreed with all participants in the transaction. Etherium and EOS platforms are currently the most popular smart contract systems.

Consider the world practice of implementing Blockchain technology. In Sweden, the registration of land on the basis of a distributed registry system is successfully functioning. The crypto payment system in China is one of the very first successfully implemented areas using the Blockchain. Cryptocurrency is also used in Canada and is gradually developing due to large financial investments from the state. With this technology, the population of South Korea can vote at various levels of elections. South Africa is working hard on this now and plans to introduce a biometric data system together with the Blockchain to eliminate violations related to the identification of citizens. In Singapore, on the basis of the Blockchain, a business is registered, citizens express their will and a crypto payment system is functioning [1, p. 36].

The United States have achieved particular success in the Blockchain technology implementation industry by sending huge funds to support research and the inclusion of this system in many processes. For example, voting in elections, registration of land, business registration is carried out using the Blockchain. Special types of Blockchain systems are being created for their implementation in the healthcare sector and for use in identifying users.

The implementation of Blockchain technology in the field of public services is currently the best in Estonia. The unified electronic state system for recording medical information about citizens, which is a decentralized, open structure that connects databases and numerous services, is successfully functioning. Thanks to the work of this system, it was possible to minimize the costs of operations with new external users and optimize them, speed up the process of transmitting data on the medical condition of individual citizens, increase the speed of providing medical and insurance services to the population, prevent document fraud and make information databases safe. The introduction of Blockchain technology resulted in the saving of 2% of the country's GDP on paperless work and the creation of more than 4,000 electronic services.

Positive experience in implementing distributed registry systems is already present in Russia. Projects on registration of equity participation, registration of mortgages are implemented in certain regions of Russia, such as the Novgorod region, the Chechen Republic, Moscow and St. Petersburg.

Blockchain increases the availability of information from the registry to the public, while all data is repeatedly checked by independent structures. Information certification using the Blockchain technology will be carried out by Rosreestr, Sberbank, Federal Tax Service and Rostelecom [2, p. 185].

The experiment on the use of Blockchain technology in electronic elections in the Moscow City Duma of the seventh convocation was held on September 8, 2019 in three constituencies. According to the authorities, the results of the use of the Blockchain are positive, but, as many media note, the system was poorly designed from a security point of view, because a fairly simple encryption code was used, as well as a temporary failure of one-hour duration [6].

Blockchain technology can be introduced into the current education system in Russia, replacing the exam by collecting student data throughout the entire period of study and forming a rating based on students' achievements. A similar system is being considered for implementation in state bodies with the aim of motivating public servants and their promotion on the career ladder.

The potential for using blockchain in public administration is huge for Russia. The introduction of technology will significantly accelerate state processes and operations, have a positive effect on the attitude of citizens to government structures, strengthen the country's economy and create a new, better information space. This requires decisive action on the part of the state, for example, consolidation in the strategic documents of the information development of the Russian Federation of accelerated implementation and application of the block.

Other options for application of Blockchain technology. Despite the fact that Blockchain technologies are largely related to finances, the use of a distributed registry system is already used in many other areas.

Blockchain in the field of authorship and ownership is of great benefit. So, thanks to Asccribe service, creative people can confirm authorship and save it using the Blockchain. Unique identifiers are created, digital certificates in digital form for authentication, and then a digital edition is formed. At the same time, there is a mechanism for the transfer of ownership based on legal aspects. Such services include Bitproof, Stampery, Blockai, Verisart, Crypto-Copyrightcrypto-copyright.com, Monegraph, Proof of Existence [5].

The Blockchain company Factom uses distributed registries in the field of database management and analysis in various fields. Many companies, non-profit organizations and governments use Factom services to simplify the procedures for recording and recording various kinds of information about any processes.

The diamond industry is notable for its high crime rate related to gem substitution, money laundering, terrorist financing, etc. But Everledger has created a register with immutable data that can be used to identify diamonds and track all operations with them. Information is available to law enforcement agencies, insurance companies, which increases the security of this industry. In fact, each diamond has a «digital passport» that allows you to trace the transactions associated with it.

A number of companies use Blockchain in identification, as well as in confirming access rights, for example: 2WAY.IO, Guardtime, ShoCard, BlockVerify, Onename, HYPR. Decentralized distributed registries are used to store any data, make

transactions in a safe way, provide access to personal data in accordance with the degree of their openness. Civic, UniquID Wallet, Identifi, Evernym platforms work to improve data security and create Blockchain-based information security technologies.

Chronicled launched a promising platform for the Internet of things, based on Blockchain technology and aimed at developing consumer experience. This project involves the introduction of BLE and NFC microchips into the product to track items and improve interaction with the consumer [5].

The development of software solutions in the field of industrial equipment and systems management is the responsibility of Filament. Chimera service allows you to care for people in need of care, using remote monitoring of a person's physical characteristics.

There is a tendency to develop a system of distributed registries based on constantly growing experience in its use. In the era of the development of a digital society, where information and communication technologies are of great importance for improving the quality and standard of living of the population, Blockchain is becoming especially important.

Blockchain is used in many fields of activity, since it brings great benefits to companies, states, and society. To improve the existing system of distributed registries, it is necessary to invest huge resources to open up even more opportunities for humanity and bring it to a new level of information development.

Список литературы

1. Beskrovny R.D., Trifonova A.K. The use of blockchain technology in Russian public administration // Scientific notes of young researchers. – Moscow, 2018. – No. 2. – p. 33–40.

2. Nurmukhametov R.K., Stepanov P.D., Novikova T.R. Blockchain technology and its application in trade finance // Financial analytics: problems and solutions. – 2018. – T.11, No. 2. – p. 179 – 190.

3. Sokolova T.N., Voloshin I.P., Petrunin I.A. Advantages and disadvantages of blockchain technology // Economic Security and Quality. – Saratov, 2019. – No. 1 (34). – p. 49–52.

4. Sholts Yu., Scheler T., Sokolov Yu. I., Kotsoeva V.S., Elkina A.A. Blockchain technology. Principles of work and application prospects // STAGE: Economic theory, analysis, practice. – Moscow, 2017. – No. 6. – p. 67–76.

5. Mezropyan E. 21 Areas of Blockchain Application Beyond Financial Services [Electronic resource] / E. Mezropyan. – The electron. text. Dan. – New York: 2016. – Access: https://gomedici.com/21-areas-of-blockchain-application-beyond-financial-services/

6. Electronic elections to the Moscow City Duma [Electronic resource] / Official portal of the Mayor and the Government of Moscow – Electr. Text. Dan. – Moscow: 2019. – Access: https://www.mos.ru/city/projects/blockchain-vybory/

7. Магомедов Р.М. Анализ крупнейших компаний мина на рынке IT-услуг / Р.М. Магомедов // Самоуправление. – 2019. – №2. – Т.2. – С. 398–401.

8. Магомедов Р.М. Тенденции использования информационных технологий в логистике // Р.М. Магомедов, С.В. Савина, А. Р. Неврединова // Самоуправление. – 2019. – №3. – Т.2. – С. 190–193.

9. Савина С.В. Технологии BIGDATA и их применение в экономике / С.В. Савина, Т.Л. Фомичева, А.Р. Сальманов // Самоуправление. – 2019. – №3. – Т.2. – С. 282–285.

10. Фомичева Т.Л. Применение методов интеллектуального анализа данных и MACHINE LEARNING в борьбе с мошенничеством в банках // Т.Л. Фомичева, Р.М. Магомедов, Е.А. Викулина // Самоуправление. – 2019. – №3. – Т.2. – С. 337–339.

11. Магомедов Р.М. Программные обеспечения онлайн-сервисов в экономике совместного потребления (sharing economy) / Р.М. Магомедов, С.В. Савина, В.А. Асланян // Евразийский юридический журнал. – 2019. – №1. – С. 410–412.

12. Магомедов Р.М. Анализ природы и перспектив развития рынка ICO / Р.М. Магомедов, С.В. Савина, Е.А. Деменкова // Экономика: вчера, сегодня, завтра. – 2018. – №12А. – С. 262–267.

13. Магомедов Р.М. Робоэдвайзеры как основа финансовых технологий будущего / Р.М. Магомедов, Т.Л. Фомичева, Н.М. Граур // Экономика: вчера, сегодня, завтра. – 2018. – №12А. – С. 256–261.