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BLOCKCHAIN AND THE APPLICATION OF BLOCKCHAIN TECHNOLOGY

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Abstract

Thanks to cryptocurrencies, blockchain technology has recently become the focus of interest of both scientists and the public. The paper presents the principles on which blockchain is based and analyzes the possibilities of the application of blockchain technology in more detail. In a part of the analysis, some of the most common cryptocurrencies were considered, such as Bitcoin, Ethereum, USD Coin, Ripple, and ADA. Blockchains' applicability in supply chains, finance, real estate, health care, voting, and smart cities the authors discussed in the chapter about the application of blockchain technology. A separate chapter discusses the limitations of blockchain technology. Based on the analysis, at the end of the paper, the authors conclude that blockchain technology has great potential in automating and optimizing business processes and protecting the information and privacy of users. Given the demonstrated interest of companies in blockchain technology, investments, and demand for staff who understand it and can create applications, the authors concluded that the time of blockchain is yet to come.

Keywords: *blockchain, Bitcoin, Ethereum, Ripple, voting, smart city.*

1 INTRODUCTION - BLOCKCHAIN

The blockchain and the principles on which it is formed are still little known not only to the general public but also to the most blockchain technology users, although more than 30 years have passed since the emergence of the blockchain as a research project (1991) and more than a decade since its first mass use (Bitcoin - 2009). Many have heard of the blockchain, and even the definition that it is a "distributed ledger that facilitates the process of recording transactions and tracking assets in the business network" (Gupta, 2017), but what the blockchain is and how it works is unknown to the vast majority.

Therefore, we note here that a blockchain is a distributed database shared among the nodes of a computer network. The main difference between a classic database and a blockchain is how data is structured. Classic databases collect data and store it in tables, but blockchains collect information in blocks. A filled block closes, compiles, and links to the previously filled block. All future new information will also be compiled into blocks and added to the previous blocks. In

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this way, data forms a chain, a blockchain as a timeline in which each block gets the correct timestamp when it adds to the chain. (Hayes, 2022)

For ease of understanding, Gupta (2017) suggested looking at blockchain as an operating system such as Microsoft Windows or macOS and bitcoin consider one of the applications that can run on that operating system. Bauerle (2018) used Wikipedia Free Encyclopedia with the same goal of explaining blockchain. Unlike the usual encyclopedias that are the product of one publisher, data is entered into Wikipedia in a distributed way, i.e., each user can enter data according to their authority, and the community controls the quality of the data. A Wikipedia user receives an updated version of the "master copy" from centralized servers each time he logs in. However, this is where the possibility of identifying the principles of Wikipedia and blockchain ends. Both Wikipedia and blockchain technology are realized on a distributed system, the Internet. Wikipedia is embedded in the World Wide Web (www) using client-server models. Wikipedia's digital structure is like centralized databases used by banks and insurance companies, the military, and the police. It is a centralized system. With blockchain, each node on the network receives valid information about the transaction, confirms it, updates and registers it, and the most popular record de facto becomes the official record. That is where one can see the main difference between such a record and the main copy of the record. The blockchain does not have a centralized server but distributes the data to all nodes.

2 CRYPTOCURRENCIES AND BLOCKCHAIN PLATFORMS

2.1 Bitcoin

When Bitcoin.org appeared in August 2008, and “Satoshi Nakamoto” posted his paper on a cryptography mailing list on October 31st of the same year, Bitcoin aroused interest in a very limited circle. Barely anyone understood what this is all about. Over time, many have focused more on the identity of Satoshi Nakamoto, the author of *Bitcoin:* A Peer-to-Peer Electronic Cash System (2008), than on what he wrote there. It took more than two years for Bitcoin to reach $ 1 since the first bitcoin ledger[1] appeared in January 2009. That represented an enormous increase in value. But there was a small number of Bitcoins. With smaller and larger oscillations, the value of Bitcoin grew until October 2013. Then it reached a value of about $ 120 and in the next month its first maximum of about $ 1,000. In February 2017, with a series of declines and rises, it reached $ 1,000 again. Soon, Bitcoin skyrocketed to its maximum of over $ 17,500. Its value dropped by half in the next three months. In December of the same year, Bitcoin reached its maximum of close to $ 20,000.

After that, the value of bitcoins dropped so that in December 2018, it was worth $ 3183. From September 2020, the value of bitcoin began to rise rapidly. In March 2021, it reached the value of $ 61,283. Bitcoin reached a new maximum in the middle of November 2021, $64,400. At the end of April 2022, bitcoin was worth just below $ 40,000.

Fig.1 Value of Bitcoin in the period May 2017-May 2022

[1] Ledger - a book or a computer document in which a company's accounts are recorded, especially the money it has spent and received (Cambridge Dictionary)

Figure 1 shows that in the five years from May 2017 to May 2022, the value of bitcoin increased over 24 times and that it was occasionally over 40 times higher than the value at the beginning of the observed period.

2.2 Other cryptocurrencies and blockchain platforms

Although Bitcoin has become a well-known term, almost 14 years since the idea appeared, most people, even bitcoin wallet owners, are still unfamiliar with Bitcoin mining and transferring technology, and the principles on which the technology is based. The term cryptocurrency has meanwhile become very common. New cryptocurrencies have appeared together with guessing which of them are promising and which will prove to be just a fad. There are tens of millions of indexed webpages on cryptocurrencies and they have been and are being studied by many authors, including (Čekerevac & Čekerevac, 2015), (Cekerevac, Dvorak, Prigoda, & Cekerevac, 2015), (Prigoda & Cekerevac, 2016), etc.

Here we will only mention some characteristics of the most common cryptocurrencies:

- *ETH – Ethereum*; ETH is the second most well-known cryptocurrency. It is significantly different from Bitcoin. At the end of 2021, over 188 million Ethereum tokens were in circulation, over ten times more than BTC. The coin was created in 2013 and launched in 2015. The creators are known. Bitcoin acts like digital gold, but Ethereum is a technology platform for applications not run by governments or companies. In 2021, the Ethereum blockchain accounted for more than half of the decentralized finance (DeFi) market, so price movements of this cryptocurrency could significantly impact on DeFi. (Best, Ethereum (ETH) - statistics & facts, 2021)
- *USDT – Tether USD - ERC-20 & TRC-20 protocol*; The cryptocurrency exchange Bitfinex developed Tether. Tether belongs to the stable cryptocurrencies[2] whose goal is to maintain its value stable. That allows USDT to be a means of exchange and a way of storing value, instead of being used as a medium for speculative investments. Tether (USDT) is based on a blockchain, and an equivalent number of US dollars, euros or the Japanese yen backs all tokens. One USDT is worth $ 1.00. (Frankenfield, 2022) TRC20-USDT and ERC20-USDT refer to USDT issued on the TRON and the Ethereum network respectively. They are both identical, but transfer fees are significantly cheaper with TRC20. (Emma, 2022) TRC20 offers moderate safety, and it is good enough for small amounts and high-frequency transactions. ERC20 offers high safety and is suitable for medium amounts and trading. (daisy-support, 2021)
- *USDC – USD Coin* is a USD-backed stablecoin created and issued by Coinbase and Circle in 2018 with a $1 fixed price. Each USD Coin in circulation is backed by one US dollar or other cash equivalents held in a US bank account and can be redeemed for USD at any time. Only approved regulated financial institutions that meet Circle's membership framework can issue USDCs. Like USDT, USD Coin can be sent and received by any wallet or exchange that is ERC-20 (Ethereum) compatible, along with many other blockchains (Barchat, 2021).
- *XRP – Ripple*; Ripple is a technology that operates in two ways: as a cryptocurrency and as a network for digital financial transactions. Ripple works on a decentralized, open-source, peer-to-peer platform that allows seamless transfer of any money type. Ripple is a global payment network similar to the SWIFT system for international money and security transfers, used by banks and financial intermediaries operating in different currencies. The technology is based on a blockchain with its cryptocurrency, XRP. Instead of using block mining, Ripple uses a consensus mechanism through a group of bank-owned servers to confirm transactions. Ripple transactions consume less energy than

[2] Stablecoins follow traditional fiat currencies, such as the dollar, the euro, or the Japanese yen, which are held in a specific bank account. In this way, they differ significantly from large fluctuations in the prices of other popular cryptocurrencies, e.g., BTC or ETH.

bitcoin, can be confirmed in a few seconds, and cost a little. Ripple (XRP) ranks among the most valuable blockchain-based tokens by market capitalization. (Frankenfield, 2021)

- *ADA – Cardano*; Cardano is a third-generation, decentralized proof-of-stake (PoS) blockchain platform designed to be a more efficient alternative to proof-of-work (PoW) networks as Ethereum is. PoSs are operating cheaper and have better scalability, interoperability, transaction times, and sustainability than PoW networks. The ADA token and the Cardano platform were launched in 2017. The platform runs on the Ouroboros consensus protocol which was the first PoS protocol that not only was proved to be secure but also was the first to be informed by scholarly academic research. (Conway, 2021) At the end of April 2022, the ADA market cap was $27.69B giving it a ninth place in the cryptocurrencies ranking. (Goldprice, 2022)

3 OTHER BLOCKCHAIN TECHNOLOGY APPLICATIONS

In the shadow of stock exchanges and cryptocurrency price fluctuations, new ideas about the application of bitcoin technology and its blockchains have emerged. There are more and more attempts to change the current functioning of the Internet and introduce improvements.

With the advent of Google, Facebook, Twitter, and other services, the world gained a powerful source of data and a powerful means of communication. At the same time, it was exposed to the risk of control and manipulation because these sources are centralized and subject to control from one uncontrolled center. Most users, satisfied with what they have at their disposal, do not understand the size of risks they are exposed to. More devices on the network cause more risks. The number of Internet users is growing dramatically with the development of the Internet of Things (IoT) and the Internet of Services (IoS) in all its forms: Infrastructure as a Service (IaaS); Software as a Service (SaaS); Platform as a Service (PaaS); Mobile "backend" as a service (MBaaS); or server-based cloud computing. Some users, more concerned about privacy or out of pure curiosity, turned to decentralized Tor, free software that allows anonymous communications, and Tor Browser, I2P, Freenet, Tails, Firefox, or some of those listed in (SOCRadar, 2020). Tor users can enjoy a sense of relative freedom and privacy at the expense of comfort.

For specific purposes and/or users, there is also a deep or invisible, or hidden network (Deep Web, Deep Net, Invisible Web, Hidden Web) that is not indexed by the world's leading commercial search engines. [3]. Because it is uncontrolled, this network is the most attacked by those who want control over the Internet, but it is also the most inconvenient to use, or rather, search. All these communications use encrypted connections, and instead of centralized servers, many ad-hoc nodes are used, which volunteers provide to the network. A similar principle is with blockchain. Transactions are performed by forwarding the encrypted information to be verified to the peer-to-peer network of available computers, regardless of their location. The network then performs computational operations to confirm the validity of the information transaction. After the network verifies the transaction as legitimate, the information forms into blocks. The blocks then join the existing chain, and the transaction becomes permanent. That completes the process of adding new information. Computers that are not online during the transaction will receive a verified chain at the very next transaction, when available. If a node has incomplete information or if it tries to enter incorrect information, it will be detected very quickly. In this way, redundancy and transparency are achieved. The posted information and history are irreversible. One can see that the whole system can function in a decentralized manner. To prevent bad actors from validating bad transactions or double spends, blockchains are secured by a consensus mechanism such as proof of work (PoW) or proof of stake (PoS) (Hayes, 2022).

So far, blockchain technology is most frequently used for cryptocurrency transactions. But there are no obstacles to using blockchain for other purposes, such as storing information on legal contracts, inventory of products and warehouses,

[3] More details about the Deep Web and its subgroup Dark Web can be found in (Čekerevac, Dvorak, & Čekerevac, 2016), (Yale, 2014), (Avast, 2022), etc.

transport of goods monitoring, various identifications, a realization of voting, etc. Given the potential of blockchain, now almost everyone who has an entrepreneurial spirit and understands blockchain is trying to devise some application of blockchain in society and work. Tens of thousands of applications are being developed or under development. The 10,397 cryptocurrencies were active in February 2022. (Statista, 2022A) For the sake of comparison, according to the same source, in 2013, there were 66 cryptocurrencies.

In cases that are not of general interest, it is possible to limit the blockchain to stakeholders, the entities who are in some way involved in the project. In this way, the number of participants significantly reduces, and transactions can perform faster without burdening the network unnecessarily. Some companies, such as Siemens, Walmart, Pfizer, AIG, Unilever, IBM, and others (Hayes, 2022) have already incorporated blockchain into their business.

3.1 Supply chains

The application of blockchain is very suitable for supply chains. If we add the use of the Internet of Things (IoT) to it, we can create a complete logistical solution. The application of IoT in supply chains has been written in detail by (Cekerevac, Prigoda, & Maletic, 2018), and here we will only quote that ”the IIoT with its transparency can revolutionize the supply chain, and at the same time to give both operational efficiency and revenue opportunity. The companies that understand that the supply chain isn’t only a way to keep track of a shipment can gain an edge over their competitors“. As an example, we will mention the Food Trust™. IBM created the blockchain Food Trust™ as a collaborative network of growers, processors, wholesalers, distributors, manufacturers, retailers, and others, enhancing visibility and accountability across the food supply chain (IBM, 2021). The goal was to ensure (IBM, 2021):

- *Increased supply chain efficiency* – To run a more efficient food network by helping to eliminate bottlenecks in the supply chain.
- *Greater brand trust* – To enhance the reputation for safety and quality through transparency.
- *Compliance confidence* – To ensure safety and regulatory compliance and avoid recalls.
- *Enhanced sustainability* – To increase awareness of sustainability opportunities and practices in each step of the food chain.
- *Improved safety monitoring* – To monitor food products in the supply chain to accurately judge remaining shelf life.
- *Fraud prevention* – To make supply chains less susceptible to fraud and errors with end-to-end traceability.
- *Reduced waste* – To better track food wasted and food rescued while minimizing waste hot spots.

To further develop supply chains, in addition to the efforts of participants, changes in the legislation at the world level are necessary. The regulation should evolve in terms of supporting change. Of key importance is that all, sensors, devices, methods, and software platforms stay transparent (Cekerevac, Prigoda, & Maletic, 2018).

The use of blockchain in supply chains enables the monitoring of products from the beginning of production to end-product delivery. Until recently, this was applicable only in special-purpose industries, and now that possibility is available to everyone, above all, to the food industry. Time tracking of products from the farm to the end-user is enabled.

3.2 Finance

Blockchain has the potential to have a significant role in finance, especially in the provision of banking services. In modern banking, there are still limitations in the provision of services. The working hours of banks are a significant element here because banks are physically available only within their work hours. Thus, banks are unavailable on weekends and holidays and when they have organizational changes to a greater extent. Even e-banking can have restrictions like "transactions up to $XXX we will execute immediately, and larger payments we will execute the next working day.". Even heavier restrictions can appear in international transactions due to different legal regulations and differences in time zones. Transactions on hold for a day or two and in international traffic for longer are not uncommon. As a result, banks and customers are exposed to unnecessary risks. Blockchain has no such restrictions. It can execute transactions at

any time and in about ten minutes. The duration of the transaction itself depends on the time required to create a new block and add it to the blockchain. Improvements in hardware and communications will have a positive impact on transaction speed.

Another great advantage of blockchain and cryptocurrencies lies in cryptocurrencies' independency from banks and states. The dollar, the euro, the yuan, the ruble, and other local currencies are managed by central banks. If a client has money in countries with unstable management, he faces a high risk of losing the value of his money. Even in ideal conditions, there is always a risk bank will be hacked and that the client's data will be compromised. The bank may go bankrupt, and the client loses his money. Most of these risks are much lower or do not exist in the field of cryptocurrencies on the blockchain. Crypto wallet owners can dispose of their money in a way that suits them regardless of their location. The owners are fully protected, in theory. Cases of cryptocurrency exchangers hacking are also known. But, luckily, although unpleasant, they are rare and do not tell us much about the safety of the blockchain itself, since exchanges are considered centralized entities with points of failure that are not on the blockchain itself. Some of them are discussed in (Newman, 2022), (Kharpal & Browwne, 2021), (Hern, 2014), etc.

Another, more realistic risk for cryptocurrency owners is frequent changes in the value of cryptocurrencies. Due to the small share of cryptocurrencies[4] in the total value of currencies, changes in the value of individual cryptocurrencies are frequent and with big ups and downs, although in the long run, the owners of the most famous cryptocurrencies have achieved significant (and some enormous) gains. As the market capitalization increases, the value of the most used cryptocurrencies will be more stable and the oscillations less important

3.3 Real estate

Selling and buying real estate is always a challenge for both, the seller, and the buyer. They are most often related to the need to involve intermediaries, lawyers, and the state through its representatives, banks, and cadastres. That takes a lot of time. The multitude of participants in the process increases the risk of inefficiency and human error. Correcting every mistake in such cases requires time but also financial losses. In some cases, it may happen that, e.g., due to the war situation or natural disasters, or the destruction of the cadastre, the owner cannot even prove his right of ownership.

The application of blockchain technology can eliminate most of the mentioned shortcomings. Interested users can create their blockchain or join an existing one. In that way, they can record their property, which will be generally recognized. By applying smart-contract technology, the seller and the buyer can contract all the necessary elements, and the contract will be activated automatically. As soon as the buyer pays the agreed price, the blockchain will note the property, and the subject of the contract will change the owner, which will be generally recognized. The smart contracts can incorporate elements of security deposits which will be automatically activated in the case of a deviation of one party from the contract. All this can take place at incomparably lower costs than the costs associated with the classic buying and selling processes.

Stakeholders do not have to use 'smart' contracts only to buy or sell real estate. They can use 'smart' contracts wherever existing paper contracts apply.

3.4 Health care

Blockchain technology is very applicable in healthcare. Classic systems, which are currently in mass use, include a centralized system that covers all policyholders and to which users access their user accounts and passwords. This system can be comfortable to use but carries all the risks of centralized systems. In case of server failure, the entire system is compromised, if not unusable. On the other hand, the server owner can access all user data. It can be a means of controlling all

[4] In early April 2021, the total market cap was 2.08 trillion U.S. dollars. At the beginning of November 2021, it was 2.87 trillion U.S. dollars. (Morris, 2022) (Statista, 2022B) On December 31, 2021, there was around $40 trillion in physical money present globally. This amount can touch a quadrillion if cryptocurrencies, broad money (M2 and M3), and investments and derivatives are added to that total. (Jeffries, 2022)

users, both patients and doctors, pharmacists, and other participants.

Blockchain technology can offer the creation of individual chains that will include only those connected to the patient and his treatment. Every medical record regarding the patient will be encrypted and written in a blockchain without the possibility of modification or removal and stakeholders will be able to access the records using their private keys. That better protects patient privacy while preserving data integrity.

3.5 Voting

There are always organizational problems at elections, starting from the voting place where the elections will be held, through printing ballots, keeping records, and controlling the regularity of the voting process, up to counting votes and final reporting on election results. Depending on the importance of voting, doubts about whether voting was regular or not can last for years. One such case was the US presidential election in 2016. The defeater usually uses the suspicion of irregularity to shift the "blame" for the failure to an external factor. That has become a practice and is not favorable for the voting system functioning and the 'normal' work of the selected candidates after the elections.

Blockchain can offer a suitable solution here as well. Each voter creates their own "coin" and "pays" it to the account of one of the candidates. Blockchain registers the payments, and after the voting is over, the results can be published practically immediately. At the same time, with the provided transparency, there is no risk of falsifying the results. Such an experiment with 144 voters located worldwide was conducted successfully in West Virginia voting in 2018. “This is a first-in-the-nation project that allowed uniformed services members and overseas citizens to use a mobile application to cast a ballot secured by blockchain technology” (Wood, 2018).

3.6 Smart cities

Migrations have always existed and will continue to exist. In recent decades, we have witnessed mass migrations and significant population growth in large cities as a result of newcomers' hopes of living better in the big city than in their current place of residence. The most urbanized regions in 2018 were North America (82% of the urban population), Latin America and the Caribbean (81%), Europe (74%), and Oceania (68%). The rate of urbanization in Asia is approaching 50%, and Africa is still predominantly rural with 43% of the urban population. According to forecasts, by 2030, the world will have 43 megacities with more than 10 million inhabitants, most of whom will be in developing regions. About half of the world's urban population lives in communities of less than 500,000 people. (Cekerevac, Prigoda, & Bogavac, 2022)

Cities must become smart to survive. In smart cities, it is necessary to use smart devices and equipment, tools, and machines with computer capabilities. Increasingly, these are IoT devices. Their memory enables data storing from sensors and performing operations for which devices are programmed. Smart devices include (Cekerevac, Prigoda, & Bogavac, 2022):

- sensors for monitoring the situation and notifying about changes in the environment.
- actuators that, based on observed changes in the environment, do physical actions through management actions.
- microcontrollers (usually microprocessors) with built-in memory, clocks, and equipment for connecting to external devices such as sensors, actuators, and transceivers for wireless data transmission.
- microcomputers with microprocessor, memory, and I/O devices on the same chip.

For the city to be 'smart', it must process and store a large amount of data. In doing so, it is necessary to perform appropriate transactions between unreliable participants. Blockchain technologies are needed to address transparency and security issues.

The blockchain industry is growing at an extraordinary rate due to the growth of the API economy. According to Cisco estimates (Heal, 2019), it is expected that 10% of global GDP will be stored on blockchains by 2027. In an attempt to ensure sustainability, cities are becoming 'smarter' every day.

In the case of smart cities, the following advantages of blockchain technologies stand out (Safonov, Kirsanov, & Palamarenko, 2022, p. 131):

- the trust of blockchain entities towards each other.
- the possibility of effective control of performed operations.
- stability of stored data integrity; and
- transaction speed.

Smart-city management systems in Great Britain, India, Korea, Singapore, Finland, and Switzerland, have already accepted blockchain technology, and this list will constantly grow. Blockchain has the potential to make cities smart - it allows the city to increase the efficiency of urban structures. (Woetzel, et al., 2018)

Sam Mire (2018) lists 12 possible uses of blockchain:

1. universal ID cards,
2. prioritizing local commerce,
3. land, property, and housing management,
4. energy / water / pollution management,
5. improving public transit,
6. interoperability for smart devices,
7. security for IoT devices,
8. rewarding citizenship,
9. urban planning,
10. departmental transparency,
11. universal data storage platforms, and
12. KSI – keyless signature interface for hosting government services and records.

Here, the blockchain is not considered just a platform on which a mass of new data can be securely stored and accessed by those authorized. Blockchain can be used as an interoperable platform that allows smart city dwellers to demand a certain standard from individuals and businesses when it comes to communal and environmental care. Also, such a platform can give greater voting rights in decisions that affect their hyper-local communities, from budgeting to elections, etc. (Mire, 2018)

4 LIMITATIONS OF BLOCKCHAIN TECHNOLOGY

One of the technological shortcomings of the bitcoin technology is the speed of transaction processing, i.e., the small number of transactions per time unit that can be considered insufficient for efficient use. Bitcoin users were the first to notice this. Many did a lot of work on creating models with increased transaction speed. Table 1 shows the average duration of transactions of cryptocurrencies with the highest market cap in March 2022. Bitcoin has the largest market share, so it survives even though the transactions take a long time. However, one can see that followers in terms of market share are significantly faster, which gives them a competitive advantage.

Table 1 Average transaction speed of cryptocurrencies

Characteristic	Time [min]
BTC – Bitcoin	40
ETH – Ethereum	5
USDT – Tether USD - ERC-20 protocol	5
USDT – Tether USD - TRC-20 protocol	2
USDC – USD Coin	5
XRP – Ripple	n-i.
ADA – Cardano	10
LUNA – Terra	n-i.
SOL – Solana	n-i.
AVAX – Avalanche	1
DOT – Polkadot	2
DOGE – Dogecoin	40
UST – TerraUSD	n-i.

** n-i. means near-instant*
Source: (Best, 2022)

The slowness of transactions is a consequence of the multitude of computational operations that need performing when validating a transaction and the demand for computing resources. Computer time is directly related to electricity consumption, affecting both the country's energy stability and environmental pollution. Thus, for example. China, a country that has long been at the forefront of Bitcoin mining and had a 75% share in total mining in September 2019, introduced a ban on further Bitcoin mining in June 2021. After that, the United States, Kazakhstan, and Russia took over. (EB, 2021)

Another problem with blockchain technology is related to the limitations of storage capacities. The total memory capacity is practically unlimited, but the capacities of individual nodes are limited. Also, the flow capacities of local networks are limited. All this affects the slowness of large blockchains. In the case of private blockchains with a small number of participants, these problems do not exist.

Legislation in the field of blockchain technology and cryptocurrencies is still undefined. There is no

uniform attitude of state administrations towards cryptocurrencies in the world. It is clear to everyone this must be resolved. Many are researching, but concrete results are rare. The regulatory situation is changing over time. For example, in September 2021, China declared all the cryptocurrencies' payments illegal. Previously, China was seriously dealing with cryptocurrencies. (BBC, 2021) This ban is explained by the concern that cryptocurrencies "seriously endanger the security of people's property". In Serbia, the Law on Digital Property of June 29, 2021, recognized the field of digital property, cryptocurrencies, etc. The law defines digital assets as 'digital value records that one can digitally buy, sell, exchange or transfer'. One can also use it as a "medium of exchange for investment purposes". There are two types - virtual currency and digital token. Blockchain is recognized as a system used for transactions and ensures that each transfer of value occurs only once. According to this law, legal entities can receive cryptocurrencies. The only condition is that the value paid in cryptocurrency converts into dinars through an exchange office. In that way, though the buyer paid with cryptocurrencies, the legal entity will receive dinars to the account. (Maksimović, 2021)

When it comes to individuals, the possession of cryptocurrencies is considered the possession of the property, so taxpayers need to apply any capital gains from the sale of digital assets. In Serbia, one must apply within 120 days from the end of the quarter in which he realized the income from the transfer of digital property. This deadline should enable the citizen to submit a collective application for transactions performed in the previous period. The problem is that, even in March 2022, the citizen could apply only in paper form. Just filling out the application is quite creative and determining the amount of tax will be even more creative. If someone bought, e.g., Bitcoins on several occasions, he likely bought them at different exchange rates. When selling, he sold them at the rate stated in the application. But a huge difference can arise due to the reporting of the price at which he bought them. It is not the same whether the application will state, e.g., $ 1 or $ 25,000. Rilakovic (2022) proposes that a tax rate of 15% be applied to the entire sales revenue if there is no data on the purchase price. According to the valid Serbia laws on games of chance and personal income tax, the games via the Internet and telecommunications are exempt from paying taxes. The winner gets the entire amount he wins. Given the stochastic changes in the market, buying cryptocurrencies is very similar to the game. The citizen is the only one who is at risk. The state of Serbia generates less than 1% of public revenues from capital gains tax. We believe that the state could waive this tax until the market stabilizes. That would relieve both taxpayers and government employees of activities related to determining the amount of taxes, and the comfort of the citizens would increase, but it would also accelerate the development of new technology.

Significant obstacles to the introduction of blockchain technology in the companies' business include the lack of understanding of the technology itself by the management of these companies. A survey that included 1,000 directors from seven countries found that directors in the United States and some EU countries were ready to implement the blockchain in 2019 in the next few years. In the countries of Central and Eastern Europe, the use of blockchain was only announced. About 70% of respondents saw the blockchain as more than a payment technology, and 76% believed that the use of blockchain would be widely present. However, only 27% expressed a willingness to replace their existing system, or at least part of it, with blockchain technology. 42% of respondents thought that their management team understood this technology. (Deloitte, 2019) Provided that the survey results can be considered relevant, 42% is a respectable figure.

5 CONCLUSIONS

Blockchain technology has great potential in automation, exchange enhancement, process optimization, and information protection. It can be used for a variety of purposes. Due to the decentralized system, there are practically no capacity constraints. In addition to increased transaction security, blockchain allows better privacy for users. Reducing the amount of human labor involved also reduces the risks of incorrect manual data entry. Transactions can become much cheaper because "third-party" participation is not required. Transactions are at the same time more secure because the whole system is transparent. However, although transactions are

generally simple, they need a lot of computer time, reliable hardware, and high consumption of power, so they cannot be free.

Blockchain time is coming. Companies announced many investments in this technology, but before they include blockchains into their business *en masse*, they need to understand it and provide staff who will successfully apply it. Given the rapid technological development of society, the speed of development of the application of blockchain will mostly depend on the building of social capacities and legal regulations.

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