

Research Paper / Article

DOIs:10.2015/IJIRMF/202212009

The effect of blockchain technology on the Fourth industrial revolution via AI and machine learning

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Abstract: The invention of blockchain technology is one of the most important developments in recent years. At the World Economic Forum in Davos (2015), the following definition was given: blockchain is a new technology that eliminates the need for third parties to ensure trust in financial, contractual, and elective actions. In technical terms, blockchain is the latest development based on a mathematical algorithm, with the help of which a continuous chain of blocks is built between users with encrypted information and a link to the previous block. Due to encryption features, information can only be entered once and cannot be changed in any way. As a result, none of the users are connected to any shared server. However, each user of the system can see the transactions of others in encrypted form, but it cannot affect this in any way.

Key Words: blockchain, industrial revolution, decentralized, modern, role, economy.

1. INTRODUCTION:

We are witnessing the unfolding of the 4th Industrial Revolution. Exponential technologies are emerging, such as Blockchain, the Internet of Things (IoT), Artificial Intelligence (AI), Quantum Computing, and Big Data. The convergence of such technologies is aimed at increasing efficiency, reducing costs and, in many cases, eliminating the need for intermediaries. The combination of Blockchain, AI and IoT is being tested and/or implemented with a significant number of use cases. The ability of the blockchain network to provide tamper-proof and transparent recording of information is great for many industries. Its integration with data obtained from AI and IoT procedures is aimed at achieving efficient and innovative procedures in various sectors.

The fundamentals of these three technologies allow for multiple uses and innovative applications in many industries. The interaction between exponential technologies is an important step towards economic growth through digital transformation. This blog post delves a little deeper into the structure of AI and IoT and demonstrates notable use cases when they converge with blockchain technology.

Currently, AI procedures mostly perform relatively simple tasks like those mentioned above. Enabling machine learning allows you to perform automated actions based on predefined rules and memory. It remains to be seen to what extent AI services can broadly incorporate human intelligence for decision-making. Theoretically, AI applications will be able to improve their intelligence by repeating tasks over time. Thus, these services can significantly replace the need for human intervention. In an ideal scenario, machines will perform actions faster, more efficiently, and smarter than humans.

Blockchain networks act as secure mechanisms in which transactions are stored without a central point of failure. For example, a transaction that blockchains can store is a parcel temperature monitored by an IoT device. In addition, for private blockchain networks, patient health data collected using body signals can be recorded and tracked. This increases the transparency and reliability of patient information in medical institutions, eliminating time-consuming tasks such as searching for medical history and data loss. In addition, the integration of AI procedures can initiate actions such as notifying the doctor and patient of possible medical consequences in accordance with established patterns. The blockchain can transparently record all this information.

Smart contract technology can provide self-executing procedures, which means that blockchain will improve an additional tool in addition to a transparent general registry. In the above example with the delivery package, if the package temperature drops below the set limit, smart contracts can apply a penalty to the default party, for example, to



the truck driver. The parties can pay this fine (or receive a reward for the successful provision of services) using blockchain tokens. IBM and Maersk's TradeLens delivery solution have applied a similar supply chain concept in recent pilot projects.

All 3 technologies contribute from their side, but in order to achieve maximum efficiency and security, integration is inevitable. Even when intelligent data is collected using AI algorithms and combined with reliable data transmitted through IoT sensors, security remains questionable. This is where blockchain comes into the equation as a decentralized, transparent ledger of transactions. Identification of the parties is possible thanks to self-confidence, when users can control what data they share and who has access to it. This feature is necessary for ecosystems that require digital identification and the security of sensitive data, such as the healthcare industry.

The system is made complex, but this is a necessary measure to protect users and prevent hacking. For a better understanding, you can draw an analogy with a standard diary, where entries about what has been done are made sequentially in chronological order. So that no outsider can enter changes in the diary with their own hands, all information is encrypted in a special way, and the cipher is thought out efficiently. If the diary is in one copy, anything can happen to it.

Therefore, for reliability, the diary has many copies, which are stored in different copies. Moreover, when new information is entered in the diary, it is updated on all copies after verification.

There are three types of blockchain technology. The first is a public blockchain. The name speaks for itself. Such a blockchain network is completely open to everyone. No one needs any permission to participate. Any transactional process through such a blockchain is approved for everyone [9].

Everyone has every right to upload the code. Anyone can check their status, as well as make a decision about adding any blocks to the network. In addition, you can easily join the network without any permissions, and the system or servers do not require any maintenance. The public blockchain system is decentralized. This means that transactions are processed by many special participants in the system – miners. As a rule, they can be anyone who has the appropriate hardware and software [13].

Functions of miners in blockchain systems:

- saving copies of data that protect the system from data loss and information forgery;
- confirmation of transactions in the system;
- checking operations performed by other miners.

Usually, the motivation of miners to help blockchain systems register and conduct operations, even though mining equipment is not cheap, is the reward from the system for conducting the transaction, as well as the commissions that transaction participants pay miners for processing the transaction.

The second type is a unified blockchain. It is also called a "consortium blockchain". This is a kind of counterweight to the public blockchain network. This is because people don't get access to the system and any transaction verification process. No one has the right to read this blockchain just like that. A group of leaders manages all processes. With this blockchain network, no one has the right to log in and participate just like that. Before you can participate in any process on this network, you need to get the appropriate permission. Such blockchains are considered exclusive and are created for the development of private businesses [12].

The third type is a private blockchain. The difference between a private and a consortium blockchain is that, unlike the latter, a private blockchain is controlled by only one user [11].

2. MATERIALS:

Analysis of recent publications on the issue and identification of previously unresolved parts of the overall problem. The level of development of the topic in foreign literature is quite high [6]. The main researchers can be considered business consultants Alex and Don Tapscott, reporter Paul Vigna and entrepreneur Andreas Antonopoulos. In the Russian literature, we can highlight the articles of Vitaly Buterin, the developer of the second most popular cryptocurrency – Ethereum [7].

However, in addition to extensive research, there are many statements about technology from various famous people, such as investor Warren Buffett or IT specialist Edward Snowden [4].

Scientist R. Mellon (R. Mellon) believes that blockchain technologies eliminate the need for familiar economic, legal and political institutions, which in the traditional economy serve as intermediaries of trust, since they eliminate the actual need for Trust, replacing it with evidence [2].



3. DISCUSSION:

party;

People of the XXI century are on the threshold of the Fourth Industrial Revolution and we can understand it with our own eyes even now. All previous transformations took place due to the rapid development of scientific and technological progress, and the current case is no exception. The first industrial revolution was associated with the invention of the steam engine, the second – with the invention of electricity, the third – with the beginning of automation and the use of IT systems and other electronics. The fourth one echoes the robotization of industry and the use of cyber-physical systems that use the latest computing resources and certain physical capabilities to improve the efficiency of industry. According to the founder of the World Economic Forum, Klaus Schwab: "we are on the threshold of the 'Fourth Industrial Revolution' not because a certain line of new products is about to appear, but because the combination of different technologies is beginning to generate fundamentally new systems: mobile devices, sensors, nanoprocessors, renewable energy resources, neuroscience, virtual reality, artificial intelligence, etc". [14]. And it is the blockchain technology that can best contribute to this, being used independently and in combination with other technologies.

First, blockchain technology is used independently of the development of other technologies [10; 6]:

- in creating P2P transactions – decentralized relationships on the internet that do not require access to the 3rd

- in creating smart contracts-agreements on the internet that operate on mathematical algorithms and do not require trust between the parties, because if the conditions are not met, the contract will be canceled;

- tracking the necessary information in production;

- simplified systems for registering assets and property rights;

- supply chain management.

All this will undoubtedly bring significant changes to the industrial system.

However, in addition to this, blockchain technology can be called A Meta-Technology, because it affects other technologies and, in turn, consists of several technologies. It challenges other existing software technologies and can replace or supplement existing practices [12; 15]. Therefore, blockchain can be incredibly appropriately used in other fundamental concepts of the "Industrial Revolution 4.0", such as:

- "Internet of things" – a network of physical objects that can interact without human influence. The technology can be used both in everyday life and in business, when providing services remotely and collecting data, obtaining instant market data, implementing self-service, etc. one of the main problems of this technology is the issue of protection against system hacking and data leakage. As soon as there was a stir around the Internet of things, cybersecurity experts began to assess the risks of mindlessly implementing a technology that is almost impossible to control.

The worst-case scenarios were easy to imagine: scammers gain access to your home, car, phone, TV, and medical history. With state support, hackers remotely control planes, highways, voting booths, and power grids. Terrorists kill thousands of victims simply by turning off their pacemakers [14].

And it is the integration of blockchain technology into the Internet of things that will create a new computing segment in which data can be safely processed and analyzed, while remaining private, which will increase security and confidentiality when using devices connected to the Internet [8]. In addition, the interaction between different machines will require certain monetary transactions, where the use of cryptocurrency can be successful;

- "artificial intelligence" is one of the most promising areas of computer innovation technologies, which studies methods for solving problems for which there are no methods of solving or a person is physically unable to solve them. Artificial intelligence systems have capabilities similar to human intelligence in planning, learning, solving logical problems, as well as social skills and creativity. There are developments ranging from driverless cars to technologies that independently develop medicines. Blockchain, in turn, can be used as the basis for decentralized coordination platforms for various components of artificial intelligence, including data, algorithms, and computing power. With the use of blockchain, artificial intelligence could reach a new level of scale and innovation, and all artificial intelligence solutions will become more transparent, understandable and trustworthy [6].;

- "unmanned aerial vehicles" - objects that can include both airplanes and robotic drones that can explore hardto-reach areas when extracting resources, create various structures during construction, water plants and fight pests in agricultural production, safely and quickly transport cargo and at the same time act in cooperation. Technical solutions based on blockchain technology are used to coordinate and navigate unmanned aerial vehicles in urban airspace;

- "robotics" – cyber-physical high-tech objects that can perform certain work instead of a person. The use of such devices in production not only reduces the cost of resources and time, but can also help to perform a variety of complex work: lifting huge loads, working at the micro level where "jewelry" accuracy is required, working in unfriendly, harmful and dangerous places for humans, exploring and analyzing a lot of information, or just working 24/7 without stopping for sleep and lunch break. Such workers will lead to changes in various production processes and



replace people in many industries. And as with unmanned aerial vehicles, some coordination and exchange of information is necessary without the influence of other parties. The blockchain can help you do this.

One of the areas where blockchain can be used is education. One interesting potential is the ability to organize and verify diplomas using the blockchain. Technology can completely eliminate diploma fraud, which is a real problem in many parts of the world. As a rule, universities have administrators who fully or partially deal with employers ' questions about the qualifications of future employees. When using the blockchain, these administrators no longer need to spend time on these interactions, since each diploma is available in an unchanged form on the network [15].

Despite all the advantages of blockchain, the technology is not perfect. Poor scalability is one of the most important problems in the blockchain. Since the advent of bitcoin, it has been the focus of attention of both industry practitioners and scientists.

According to experts [3], it is difficult to create a system on the blockchain that offers users the optimal combination of scalability, decentralization and security. Blockchain systems, in fact, can only have two of the three properties. In each case, you need to make a certain compromise.

As the size of the blockchain increases, so does the load on devices that support the functioning of the system. So, if a few years ago for mining, say, bitcoin, the power of a home computer could be enough, today it has become almost impossible to engage in mining alone due to high prices for powerful equipment and high energy consumption of the process itself.

The average electricity consumption for mining is more than 0.21% of the total amount of energy consumed by the world's population. When compared across countries, more electricity is used to support the Bitcoin blockchain than Austria or Bangladesh consumes.

Electricity costs are unavoidable for the use of blockchain technology and are constantly increasing, so they can prevent the use of blockchain as a data warehouse in the long run.

Worldwide, the amount of energy extracted from renewable or alternative sources does not exceed 20%, so traditional methods of generating electricity still make a significant contribution to environmental pollution. According to various sources, from 20% to 74% of crypto farms operate at the expense of renewable energy sources, but the exact figure is almost impossible to name.

According to the results of an analysis conducted by scientists at the Technical University of Munich, during the production of electricity necessary to support the Bitcoin blockchain for one year, about 22 tons of carbon dioxide enter the atmosphere. However, experts do not call for kicking cryptocurrency mining at all. On the contrary, they hope that bitcoin systems and other digital currencies will help humanity end the era of environmental pollution and take a step towards cleaner energy [3].

So, one of the most pressing issues of implementing blockchain technologies is their poor scalability. The size of blockchains and the capacity to support them are constantly growing, which leads to a large consumption of electricity, which can be compared with the consumption of an entire country. However, on the other hand, the rapid introduction of blockchain technologies can draw even more public attention to the problem of environmental pollution and contribute to the spread of the use and extraction of alternative energy types.

Any network can be attacked, and blockchain is no exception. However, threats to distributed ledgers are different from threats to conventional computer networks.

In banks, the main identifier of a user is their passport or power of attorney on behalf of the organization to manage the account. In extreme cases, you can always come to the branch and put your assets in order. When it comes to blockchain, access to the wallet is provided using a private cryptographic key. The loss of this key is equivalent to the loss of the wallet itself: if the key becomes known to an attacker, they will be able to instantly withdraw your funds to their account, and if it is lost, you will not be able to manage your own crypto assets yourself. To get the key to the wallet, scammers go to a variety of tricks. Here, viruses that can steal the desired file from your computer and phishing sites that mimic the platforms you know are also used. Scammers try to find out the private key itself in any way, or get a username and password to access various services.

Unfortunately, now a relatively small number of people understand how the blockchain works in the full sense. Today, not every ordinary user can even boast of knowledge of Basic Rules for protecting personal data on the internet. If you plan to implement blockchain in a system whose users are broad segments of the population, this can lead to unpleasant consequences. There is a possible solution to the problem of identity theft: link public keys to an individual or legal entity, but this mechanism requires additional costs.

To prevent annoying incidents with the loss of your own funds, you need to follow the rules of digital hygiene. Both private users and business owners need to encrypt files on their computer, avoid using the same passwords, enable two-step authorization, and carefully monitor addresses in the browser. But for businesses related to cryptocurrency payments, these measures will not be enough. Companies also need to use "cold" and "hot" wallets, that is, store only



the data of a "hot" wallet on devices connected to the internet, which contains only a small part of crypto assets. Cold wallet data must always remain on a device that is not connected to any network, so that it cannot be stolen by any online attacks. To ensure protection, you can also use an electronic signature, so that no employee or partner has full access to the wallet without confirmation from other responsible persons. However, even with such measures, there are a number of threats that are worth paying attention to [8; 9].

One of the serious threats to users of blockchain systems is the "51% attack"-this is a potential attack on the blockchain network, as a result of which one organization can control most of the system, which can lead to network failure. In other words, an attacker who owns 51% of the entire public blockchain network will have enough power to intentionally exclude or change the order of transactions. A successful attack will also allow the attacker to prevent some or all transactions and prevent the mining of some or all other miners, which will lead to the so-called mining monopoly [28].

Usually, new popular blockchains become victims of such attacks. Large networks are virtually immune to user attacks. For example, as bitcoin activist Andreas Antonopoulos correctly pointed out, hackers will have to spend about 1 billion to launch such an attack on the Bitcoin blockchain. At the same time, all they will receive is a ten – minute window, during which it will be possible to commit one theft [8].

DDoS attacks are another type of hacker attack, the idea of which is to forward a large number of similar requests to encourage network failures. However, most cryptocurrencies are protected from such attacks, which cannot be said about businesses that use blockchain technologies in their activities.

So, users of blockchain technologies, as well as users of other computer systems, take a certain risk associated with the activities of intruders and hackers. In order not to get into a difficult situation, you need to use secure cryptocurrencies, implement the protection of blockchain systems in business, and adhere to Standard digital hygiene rules.

In the modern world, banks act as intermediaries in the economic environment, controlling and coordinating all the activities of the financial system through their internal registers. Since these registers are not public, they inspire confidence in banks and their often outdated infrastructure. In turn, blockchain technology can change not only the global foreign exchange market, but also the banking industry as a whole, replacing intermediaries with a transparent system that is easy for anyone to access.

What does blockchain technology do? According to Tapscott's son and father. for the first time in history, two parties who do not know or trust each other can directly conduct business and any other business, since identity verification and trust establishment are no longer the right and privilege of a financial intermediary. Moreover, in the context of financial services, the trust protocol takes on a double meaning. The blockchain can also establish trust by verifying the identity and potential of any counterparty using a combination of past transaction history, reputation indicators based on generalized reviews, and other socio-economic indicators [5].

The use of blockchain technologies in the financial sector is associated with an increase in the number of banking operations. Blockchain makes it possible to get rid of centralization and intermediaries, manual data processing, speed up processing, and reduce the costs of banks and users [5; 10].

According to the Harvard Business Review, The European bank Santander would potentially save 220 billion USD a year by using blockchain technology [3]. The use of the technology in the financial sector offers – interbank accounts, credit histories, payment relations, balance sheet coordination, settlements between legal entities and individuals, provision of smart contracts, etc.

The main advantages of blockchain technology in the field of banking and finance are [12]:

- security-the system architecture is based on the blockchain, eliminates the presence of a single information storage point and reduces the need for data transmission through intermediaries;

- transparency-the blockchain standardizes all internal processes and creates a single, common, reliable data source for all network participants. Transparent registers simplify cooperation and reaching agreements between different parties to public relations;

- programming capability-blockchain allows you to automate all business processes by creating and complying with smart contracts;

- confidentiality-technologies of private information turnover, which are provided in the blockchain, allow you to selectively exchange data directly between business partners;

- performance-networks are built in such a way as to support a large number of transactions and ensure compatibility with other chains, creating an interconnected world wide web and spending a minimum amount of time on it.

In addition, due to the innovative nature of blockchain technology, the ways in which new transaction blocks interact with each other can lead to completely new types of financial services.



4. RESULT:

The most popular is the public blockchain, because of the very idea of a system beyond anyone's control. The key area in which blockchain technology is being implemented today is the financial sector, namely payment systems built on the use of cryptocurrencies as a specific payment tool.

Cryptocurrency, in turn, is a type of digital currency, the accounting and issuance of which is based on mathematical and cryptographic methods. The total market capitalization of cryptocurrencies in the world as of November 1, 2021 reaches about 5500 billion and the total number of cryptocurrencies is about 4 thousand, it is difficult to say the exact figure, because from day-to-day new ones appear or old ones disappear.

The most popular, in turn, are Bitcoin with a market capitalization of 327 billion Ethereum is worth 554 billion





Figure 1. All industrial's revolutions

However, depending on the field, other types of blockchain technologies may also be appropriately used. So, a private blockchain allows you to configure various processes in the company, when it is necessary that only a limited number of users have access to certain information or transactions. For example, this may be relevant for medicine: a particular doctor has access to the patient's card and can enter certain information about treatment, diagnosis, medication prescriptions, and do so for the entire duration of treatment.

The patient will have access to this private blockchain throughout their life, and the doctor will have access to it for the duration of treatment.

In general, the blockchain will be used in a wide variety of areas, such as: money transfers, micropayments, smart contracts, identification of physical objects and assets, Public Administration, defense and security, international activities, and so on.

So, the blockchain is a distribution system with special encryption, in other words, a complex innovative cryptographic technology that exists in various forms, is rapidly developing and has many advantages along with well-established economic and legal systems.

The first attempt to solve the problem of payment security on the internet was made in 1981. The main problems were that the user was forced to report too much information about themselves. Besides, there was always a third party.

So, there was a threat of data leakage and the need to pay a commission. Only in 1993 was the first digital payment system created, which was relatively secure and allowed anonymous payments to be made online – eCash. It was developed by mathematician David Chaum. Later, Microsoft included eCash in its products. However, after 5 years, the company went bankrupt, then users did not care much about the security and privacy of online payments [5; 9].





Figure 2. Emerging energy blockchain use cases

In 2008, a revolution is taking place. A person named Satoshi Nakamoto publishes a scientific article "Bitcoin: a Peer-to-Peer Electronic Cash System", where he describes a new protocol for an electronic payment system [8]. Nakamoto soon released the first bitcoin exchange app. The network began to quickly gain a circle of users. After all, there was no such thing before that people could exchange money privately, safely and without third parties. A year later, Satoshi Nakamoto was completely removed from network support on his own, transferring control of the program's source code to other developers.

There is no private information about the developer. The identity of the author of the blockchain has not yet been established. According to one version, the protocol was developed by a group of people who identified themselves as Satoshi Nakamoto [5; 9].

However, the real rise of blockchain technology and cryptocurrencies occurred in 2017-2018. Then the increase in the price of one bitcoin from January 1, 2017 to December 16, 2017 reached 2000%, and the market capitalization of the cryptocurrency market increased from 15 billion US dollars to 645 billion [9].

This process can be viewed from two sides. On the one hand, such success of the latest technology can please, because in this way humanity has taken a step forward: the brilliant development has become incredibly popular and has spread to the masses. Millions of people around the world have learned such terms as "bitcoin" and "blockchain". However, on the other hand, the sudden and lightning-fast rise in the price of bitcoin has attracted a lot of attention from unqualified investors, who have further fueled this market. There was a real hysteria around the new technology.

At its peak, bitcoin was worth 59,783. [9] People massively bought bitcoins and high – power computer video cards, with the help of which they were engaged in "mining" - the process of maintaining the functioning of the entire decentralized blockchain system, which is awarded a certain amount or part of cryptocurrency. Thus, the share price of the main manufacturer of computer video cards, NVIDIA CORP, increased by almost 80% in 2017, not without the influence of miners.

Wanting to make money, individuals created small mining systems at home, and large companies began to build giant mining farms. And as a result, all this led to the "rupture of the formed bubble". In January 2018, bitcoin already lost 50% of its value and fell below 10,000. [12] Shares of leading technology company NVIDIA CORP fell 17% in price. Many people around the world have lost their money again rapidly growing, the value of one bitcoin already exceeds 18,000 [13]. However, the situation in 2019-2020 may repeat itself.





Figure 3. Indigo utility business model - blockchain impact

However, today, blockchain technology is becoming mainstream and is already used by various companies, not limited to cryptocurrencies. For example: Walmart, a retail giant, uses blockchain to track product information and manage it in everyday work, Maersk, the world's largest shipping company, is developing a platform for controlling cargo using blockchain technology, Facebook, the developer of the world's most popular social network, is trying to apply blockchain in a data management and protection system, and the giant automaker Ford is trying to use blockchain technology in its developments, which are aimed at interaction between different cars by coordinating the speed of cars, to reduce congestion and facilitate traffic, and medical companies UnitedHealthcare, Humana, Optum and Quest Diagnostics have teamed up to improve and increase the accuracy of doctors ' catalogs, protect medical data and improve the insurance system through the use of blockchain technology [9]. The list of examples can go on for a long time.

presentation of blockchain technology by an unknown person or group of people calling themselves Satoshi Nakamoto can be considered a revolutionary moment. In 2021-2022, the innovative system became incredibly widespread due to the rise of cryptocurrencies, but the fall was just as lightning fast. Now the situation is repeating itself.

Bitcoin and Ethereum – the main blockchain systems, first of all, were created for the sake of decentralization and security, sacrificing scalability (bitcoin supports ~ 3 transactions per second, and Ethereum- ~ 12). This has proven to be an effective way to promote the system, but as the network grows, limitations begin to appear. There are various new blockchains that sacrifice decentralization or security and try to promote the network in this way. It is not yet clear how effective this approach will be. But so far, no one has found the combination of decentralization, scalability, and security needed to create a full-featured, scalable blockchain network.





Figure 4. The 4th Industrial Revolution (4IR) and the Role of Blockchain

At the time of May 2022, the size of the Bitcoin blockchain is more than 300 GB. And this indicator is constantly growing due to the concept of blockchain in general.

This means that to maintain the network, there must be enough memory to store all the blockchain data. The more transactions a network has, the more it weighs and the faster it grows. You should also keep in mind that the entire transaction history must be loaded before each subsequent creation of a new block, which may take a significant amount of time. As American technical specialist Edward Snowden noted about bitcoin: "this is simply incompatible with a mechanism aimed at long-term trading, since it is impossible to store a history of all purchases that a person has made in his life, while giving others access to information about all transactions made" [13].

5. CONCLUSION:

The volume of use of the main blockchain technology – cryptocurrencies – is growing. The level of trust is not high, but it is inherent in new technologies. So in November 2020, the managing director of one of the world's largest banks, Citibank, compared bitcoin with gold and expressed his hopes that the cryptocurrency could grow in price to 300,000 by the end of 2023.

Currently, the vast majority of cryptocurrency transactions are related to trading and exchange activities. However, if people massively switch to a new type of Finance, serious changes will occur: payments will fall sharply in price – the use of cryptocurrencies will save people from having to pay commissions from payment systems.

With the full transition to cryptocurrencies, financial transactions will become completely transparent. As a result, there will be no need for such organizations as, for example, the Tax Service. Taxes of each individual and organization will become absolutely transparent – you can calculate them absolutely accurately and automatically. But taxpayers will be able to clearly track how their funds are spent.



Conclusions and prospects for further research. So, it is assumed that blockchain technology will continue to develop, and companies will invest enough funds to develop and implement technologies. Distribution registry systems do have good prospects. Manufacturers who will use blockchain in industry and people who will use a variety of blockchain technologies get a large number of advantages. This reinforces optimistic expectations from this technology.

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