Ed Tech
JOURNAL

Experiences and Recommendations regarding Cloud Cryptocurrencies

Simo Jaković[1], Dragana Petrović [1]*

1. Information Technology School – ITS, Belgrade, Serbia; simo@jakovic.com
*dragana.petrovic@imefedu.rs

Summary: Cryptocurrencies have been gaining incredible popularity in recent years. Their number has grown from a single cryptocurrency to several thousand, and the peak was reached in the period between 2021 and 2022 when the number of cryptocurrencies doubled to over 12,000. Many cryptocurrencies exist only to make money for their creators. The emergence of cryptocurrencies has changed the way in which people store money, invest, and pay for products and services. The number of companies that support payments in cryptocurrency is increasing, although there is still resistance from some countries to this method of payment. The paper explains how cryptocurrencies can be used, stored, and what cloud storage methods are currently available. It also provides a brief description of technologies that are used to create cryptocurrencies. The second part provides an overview of the profitability of cryptocurrencies, explains whether it is actually profitable to invest in this form of "digital gold", and presents the best options for mining cryptocurrencies.

Keywords: business, cloud, cryptocurrencies, currency, finance, money, Internet

1. Introduction

Cryptocurrencies emerged due to people's dissatisfaction with the way banks managed their money, and governments' desire to control currencies. Cloud computing has enabled the development and widespread use of cryptocurrencies around the world.

The paper will discuss the origin and development of cryptocurrencies, as well as Blockchain technology, providing examples of several major cryptocurrencies, and parts of the algorithm used for creating them. A part of the paper will be dedicated to digital wallets, and ways to store currencies in the cloud.

Blockchain methodology represents a new technology implemented through chains of data, or blockchains, whereby each block contains a certain type of data. The technology by which these blocks are connected into a chain is called cryptography, and it ensures their immutability. If one block is modified, the content of all other blocks in the chain will be modified as well. This methodology is based on the principles of immutability, decentralisation, and transparency. Immutability means that once the data are recorded on a block, they can never be modified again. Decentralisation means that data is stored on each member of the network/chain, instead in a single place, which allows their exchange and sharing without intermediaries. The transparency of transactions means that every realised transaction between network members will be visible.

For the purposes of our analysis, literature in the field of Blockchain methodology that studies types of cryptocurrencies, Blockchain applications, digital wallets, the future of cryptocurrencies, and their mining was used. Banafa and Mougayar explained the role and importance of Blockchain technology in the modern world. Internet sources, such as Wikipedia (page about Bitcoin) and Ripple (payment protocol) were also used. We used data from websites that provide information about cryptocurrencies, the development of Blockchain technology, and the future of cryptocurrencies. Websites Wikipedia (page about Bitcoin), Bitcoin Price and Best Cloud Mining Sites explain the types of cryptocurrencies (Bitcoin, Ethereum and Ripple). The following websites were used as a source of information for the analysis of cloud storage and mining: blockchain.com-scaling and saving with cloud Spanner, learn.bybit.com/crypto/what is cloud mining and best-cloud-mining-sites-trusted.html. Morkunas et al. explained how Blockchain technology affects corporate business and concluded that this technology will have strategic importance in the innovation of corporate business models.

2. History of cryptocurrencies

Cryptocurrencies first appeared in 2009, and the first one was Bitcoin. Bitcoin is still the most popular and widely used cryptocurrency.

It is unknown who exactly created Bitcoin, but it is speculated that it was a group of people or one Satoshi Nakamoto. Cryptocurrencies addressed the problem of outdated banking systems and created quite a buzz among people.

The original idea of cryptocurrency can be traced back to 1998 when it was discovered to what extent banks actually control money flows. People wanted to use digital technologies to create a kind of "digital gold" so as to get some sort of protection against inflation.

Bitcoin was created using Blockchain technology and became the most popular cryptocurrency. Other popular cryptocurrencies include Ethereum, Dash, Litecoin, and others. The use of cryptocurrencies was safer because no one could copy or counterfeit them, not even their creator [1].

3. Blockchain technology

Blockchain is simply software which is defined as follows: "a distributed database that exists on multiple computers at the same time. It is constantly growing, as new sets of records or blocks are added to it. Each block contains a timestamp, or link to the previous block so that they actually form a chain" [2]. There is another definition that reads: cryptography + human logic.

3.1. Blockchain components

Blockchain comprises five components:

» Cryptography;
» P2P network;
» Consensus mechanism;
» Ledger;
» Validity rules.

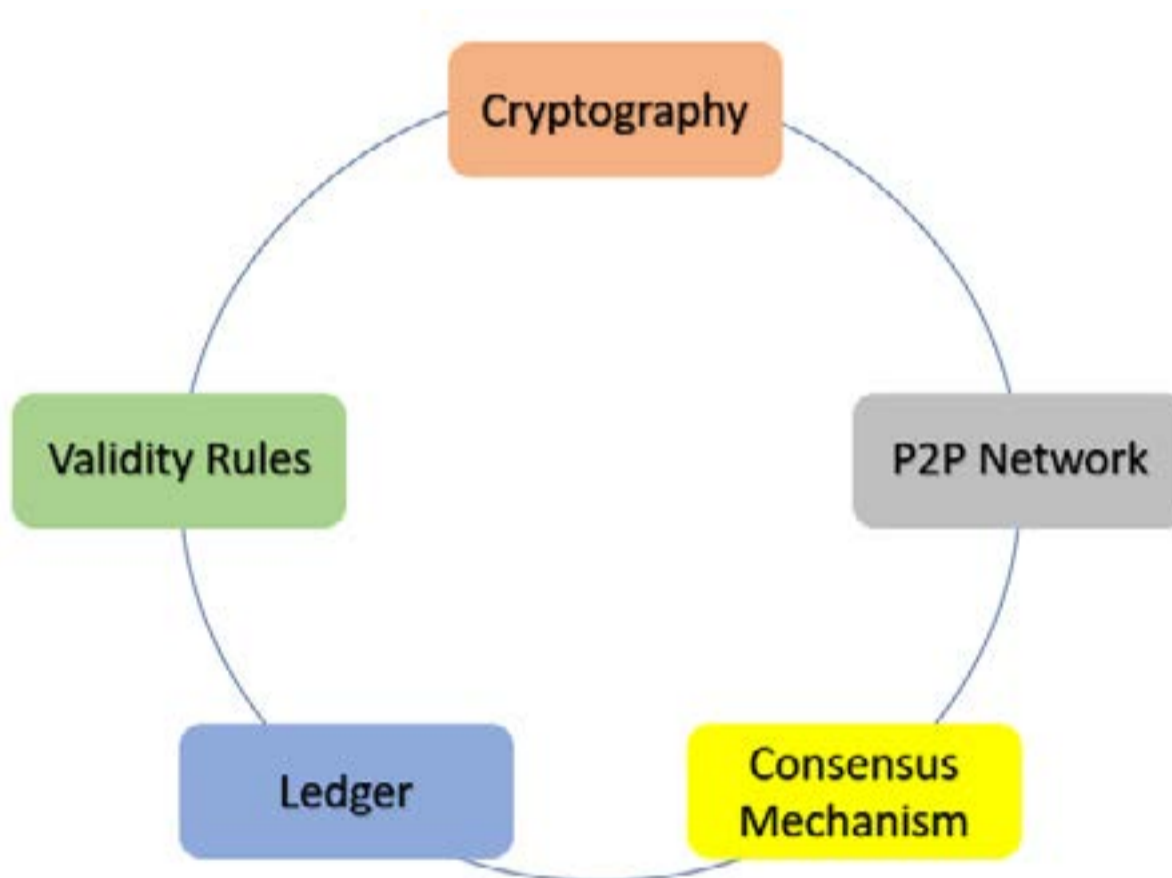Blockchain components are shown in Figure 1.

Figure 1. Blockchain components [2]

Any of the following languages can be used for programming Blockchain platforms: C++ (Bitcoin), Python, JavaScript, Solidity (Smart Contract), Java and Go. Figure 2 shows a sample of code used for creating an instance of Blockchain block in JavaScript.

4. Three types of cryptocurrency

There are many types of cryptocurrencies, and although all of them are based on similar principles as Bitcoin, each cryptocurrency is designed to provide some unique functionality. Reliability is crucial for cryptocurrencies.

Each cryptocurrency is designed using Blockchain technology, and each is encrypted using a special computer code [16]. This code is known as cryptography. The three most popular cryptocurrencies will be described in more detail below.

```
class Block {
    constructor(timestamp, transactions,
    previousHash = '') {
        this.previousHash = previousHash;
        this.timestamp = timestamp;
        this.transactions = transactions;
        this.hash = this.calculateHash();
        this.nonce = 0;
    }
}
```

Figure 2. Example of Blockchain block code [3]

4.1. Bitcoin

The first and most popular cryptocurrency was created in 2009. The algorithm for mining bitcoin (solving mathematical problems) requires more computational power than others, which makes mining more difficult and expensive. This gives value to Bitcoin and makes it more difficult to create others, which increases market demand. Bitcoins are decentralised, meaning that they do not rely on any central bank or governing body. Bitcoin uses Blockchain technology in combination with mathematical software algorithms that control its circulation, preventing the build-up of inflationary pressure due to the overproduction of units of currency. Bitcoin does not only launch trends in the cryptocurrency network built on the principle of decentralisation but has also become the de facto cryptocurrency standard [4].

4.2. Ethereum

Ethereum is a public, open-code Blockchain that can be used to develop and deploy decentralised applications. Vitalik Buterin proposed Ethereum as a platform for executing peer-to-peer smart contracts – code agreements that execute automatically when certain conditions are met, without being controlled by any central bank or national government. A notable feature of this currency is its support for "gas" based on the bid, instead of asking prices, like most other cryptocurrencies. This ensures that transactions will not get stuck because there is no incentive to process them later if they are expensive now. Other features of Ethereum include a scripting language that allows people to create their own tokens, as well as compatibility with Bitcoin addresses, which means that it is not necessary to add a new address every time money is sent. Ethereum was created in 2013 [5].

4.3. Ripple

A currency that connects banks, digital asset exchange, payment providers and companies through a unique settlement infrastructure to ensure a seamless experience for sending money globally. The company was founded in 2012 by Chris Larsen and Jed McCaleb who wanted to enable instant international payments for banks without the need for a correspondent bank. Ripple is fast and has low transaction costs (with plans to reduce them further). It is focused on integrating other providers into its network through rebranding, so that it integrates with different technologies in different use cases, such as global companies looking at transfers/payments, e-commerce sellers accepting payments from overseas consumers, etc. [6]

5. Blockchain applications in financial services

From an internal point of view of implementation, the evolution of Blockchain in the sector of financial services will take place in line with the segmentation of the main areas of application:

» consumer-oriented products;
» B2B services;
» trade and capital market;
» background processes;
» intermediary services across industries.

What is common for all cases listed above is that these transactions are on a peer-to-peer basis from start to finish, without central intermediaries.

The contracting parties do not have to know each other or require a third party to mediate the transaction. Decentralisation and finality of peer-to-peer transactions are the key innovations of Blockchain that must be preserved in order to maximise the potential effect of Blockchain implementation [17]. The identity and reputation of other parties are automatically verified on the Blockchain via wallet addresses.

There are numerous applications where Blockchain or distributed consensus ledger solutions will make much sense [2].

The biggest segments that will be affected are bonds, exchange, derivatives, commodities, securities, over-the-counter markets, collateral management, syndicated loans, warehouse receipts, and the repo market.

6. Digital wallets

A digital wallet is a cloud-based software or application that safely stores a user's payment information to allow them to buy online on different websites, or in physical stores without having to provide payment information. The procedure is fairly simple. To set up a digital wallet, you first need to install software on your device or access it through an online platform. Then, you need to create an account where you will add personal information, payment details, or any other necessary verification information. In the next step, your bank needs to confirm your payment details, and you can start using the wallet app to pay online wherever you want with a simple click or a tap. When shopping in physical stores, mobile wallets use near-field communication (NFC) to complete the payment. If the merchant's payment terminal has a contactless payment symbol, you can simply point your smartphone toward it and confirm the purchase by scanning the QR code, entering a password, or pressing the required button [7].

Cryptocurrency wallets work in a similar way as those designed for digital money, except that the latter are linked to physical vaults where physical money is stored, while cryptocurrency wallets are used for storing private keys used to gain access to digital coins stored on cloud Blockchain.

The private key is the most important thing when working with cryptocurrency wallets because without it, the user will not be able to access their money. In order to send or receive funds using a cryptocurrency wallet, one also needs a public key. This key does not allow access to the funds stored in the wallet but is used as a wallet address, such as a card or account number. Most cryptocurrency service providers offer the option of dynamic public keys, allowing their change before each transaction. This function is said to improve the security of the wallet, but on the other hand, it can also create additional problems. The point is that transactions recorded on Blockchain are immutable so that as long as the user generates a new wallet address, the old one becomes invalid. All funds subsequently sent to the old address are irretrievably lost both for the sender and the recipient. For this reason, one must be careful when entering a public key, before confirming the transaction. If a mistake is made, the funds will be lost [7].

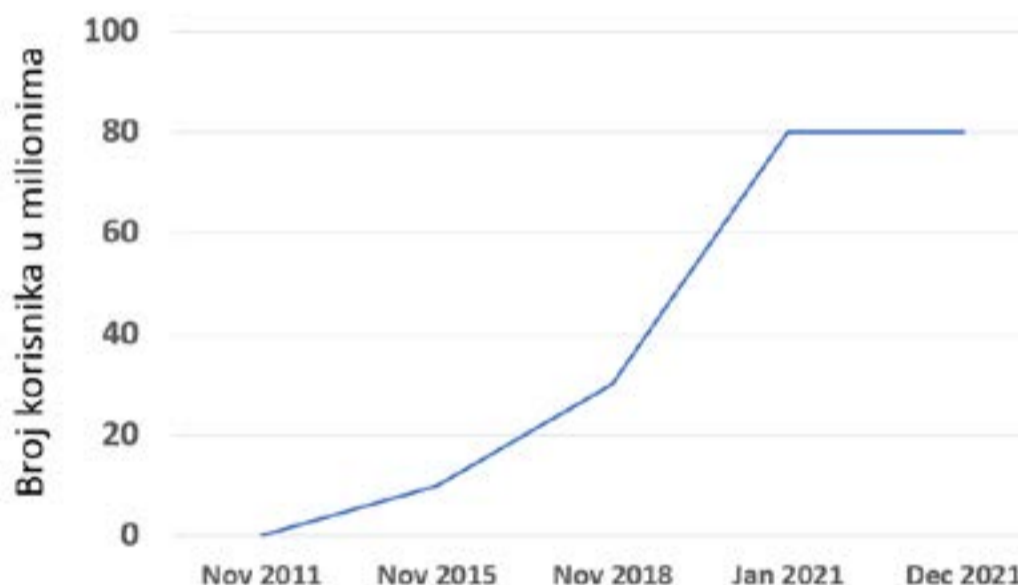Figure 3 shows the growth of the number of digital wallet users between 2011 and 2021.

Figure 3. The number of digital wallet users between November 2011 and December 2021 [8]

7. The future of cryptocurrencies

Economic analysts are predicting a major shift in cryptocurrencies as institutional money enters the market. There is a possibility that cryptocurrencies will be listed on the Nasdaq, which would further increase the credibility of Blockchain and its application as an alternative to conventional currency [9]. A crypto-verified exchange-traded fund would definitely make it easier to invest in Bitcoin, but there still needs to be a desire to invest in cryptocurrency, which may not be automatically generated with the fund [15].

Investing in cryptocurrencies should be treated in the same way as any other highly speculative venture. Cryptocurrencies have no intrinsic value other than what the buyer is willing to pay for them at a given time [18].

Cryptocurrencies are subject to large price swings, which increases the risk of loss for investors. Table 1 shows the prices of Bitcoin over the period of four years. You can see that the fluctuations in the price of Bitcoin are quite large for 2017 and 2018, as well as 2020 and 2021.

Table 1. Bitcoin prices in the period between 2017 and 2021 [10]

Year	Price (USD)
	46.732,74
2020	10.764,2
2019	7.251,28
2018	3.689,56
2017	13.062,15

Analysing a few years back, we can see that the fluctuations in the value of cryptocurrencies are large, and this is something that has attracted a lot of investors around the world in a very short period. Although many financial experts recommend cryptocurrencies as a safe investment, instead of, say, real estate, stock market shares, or others, no one gives specific reasons or explains why one should invest in cryptocurrency. The thing that supports the claim about cryptocurrencies being a low-risk investment is the ROI (return on investment) index, which is the highest for all financial products on the market. But, it cannot and should not be the only reason for investing in cryptocurrencies. What about reliability? The current price of Bitcoin is around 47,000 USD [10], but, four months ago, it was 67,000, which indicates the high volatility of this currency. In addition, it is observable that all other currencies increase and decrease together with Bitcoin which indicates their connection and interdependence. This is not good either, because it means that more or less all currencies behave in the same way.

If you want to mine them, you will again have to invest a lot of money into computers and consume a lot of electricity, so the question is – how cost-effective it is. The current price of electricity in the Balkan region is affordable, so this may be the only region in the world suitable for cryptocurrency mining. In addition, websites where you can trade in cryptocurrency charge a fee for each transaction, so this is something that one must be aware of as well.

8. Cloud storage and mining

The cloud has proven to be a suitable platform for storing and developing cryptocurrency. Blockchain, a Google Cloud user, was initially focused on creating tools to help users understand and use Bitcoin, but the company has since expanded to other cryptocurrencies, such as Ethereum, Bitcoin Cash, Stellar Lumens and Pakos Standard. Now, millions of individuals rely on the Blockchain wallet to secure and use the world's leading cryptocurrencies. Needless to say, with the growing size and geographical expansion of the user base, managing these datasets is not an easy feat, and would not be feasible without the cloud [11].

Since the company's inception, Blockchain has used the Google Cloud Platform (GCP), adding services wherever the team saw opportunities to meet their evolving needs. While Blockchain maintains some of its own hardware and data centres, the company also wanted to develop its own approach to infrastructure management so as to improve the security, reliability and accuracy of information platforms [11].

Blockchain's flagship products, Blockchain Wallet and Blockchain Explorer require complex calculations of hard-to-find data in massive, decentralised ledgers that support cryptocurrency networks. Accessing these data requires complex domain knowledge, technical infrastructure, and development effort, not to mention the time needed to process entire data chains. This became a major venture that required significant internal IT resources and overheads [11].

To manage these challenges and improve the user experience across all products and platforms, Blockchain has started running infrastructure on Compute Engine instances. Blockchain also chose Cloud Spanner as its database service of choice, because this database server can scale quickly (without hitches and delay) and provide high accessibility with low operational costs. Cloud SKL, Stackdriver and identity management products are also part of the Blockchain cloud infrastructure [11].

8.1. Cloud mining

Cloud mining is a process of cryptocurrency mining that uses a remote data centre with shared processing power. Cloud mining helps users to mine Bitcoin or other cryptocurrencies without having to use their own hardware. Mining platforms are housed in a facility owned by the mining company. The user needs to register and purchase mining contracts to start the cloud mining process. It is the process of generating cryptocurrencies using leased computational power from a third party (cloud mining service provider). Each miner actually participates in a "mining farm" (remote data centre dedicated to crypto mining) by purchasing a certain amount of "hash power" from the service provider [14]. In return, the provider will grant them access to rewards that are proportional to the amount of miner hash power they purchased. Since mining is done in the cloud, miners do not have to worry about computer equipment maintenance, noise, heat, or electricity bills. After finding a reliable cloud mining service provider, miners need only to select the type of contract to sign and the desired duration. They will have to pay upfront, either in Fiat currencies or digital currencies, after which, the provider will set up everything they need for the operation [12].

8.2. How cloud mining works

There are two types of cloud mining: host mining and hash power rental.

In host mining, miners rent or purchase mining rigs on mining farms, and pay for their setup and maintenance. This model reduces costs associated with access to electricity. In addition, since miners have more control over the rigs, they can redirect the generated hashing power to mining pools. Moreover, miners have full control over the rewards generated [12].

Hash power rental is a system in which miners lease a portion of the hash power generated by the mining farm. They essentially subscribe to a plan offered by the cloud mining company and get a share of the mining farm's profits. Miners do not have to pay for any setup or maintenance fees, and mining rewards are distributed according to the share in the hash power controlled by each miner [12].

Table 2 shows a hand-picked list of the best cloud mining companies, their popular features and website links. The list also includes open-source (free) and commercial (paid) software.

Table 2. Cryptomining websites [13]

Name	Year of establishment	Supported cryptocurrencies
ECOS	2017	Bitcoin, Ethereum, Ripple, Bitcoin Cash, Tether, Litecoin
ChickenFast	2015	Bitcoin, Ethereum and Bitcoin Cash
Trustcloudmining	2017	Bitcoin, Ethereum, Zen and more
BeMine	2018	Bitcoin, Ethereum, Zcash
Shamining	2018	Bitcoin
Freemining	2014	Bitcoin, Litecoin, Dogecoin, BCH, XMR i TRX

8. Conclusion

In this paper, we explored cryptocurrencies and explained how they operate in cloud computing. We came to the conclusion that without cloud computing, there would be no cryptocurrencies, and that it is the basis for the further development of cryptocurrencies. We have observed that the cryptocurrency market is still volatile and that the behaviour and expected profits cannot be predicted with any certainty. Many countries still do not support cryptocurrencies, and some even ban them (e.g. China), thus preventing the entry of these currencies into legal market flows. As long as cryptocurrencies do not have an intrinsic value, it is difficult to talk about their future. Also, it is imperative to create a crypto fund that would facilitate cryptocurrency trading.
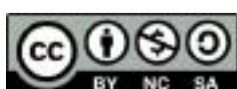
Improving cloud computing and security remains a challenge because, with the development of cryptocurrencies, financial transactions are moved to online platforms, which increases the risk of cyber attacks on the accounts of users who store their data in the cloud. The security of Internet browsers is one of the basic forms of protection when conducting cryptocurrency transactions. Browsers with enhanced security features should be used.

Blockchain technology is a new technology consisting of a chain of immutable blocks, and it is yet to find its rightful place in the 21st century. The importance of this technology lies in the fact that it is applicable in all areas of life (finance, industry, real estate, healthcare, etc.). The most popular cryptocurrencies are Bitcoin, Ethereum and Ripple. Cryptocurrency trading is gaining in intensity, which is why cryptocurrency will become the means of payment in the future. However, one should be careful when using cryptocurrencies, because they are volatile due to large fluctuations, and still represent a high-risk investment. A digital cryptocurrency wallet ensures that cryptocurrencies are always safe, as they are stored using digital passwords that are always within the user's reach. They are quite easy to use, but the most important thing is to store one's private keys that are used to access digital coins stored in the Blockchain cloud.

In conclusion, the future of cryptocurrencies in the world's financial markets is uncertain, because they are not regulated by central banks or other financial institutions. Due to their decentralisation, cryptocurrencies are subject to systemic risks, so their value can fluctuate quite a lot in short periods. However, countries will continue to seek ways to regulate cloud cryptocurrencies. It can be argued that these currencies, together with Blockchain technology will continue to pose a challenge as a means of payment, and realisation of financial transactions in the global market, and time can only tell whether they will completely replace traditional currency or not.

References

1. Frank. Cryptocurrency History. Online Wealth Chronicles. [Internet]. 2021 December 24. Available from: https://onlinewealthchronicles.com/when-why-did-cryptocurrency-start

2. Banafa A, Blockchain Technology and Applications. River Publishers; 2020

3. Mougayar W, The Business Blockchain: Promise, Practise, and Application of the Next Internet Technology. 1st Edition. Wiley; 2016

4. Bitcoin. Wikipedia. [Internet]. 2022 February 15. Available from: https://en.wikipedia.org/wiki/Bitcoin

5. Ripple (payment protocol). Wikipedia. [Internet]. 2022 March 15. Available from: https://en.wikipedia.org/wiki/Ripple_(payment_protocol)

6. Ethereum. Wikipedia. [Internet]. 2022 March 20. Available from: https://en.wikipedia.org/wiki/Ethereum

7. Jules. Digital Wallets. Easyship. [Internet]. 2021 December 27. Available from: https://www.easyship.com/blog/digital-wallets-guide

8. Number of Bitcoin block explorer Blockchain.com wallet users worldwide from November 2011 to March 27, 2022. Statista. [Internet]. 2021 December 29. Available from: https://www.statista.com/statistics/647374/worldwide-blockchain-wallet-users

9. Daily Stock Market Overview, Data Updates, Reports & News. Nasdaq market. [Internet]. 2021 December 29. Available from: https://www.nasdaq.com

10. Bitcoin Price | BTC Price Index and Live Chart. Coindesk. [Internet]. 2022 March 28. Available from: https://www.coindesk.com/price/bitcoin/

11. Poole A, Srivastava D, Blockchain.com, scaling and saving with Cloud Spanner. Google Cloud. [Internet]. 2022 January 04. Available from: https://cloud.google.com/blog/products/databases/blockchain-scaling-and-saving-with-cloud-spanner

12. What Is Cloud Mining and How Does it Work? Bybit Learn. [Internet]. 2022 January 10. Available from: https://learn.bybit.com/crypto/what-is-cloud-mining

13. Thompson B. 10 BEST Cloud Mining Sites (Bitcoin, Ethereum Mining). Guru99. [Internet]. 2022 January 05. Available from: https://www.guru99.com/best-cloud-mining-sites-trusted.html

14. Montecchi M, Plangger K, Etter M, It`s real, trust me! Establishing supply chain provenance using blockchain, Business Horizons, Volume 62, Issue 3, 2019, pp. 283-293.

15. Morkunas JV, Paschen J, Boon A, How blockchain technologies impact your business model, Business Horizons, Volume 62, Issue 3, 2019, pp. 296-306

16. Casey JM, Vigna P, The Truth Machine: The Blockchain And The Future of Everything, Book Depot Inc, 2019

17. Tapscott D, Lansiti M, Lakhani RM, Tucker C, Blockchain: The Insight You Need from Harvard Business Review (HBR Insights), Kindle Edition, Boston, Massachusetts, 2019

18. Jović Z, Kunjadić G, Monetary and Technological Aspects of the Emergence and the Development of Cryptocurrencies, FINIZ -The Role of Financial and Non-Financial Reporting in Responsible Business Operation, Singidunum University International Scientific Conference, Belgrade, 2018, pp. 63-67.