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Application of blockchain technologies as a function of progress

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Abstract: In this paper, based on a studious, comprehensive review of the latest literature, the possibilities of applying blockchain technologies from the perspective of entrepreneurship, tourism, production, supply chain, media companies, and environmental protection and sustainable development are explored. In this context, the impact of blockchain technology on business, the evolved advantages and disadvantages of application, safety and security issues, future application trends and presented examples of good practice will be explored. It will be shown how the technology works, what changes it brings to the existing data storage infrastructure, and at the same time shed light on the possibilities of using the technology in other areas. In the theoretical consideration, the most promising sectors for the use of blockchain technology will be identified from the aspect of optimizing existing business processes. The latest research indicates that the widespread application of blockchain technologies will cause many changes in electronic business. Blockchain allows banks to simplify and automate many processes, further reducing operating costs. The results of research in practice indicate that the key disadvantage of Blockchain technology is that it is not 'green' enough, because the operation of the computers that generate the codes that make up the Blockchain requires a large amount of electricity. Research also indicates that currently the possibilities of using blockchain technology are unlimited, which will certainly initiate a technological revolution in many areas of business, because its time is yet to come.

Keywords: Digitization, Electronic business, blockchain technology.

1 INTRODUCTION

Block chain technology (Blockchain technology) is gaining more and more importance today because it is starting to be applied in almost all areas of business. In this context, blockchain technology represents one of the most prominent innovations in the world of computing today. Although products using this technology are still in the early stages of development, they seem to have great potential to improve people's lives in various fields. The beginnings of this sophisticated technology date back to 1976. William F. Ehrsam, Carl H. W. Meyer, John L. Smith and Walter L. Tuchmano published a paper entitled "Message verification and transmission error detection by block chaining", in which they presented the idea of secure exchange encrypted messages. In the period from its creation until today, blockchain technology has been significantly improved and perfected, so that the algorithms that are applied have been modified and adapted to the modern business environment. The literature states that blockchain technology emerged as a response to the economic and social crisis caused by the 2008 financial collapse. in this regard, their application as a completely anonymous and decentralized payment system is particularly intriguing and characteristic. It was the loss of trust in the financial system at that time that quickly created interest in the emergence of the bitcoin cryptocurrency, with which the first transactions were made in 2010. After that, until 2017, about 720 cryptocurrencies were developed, while in February 2021, their number reaches about 8413 different payment systems. Today, it is predicted that there are somewhere around 30000 cryptocurrencies. Forecasts are that today in the world there are more than 12,500 developers dealing with blockchain, of that number, around 520 are in Serbia. Blockchain technology is a young technology that is just being developed in the world, in this sense there is a respectable number of developers in Serbia, which indicates that in this environment there really is an intellectual capacity for the application of this sophisticated technology. In this sense, it is extremely important that we investigate the background of blockchain technology because, due to the rush of enthusiasm for it, people neglected to examine it in detail and started spreading misinformation or limiting it to cryptocurrencies instead of looking at the bigger picture. In the literature, it is emphasized that the real Blockchain technology was first mentioned a little more than 15 years ago, more precisely until 2008, when the first block of data was created by Satoshi Nakamoto, that is, the time of the creation of the Blockchain technology is parallel to the time of the emergence of the idea of the Bitcoin cryptocurrency (Denic , 2024). In a study of the Bitcoin network, Nakamoto explains that although the current system works in principle, the creation of transactions between two people is based on trust in third parties or financial institutions, such as banks, which in the past have not proven to be the most reliable and have often been the main cause various financial crises and currency hyperinflation. However, new technology promises to change the world in all areas of our life, and it is also becoming more and more interesting for entrepreneurial practice (Denic, 2024). Blockchain technology has rapidly evolved into a large number of applications, such as government, tourism, banking, financial markets, agriculture, accounting, manufacturing, supply chains, environmental protection, voting systems and government services, etc. From the Association for Electronic Communications and Information Society in the Serbian Chamber of Commerce (PKS). They state that there are currently more than 20 companies in Serbia that specialize in blockchain technology development. In this sense, the most well-known use of blockchain to the general public is in the financial sector, especially in transactions with so-called cryptocurrencies, but blockchain technology can have a much wider range of applications. One of the applications of blockchain technology is the application in business, which represents the implementation of the concept of smart contracts (smart contracts), that is, contracts that, once agreed, execute their clauses by themselves, without the need for mediation.

Blockchain technology brings enormous potential for optimizing business processes and increasing the efficiency of business processes in modern business. Another possibility of application of blockchain technology is for electronic voting, where every vote is transparently recorded and the monitoring and counting are publicly available. There are two terms in the name of blockchain technology: "block" and "chain". A block is a data structure that stores data. In the case of the Bitcoin network, this is data about transactions related to the Bitcoin cryptocurrency, but in general, any data can be written into a block, such as various files, GPS coordinates, data about the status of Internet of Things devices, and so on. The term chaining refers to how blocks are linked together. With blockchain technology, blocks of data are structured in such a way that they are resistant to attackers who could change the information written in the block. The block header contains a field to store the identification code of the previous block in the chain (Tripathi, Ahad, & Casalino, 2023). In the following figure 1, one of the characteristic architectures of blockchain technology is presented.

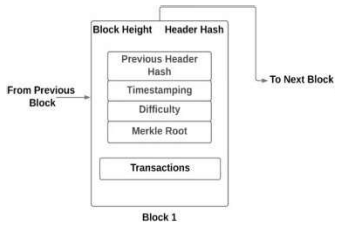

Figure1: Blockchain Technology Architecture Source (Tripathi, Ahad, & Casalino, 2023).

Blockchain technology consists of several built-in security features, such as cryptography, software-mediated contracts, and identity control (Groopman, 2022). Blockchain technology is an advanced data management mechanism that enables transparent information sharing within business networks. Blockchain technology enables so-called digital transaction records, which can be programmed to record not only financial transactions, but almost anything of value. Blockchain technology enables new ways of organizing business and has the potential to transform several economic sectors, especially the business of small and medium enterprises (Denić 2024). Many companies are researching and studying the possibilities of using this technology, and the versatile usefulness of the technology is shown by the fact that it is already being used in various industries (Stojanović J 2024). One of the applications is in the healthcare sector, for keeping patient records. There are already many promising use cases, although the research is still in its infancy. However, although early research does not specifically mention blockchain technology or name it as such, it is generally accepted in the literature that the Bitcoin network is the first practical application of this blockchain technology. In this context, on the other hand, there is still a significant lack of theoretical knowledge, which is why companies, despite the implementation of technology, still do not achieve the value they expected. Blockchain implementation is complex and requires large capital investments and adaptation of organizational processes, as it fundamentally transforms and automates business processes. The following Figure 2 presents a SWOT analysis of the application of blockchain technology in public administration in the Republic of Serbia.

Figure2: SWOT analysis of the application of blockchain technology Source (Study on the feasibility of using blockchain in the work of public administration in the Republic of Serbia). https://mduls.gov.rs/wp-content/uploads/Blockchain-studija-NIA.pdf

Businesses today are increasingly inclined to use systems based on blockchain technology. The benefits of using it include multiple factors: time and cost efficiency, saving time spent on contacts with intermediaries, privacy, security, fraud reduction, record keeping and decentralization. Research indicates that this technology also brings greater transparency in relation to data to companies in various industries, however, practice shows that such innovations in the world by their nature have both advantages and disadvantages. In this context, although blockchain technology is designed to be secure, individual nodes and computers connected to the network can be potential targets for hacker attacks. Therefore, it is necessary to develop additional security mechanisms to protect data and transactions. Another challenge is the acceptance and understanding of the technology by the general public (Tripati, Ahad, & Casalino, 2023). The transaction verification process, which is based on work algorithms, requires a lot of processing power, and therefore electricity. In this sense, Blockchain technology is a very large consumer of electricity, which has a negative impact on air pollution, given that Bitcoin transactions are mostly a speculative business (80%-90%), spending energy on this business is a pure waste of resources. However, some authors state that blockchain technology is one that has the potential to mitigate or even solve environmental impacts. Applications developed on the basis of blockchain technology can also help the environment. For example, a startup in Seattle uses a platform to combat climate change and aims to reduce or remove carbon from our environment (Levi et al., 2018).

Blockchain technologies in entrepreneurship

Nakamoto created a system in which the exchange of personal financial assets does not depend on trusting a third party, but on network participants ensuring that the data in the network is accurate, with Nakamoto paying particular attention to the protection of personal data and privacy, thus creating the possibility of applying this technology in business. As blockchain technology and its use cases continue to develop and improve, the aforementioned technology enables companies to achieve greater transparency, traceability and operational efficiency for many blockchain technology business transactions and contracts. The rise of the Internet led to the decline of brick-and-mortar stores and traditional media companies, but it also spawned the largest technology companies we know today (Denić, 2024). The application of these technologies in education, for the storage of diplomas and certificates, would significantly reduce the possibility of misuse and falsification of diplomas. The pricing models companies choose to implement blockchain technology are also critical. Different approaches,

such as transactional payment or subscriptions to access services, can affect the general acceptance and availability of this technology for smaller businesses (Di Stefano, Khizhniak & Turol, 2023). More than 90 banks around the world are also starting to think about useful technology solutions and actively engage, according to Deloitte (2020), more than 50% of executives in different countries around the world said that they are. they have used blockchain technology rank blockchain among the top five priorities in the companies where they do business. Investments in blockchain technology are expected to reach $3.1 trillion by 2030. Blockchain technology has brought significant changes to banking, simplifying banking transactions, reducing costs and increasing security. According to the obtained data, which is presented in Figure 2, it was determined that about 19% of small and medium-sized enterprises use blockchain technology. About 24% of companies plan to use it in the next two years, 25% are evaluating the possibilities of using it, and 32% of companies are not thinking about using it. Gartner (2021) and Grand View Research estimated that the business value created by blockchain technology will increase to $176 billion by 2025 and $3.1 trillion by 2030. According to the Global Startup Ecosystem Report (2021), companies based on blockchain technology represent 10% of startups worldwide.

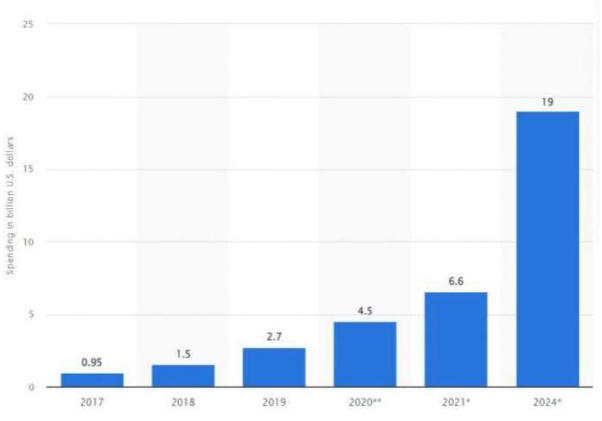

Figure2:The use of blockchain technologies in small and medium-sized enterprises Source: Top Technology Trends Survey (2019).

The smart contract segment dominated blockchain technology in the financial sector in 2018 and is expected to generate the most revenue through 2026. The growth of this segment is primarily driven by the increased need for self-executing contracts between banks, but also between banks and clients. Using blockchain technology, transactions are conducted directly between parties in a decentralized network, significantly reducing the need for intermediaries (Hayes, 2024)

Table 1 Blockchain in banking

Source: (Hayes, 2024)

Lastnost	Banke	Bitcoin
Opening hours	9:00 a.m. to 5:00 p.m. on weekdays; limited hours on weekends; closed on bank holidays.	24/7, 365 days a year.
Transaction costs	• Card payments: Commissions are paid by stores. • Checks:1$–30$.•ACH transfers: up to3$.•Transfers: Domestic up to $25,International up to45$.	Variable fees $0–$50 determined by miners and users.
Transaction speed	• Card payments 24–48 hours • Checks: 24–72 hours •ACH: 24–48 hours • Transfers: up to 24 hours	From 15 minutes to over an hour, depending on network traffic.
KYC rules	Requires KYC procedures; legal customer registration.	No identification required; anyone can participate.
Ease of transfer	Requires identification, bank account, and mobile phone.	Request
Privacy	Data stored on the bank's private servers; depending on the security of the bank and the user.	Traceable, but anonymous ownership is possible.
Security	Depends on the security of the bank's servers and the user's security measures.	A larger network means greater security; cold storage recommended.
Approved transactions	Banks can reject or freeze accounts.	The Bitcoin network does not restrict usage, local guidelines must be followed.
Account seizure	Government authorities can easily track and seize bank accounts .	Anonymously used Bitcoin is difficult to track and seize.

Blockchain technology in tourism can play a key role in removing these barriers and streamlining the process. Tourism is an industry that is under great pressure from information and communication technologies. Research in practice indicates that the tourism sector needs to combine technology, knowledge and money in order to create new products that will satisfy the needs of customers. Blockchain technology has attracted the attention of many researchers in the mentioned sector. This creates an opportunity to develop smart objections or a single digital identification document to support many business activities (Cutts, 2019). Kvok and Koh (2019) believe that the applicability of blockchain technology in the tourism sector is suitable for exchanging information, ensuring better business processes, reducing costs and improving user experience. Based on the research, it is expected that blockchain technology will have a great impact on the tourism sector.

Blockchain technology in logistics

Predictions are that the logistics industry is likely to benefit the most from the adoption of blockchain technology. In this context, it is currently difficult to track the edge in the international freight environment due to the long weather cycle and opaque information. It enables faster and more reliable logistics operations and enables better supply chain optimization by providing accurate and up-to-date data on delivery status (Cai et al., 2023). Complex trade networks can be carefully traced from origin to user endpoints. This, in turn, provides a higher level of security, increases object confidence and quality control. As a result, we can say that blockchain technology offers promising solutions to supply chain monitoring challenges, but careful consideration of costs, privacy, pricing models and investment decisions is required before deciding to apply it (Di Stefano, Khizhniak & Turol, 2023). . The Swiss postal agency "SwissPost" and the state telecom "Swisscom" published a joint statement on December 6, 2018. They jointly developed a friendly blockchain to build a simple, secure and sustainable infrastructure. According to a recent prediction, digital technologies will play a key role in repairing the disrupted global supply chain in the next three to five years (Denić 2024). Blockchain technology is used to track cargo in real time, enabling greater transparency and reliability in tracking the movement of goods. This improves the efficiency of logistics operations and reduces the chances of errors or fraud (Baltruschat et al., 2023). When managing the supply chain, we must pay attention to three important flows: informational, financial and, on the spot, material. Blockchain data chaining technology can be used in all the above-mentioned flows, both in the logistics market and in proactive management (Lesueur et al., 2021). In the literature, it is emphasized that supply chain technology should help in tracking the path of the product from the supplier of raw materials. consumer. In May 2019, the Korea Customs Service put the world's first blockchain-based logistics service for export customs clearance to trial. It signed an appeal with 48 institutions and companies, including public institutions, shipping companies and insurance companies, to promote blockchain-based export logistics and export customs clearance services.

The computer company IBM and one of the largest logistics companies, TektitMaersk, have joined forces and developed a platform for digitized shipment tracking called TradeLens[1] based on blockchain technology. The leverage platform uses a distributed blockchain network to collect data from many different entities and allows all network participants to see this data in real time. The platform is still in the development phase and time will tell how useful it is and what the rate of adoption is among logistics companies and their clients. It is predicted that blockchain technology in the supply chain should also enable accurate demand forecasting, effective disruption management and reduced inventory management costs due to its ability to create and share records of activities throughout the supply chain. For the successful implementation of blockchain technology in the transport sector, clear standards and guidelines must be developed and education and training provided for all involved parties (Tahora et al., 2023). Blockchain technology can also contribute to social responsibility in supply chains by providing information on the origin of goods, as a company's control over the origin of goods is often limited.

Blockchain technology in the media offers a fair deal for all actors in the media industry, while at the same time enabling a large amount of innovation and new business models. The well-known author Kahn MTE 2021 highlights the application of blockchain technology in the industry in power: design and management of the energy sector. However, data shows that blockchain technology is estimated to be worth USD 166.6 million in the media and entertainment industry alone in 2020, growing at an annual growth rate of 71.4 percent in the period to 2026. Research shows that new technologies are profoundly changing the global media and entertainment industry, especially in the areas of program production and distribution, with blockchain technology having the most prominent technological impact (Stojanović K 2024). According to Accenture, 55% of media and platform leaders consider blockchain technology one of their companies' top five priorities. Likewise, 83% of executives plan to increase investment in blockchain technology over the next three years. It is expected that the development of advanced technologies and digital transformation will drive the growth of technology implementation in the media industry. In this regard, some authors emphasize that the media industry is plagued by many intermediaries, unequal distribution of profits and numerous inefficiencies that could be solved using blockchain technology. In this sense, smart objections play an important role here, because they would contain a set of rules based on which a predetermined process would be launched.

Blockchain technology and the environment.

One of the main challenges that blockchain technology is currently facing is its impact on the environment. It is noticeable in the literature that in the last few years, governments and organizations around the world have focused on the use of various technological tools to mitigate climate change and the challenge of biodiversity loss. The impact of blockchain technology on the environment is extremely obvious. In this context, Johnson (2021) points out that Bitcoin mining is quite expensive and generates significant amounts of waste. It produces about 0.13% of global carbon emissions, which is 37.2 billion tons per year. Tim Berners-Lee (2022), known as the inventor of the World Wide Web, called Bitcoin mining one of the most pointless ways to consume energy. In this sense, the well-known author Trubi (2018) claims that the amount of electricity consumed by blockchain technology poses a serious threat to the global commitment to reducing greenhouse gas emissions. Blockchain technology, combined with smart objections, promises transparent and secure platforms capable of providing creative and ecologically responsible business solutions (Polas et al., 2022). Despite the potential advantages, the huge energy consumption is one of the main obstacles that must be overcome. Many actors in the economic sector are naturally looking for ways to solve the problem (Polas et al., 2022). The well-known author Lu (2020) explains that modern companies have realized that the social aspect of sustainable development is also very important for economic development. Currently, blockchain technology related to cryptocurrencies is heavily criticized for its environmental impact, or the social aspect of sustainable development is completely different.

Blockchain technology in SMEs Blockchain and product lifecycle management (PLM) can work together in several ways - one option is to use blockchain technology to secure and store data as part of the product management process.

Blockchain technology can serve as a reliable log that records all changes that occur in the process, which could help companies reduce the risks associated with product data changes and ensure that product data is accurate. Companies are exploring the possibilities of implementing blockchain technology into their daily processes, but they are also incorporating it into them. At the same time, there are a large number of startups and smaller companies experimenting with blockchain technology and providing various enterprise use cases. Blockchain technology has proven to be extremely useful in modern business, offering opportunities to improve business efficiency, increase transparency and reduce the risk of fraud. In practice, there are fears that blockchain technology could be used for money laundering and the creation of illicit value. The authors Tapskot et al. (2021) state that blockchain technology in the financial sector could reduce processing costs, reduce fees, make payments safer and more reliable. The rapid growth and popularity of this technology is evident from the event in 2010 when Laszlo Hanyecz bought two Papa John's pizzas for about $30 with 10,000 bitcoins, which were valued at over $80 million in 2018, highlighting the exponential growth of the technology and cryptocurrency (Tripati, Ahad and Casalino, 2023). However, the attitudes and potential disadvantages of using blockchain technology for small and medium-sized enterprises. The technology is still relatively new and inexperienced, so there are concerns about scalability, security and regulatory compliance. Moreover, implementation costs may be too high for them, especially for those who do not have technical expertise or development resources (Denić 2020). In this context, Bulsara and Vaghela (2020) emphasize that blockchain technology offers solutions to stores through the Internet, primarily in the areas of cyber and financial security. The same authors explain that smaller businesses could use blockchain technology to facilitate inventory management and payment processing. Important features that blockchain technology brings to online stores include cost savings, easier and faster transactions, improved business processes, transparency, improved supply chain management and greater access to global consumers, especially for smaller businesses (Bulsara and Vaghela, 2020). Although blockchain technology offers numerous advantages, it also presents certain limitations and challenges. Scalability is one such challenge, as the size of the blockchain grows with each added block, potentially leading to increased storage and processing requirements (Alshahrani et al., 2023). It is concluded that blockchain technology can reduce transaction costs and speed up money transfer processes in transactions between companies. it is predicted that the use of blockchain technology in the financial sector could reduce the operating costs of international transactions from 26 to 15 dollars and reduce the annual operating costs of companies.

According to Darlington et al. (2022), decentralization means that there is no single point of control in the system. Transactions and data are distributed through a network of nodes, making the system more resistant to attacks. This improves the security and reliability of the system, which is especially important for companies that need secure and reliable systems. Well-known authors Marten and Kai 2017 emphasize the importance of security and privacy in ways: improving security, data ownership, access control and privacy protection. Blockchain technology consists of somewhat embedded security features such as cryptography, software-mediated objections, and identity control (Groopman, 2022). In traditional systems, this data is collected centrally, but rewards are awarded based on previous purchases. The transition to a blockchain-based system enables the calculation and issuance of reward points when they are earned (Marr, 2022). In some cases, the use of blockchain technology may conflict with legal regulations. For example, in some countries, some forms of cryptocurrencies and ICOs (initial coin offerings) are illegal, which can cause legal problems for companies using this technology (Sommerhalder, 2023). In the future, we can expect blockchain technology to play a key role in creating new business models and improving existing processes (Tripathi, Ahad, & Casalino, 2023). In order to realize the full potential of the blockchain, it is useful for users participating in multiple interconnected chains to be connected via a single protocol. This reduces friction between users as they can access different decentralized applications without changing networks (Sommerhalder, 2023). Since the blockchain is an immutable ledger, the data on this platform can be secured, which prevents manipulation or falsification. We have mentioned immutability as one of the important advantages of blockchain technology, sometimes the immutability of data can also pose a danger, and that for some data it may be more appropriate not to be recorded permanently.

CONCLUSION

By implementing a platform based on blockchain technology, numerous advantages can be achieved in a real business environment. However, it is important to emphasize that the implementation process itself requires professional and trained human resources, i.e. a high level of knowledge and technical skills for the implementation and maintenance of these technologies. Blockchain enables the transparent sharing of information within a business network, which increases trust between participants and reduces the need for central intermediaries. Blockchain technology represents the basis for the transition from the Internet of information to the Internet of digital values. Also, every transaction using blockchain requires a significantly higher consumption of electricity, which is certainly significant in terms of environmental protection and sustainable development. The implementation of blockchain technology in business processes also requires a complementary digital infrastructure, which is not always easy for small and medium-sized enterprises to access. Research has shown that blockchain technology can significantly improve the efficiency of operations by reducing transaction execution time and increasing their transparency. However, the problem that arises in the application of this technology is that there are a large number of different blockchain platforms with different protocols and standards, and when exchanging data, there may be a problem of system interoperability. In agriculture, which accounts for 11% of the GDP of Serbia, it is proposed to introduce blockchain technology into the agricultural distribution system so that production and deliveries can be managed more efficiently. The adoption of blockchain technology is growing quite rapidly in various sectors around the world. Logistics processes, like other aspects of life, can be defined and evaluated using data to which blockchain technology gives added value. Companies are exploring the possibilities of implementation in their daily processes, but startups are experimenting with blockchain technology to provide different

use cases. It is proposed to introduce a land management system that uses blockchain technology to improve the land management system in Serbia, but where public trust is currently lacking. Blockchain enables the automation of many business processes through smart objections, which reduces operational costs and increases the speed of transactions, confirming our first hypothesis "Blockchain technology can improve operational efficiency by reducing transaction execution time and increasing their transparency in companies.""Blockchain technology was developed primarily for the cryptocurrency system, but it could also play an important role in solving the challenges facing global economies today. Many developing countries lack the robust banking, internet or electronic systems necessary to take advantage of the global digital transformation. The adoption of blockchain technology and cryptocurrency could be instrumental in helping these countries.By studying these authorities, we found that blockchain technology not only improves efficiency and security, but also drives innovation and new business models. By enabling decentralization and greater autonomy, it opens the door to new possibilities and solutions that can positively affect more aspects of the social infrastructure, or even the society itself , as a disruptive technology, can lead to equal and decentralized network management using a distributed ledger. Our research has shown that companies that adopt this technology can significantly improve their business. This, in turn, leads to greater customer satisfaction and long-term business growth. It is clear that blockchain technology represents a significant turning point in the digital transformation of companies. The versatility of blockchain technology is evident in its wide range of uses, as it can facilitate and improve various processes, from storage to delivery and, on the spot, not least, payments. Its use itself increases the transparency and efficiency of the supply chain and generally improves the performance of all logistics processes. Data accuracy and transparency enable organizations to proactively manage processes, which increases the speed of logistics processes and reduces costs. It is important to emphasize that the complete security of Blokjen technology has not yet been fully proven and sufficiently researched, and that more and more scientific papers dealing with this topic are appearing in the literature. After the system evaluation and familiarization with all the possibilities offered by blockchain technology, it is to be expected that sooner or later the regular practice of business: production, sales, logistics, education, healthcare, banking, environmental protection and sustainable development and life in general will undergo a complete transformation. with the help of blockchain technology.

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