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Erdogan Kaygin *, Yunus Zengin **,
Ethem Topcuoglu ***, Serdal Ozkes ****

The Evaluation of Block Chain Technology within the Scope of Ripple and Banking Activities

* Kafkas University,
Kars,Turkey

E-mail:
kaygin@kafkas.edu.tr

** Kafkas University,
Kars, Turkey

E-mail:
yunuszengin@kafkas.edu.tr

*** Kafkas University,
Kars,Turkey

E-mail:
ethemtopcuoglu@kafkas.edu.tr

**** Kafkas University,
Kars, Turkey

E-mail:
serdalozkes@jandarma.gov.tr

Abstract: Technological developments have always led to changes in all aspects of our lives. Crypto currency is one of those changes. As a result of those changes, thousands of currencies such as bitcoin, ripple, litecoin and ethereum have evolved and have found a use in business. The present study focuses upon Ripple and tries to explain its effects on banks and business theoretically. It has been stated that the money transfer performed through Ripple is faster and more economical when compared to present systems. Additionally, it has been realised that the present SWIFT system has been influenced by that speed and economy, and therefore taken considerable technologic steps with an effort to improve its system.

Keywords: Ripple, Bitcoin, block chain, crypto currencies, banking and Ripple, SWIFT.

JEL Classification: M15, M21, M48.

1. INTRODUCTION

The internet, computer, mobile phones and other technologic activities have great impact upon daily lives of people and the technology increasingly penetrates into our lives. Technology alters existing habits over time. While reading a printed newspaper was a tool and an indicator of cultural level in our society, currently reading a printed newspaper instead of using mobile phones provides learn-

ing later rather than being up to date. This change cannot only be observed on this example but also by looking at the number of people who go to a pay office to pay their gas and electricity bills as a result of mobile and electronic banking activities, which constitutes the changes easily observed in daily life.

Business life has undergone changes as did our daily lives. Entrepreneurs have a tendency to open virtual stores on websites instead of physical shops or stores. Thanks to this method, rents for shops and stores are not paid, a store is not restricted to a single area, the restriction of space and place goes away, transactions can be controlled by computers or even by mobile phones, strong companies are addressed in terms of refund and the refund is definitely taken (Wong, Lau & Yip, 2020). In many societies, it has been common to purchase extra-territorial things through the use of foreign websites such as Alibaba, Ali Express, Gearbest, Geekbuying, Geek, Amazon, and eBay.

The increasing spread of electronic shopping systems has resulted in an increase in commissions paid to the banks and duplicated spending; secure electronic systems of spending and payment have been needed due to slow processing speed of the banks, being the third party and the incidents of stealing credit card information (Luburić, 2020). The Bitcoin and block chain technology had been formed in response in 2008 by Satoshi Nakamoto and the first Bitcoin transaction was effected in 2009 (Gulec & Aktas, 2019). The technology of block chain has developed in time and paved the way for companies of crypto money and block chain solution such as Ripple, Ethereum, Litecoin, Corda, Nexledger, and Hyperledger using the same technology as Bitcoin and being privatized in accordance with its area of use.

2. CONCEPTUAL ENVIRONMENT

Throughout the present study, the money transfer systems used in our country and in the world, Bitcoin and block chain technology and the negative effects of Bitcoin upon business have been explained within the scope of conceptual environment. Furthermore, the opportunities to be provided by Ripple showing performance in the field of banking by privatizing the same technological elements as Bitcoin have been considered.

2.1. The Present Banking System

There are three different practices in terms of money transfer. The first one involves remittance process in which money is transferred from bank A of the deposit account to another account in bank A. The remittance is allowed every day for twenty four hours and the time for money transfer between accounts is stated with seconds. The second practice involves EFT (Electronic Fund Transfer) in which money is transferred from deposit account of bank A to a deposit account in bank B in Turkey. Through this method, transactions can be performed every weekday between 8:30 a.m and 05:30 p.m except during bank holidays (TCMB, 2019). When compared to the remittance system, the process of transaction is longer and more costly. The third practice involves SWIFT (Society of Worldwide Interbank Financial Telecommunication) in which money is transferred from a bank account in Turkey to another bank account abroad. The transaction through this system can be performed every weekday until 05:00 p.m except during bank holidays (Kuwait Turk, 2019). It can be performed by authorized banks. The transaction actualizes within 3-4 days while it changes from one bank to another (Sanlısoy & Ciloglu, 2019). The SWIFT process is more expensive in comparison to EFT and remittance practice. In the world, approximately two millions daily and over 7.8 billions yearly SWIFT transactions are conducted in 200 regions. The value of SWIFT transactions performed in a day is above 300 billion dollars (SWIFT, 2018a).

2.2. Bitcoin and Block Chain Technology

Many innovations and inventions exist and develop as a result of building new and better ones upon present ones rather than finding out nonexistent ones. Indeed, the block chain technology was built upon peer-to-peer (P2P) technology. The P2P technology was used in programs such as Napster, LimeWear, Bittorrent in 1990s to enable videos, music and other data to be shared without a central authority. Together with block chain technology located upon P2P, Bitcoin is shared instead of films and data. The security of Bitcoin system is provided through crypto technology and interpersonal money transfer is performed without need for third parties such as banks and financial institutions. This system provides opportunity for faster and cheaper money transfer (Kaygin, Topcuoglu & Ozkes, 2018).

In Bitcoin system, the currency is named Bitcoin and abbreviated as BTC. One BTC is separated into smaller currencies corresponding to 100 millions Satoshi (Bonneau et al., 2015). For purchase and sale of Bitcoin, stock markets such as

Binance, KuCoin, BitFinex, Coinbase and Kraken exist and transactions are conducted on those stock markets in exchange for dollar, euro, yen, and renminbi whereas in Turkey there are stock markets like BtcTurk in which transactions are performed through Turkish Lira (TRY).

As no central authority exists, reliable nodes in more than one point (i.e. computer systems) are needed to provide maintenance of the system and to perform transactions. Called miners, those nodes take the responsibility of mathematical calculations so as to operate the system, complete the blocks and form new bitcoins. The miners are given incentive payments so that they can cover CPU power (electricity power) and other costs that they have spent during transactions. This incentive payment involves giving 50 BTC award (12.5 BTC since July 2016) to the first miner forming successful block (Khalilov, Gündebahar, & Kurtulmuşlar, 2017).

The system continues by interpenetrating in the form of a chain created by blocks coming together. In nearly every ten minutes, a block having 1 MB processing limit is formed and 7 transactions are performed in a second in each block (Zheng et al, 2017). The one who wants to transfer Bitcoin signs digitally the hash (proofing keys) of the previous transaction and public key (anonymous name) of the one who will get the money and form transaction by adding those to the end of records. The credit side can confirm signatures, tenure and the chain via system (Nakamoto, 2008).

To operate the system mentioned above, some critical elements are required as follows;

Security; the security of the system is provided by Secure Hash Algorithm (SHA), a system which enables storing demanded information by separating into insignificant pieces with a definite algorithm and resolving them by combining those insignificant pieces when demanded. It is known as a cryptographic system SHA-2 (SHA-256) used by Bitcoin. At present, many applications utilise from SHA-1, which could be broken formally in 2011 by the USA National Institute of Standards and Technology (NIST). Furthermore, over 9 quintillion SHA-1 accounting (9.223.372.036.854.775.808) in total was made by the cryptology group in Google and Centrum Wiskunde & Informatica (CWI) and it was proved that SHA-1 was able to be broken with 6500 years CPU (processing unit) accounting to complete the first phase of the attack and 110 years GPU (graphic unit) accounting to complete the second phase (Karakose, 2017). It is impossible to break SHA-256 cryptographic technology for now.

Distributed Accounts Recording Book (public ledger); It is compulsory for businesses and banks to keep accounts or records, which are generally kept and recorded at a single central point. Moreover, the records kept are secret and the businesses do not want them to be known by anyone except for stakeholders. While the present system is like that, those records are used, kept and seen by all nodes included in the system with block chain technology rather than being at a single point. It is possible to see all records belonging to transactions performed as of January 3, 2009 when the system started to be used. Those records are accessible to public and the vendors and purchasers can be viewed through anonymous names (i.e. nickname).

Cyber Security; while collecting records at a single centre or in a hand pose a risk to cyber attacks, keeping the records in a distributed way at various nodes prevents the risk of a central attack. While attacking the banks and business systems practicing single, common and certain security protocols is quite easy for cyber pirates, it seems impossible to succeed in attacking a system consisting of ten thousands or perhaps hundred of thousand users, renewing itself every ten minutes (every few seconds for Ripple) and working instantaneously over the same record book. After a block is closed, both transactions of the previous block and those belonging to the new block should be blocked until the other block is reached (i.e. ten minutes). As stated by Nakamoto, such interference is impossible without gaining 51 % of the system (Nakamoto, 2008).

In Bitcoin system, gaining 51% of the system by one segment is called Byzantine Generals, which refers to the fact that some generals betray during a war and work for the benefits of the enemies by participating in their folds. In this respect, Byzantine Generals problem appears as the matter in which some miners in nodes cooperate and gain 51% of the management (Schwartz, Youngs & Britto, 2014). The shares of miners over mining pools system transactions are found to be F2Pool (18.2 %), Poolin (15 %), BTC.com (11.1 %), Antpool (9 %) (btc.com). In the light of this data, it is thought that experiencing the Byzantine Generals problem will not be as difficult as expected.

Double Posting, the mistakes of double posting disappear as a result of making instantaneous entries and approving within approximately ten minutes by majority of the users. It is not possible for the one not having money to spend and for a spending to be taken in twice (Aggarwal et al., 2019).

Time, confirming the accuracy of transactions and controls performed by the banks sometimes takes hours and even days while complete accuracy of hashes

providing confirmation in this system can be obtained within 30 minutes (Monrat, Schelén & Andersson, 2019).

The use of Bitcoin in processes such as laundering, illegal sale of drugs and weapons, child pornography is quite common. 46% of transactions performed by 26% of total Bitcoin users consist of illegal transactions (Foley, Karlsen & Putniņš, 2018). It has been realized that the purchase and sale processes practiced with Tether, a crypto currency, lead to speculative movements upon and increase its prices (Griffin & Shams, 2018).

The value of Bitcoin can increase or decrease instantly as it has not been produced in exchange for a value (i.e. gold, silver etc.). The fact that one Bitcoin was traded for 12$ in October 2012, 266$ in April 2013, 1240$ in December 2013, and 339$ in April 2014 in free stock market draws an inconsistent graph (ECB, 2015). In free stock markets, a Bitcoin costing 13,854$ on average during January 2018 was traded for 10,125$ as of February 9, 2020.

The fact that the wishes of the states to collect taxes from earnings gained through Bitcoin and to keep those markets in order increases day by day and it will make it difficult to provide maintenance of the system. Especially observing the presence of terrorist organisations, illegal groups and laundering enforces the demand for controlling those markets. Carrying taxation into practice in France in 2014 and the legal arrangements performed in Sweden, Germany, the USA, and Japan prove these cases (Uzer, 2017,).

When the matters mentioned above are considered, the currency of Bitcoin is found to pose great risks for business and banks and is thought to bring about damages rather than benefits. In this respect, the issue will be evaluated through Ripple which will provide facilities for business and banks using block chain technology and will not create problems in terms of legal procedures (Koc, 2019).

Ripple was founded by Jed McCaleb, Arthur Britto, David Schwartz, and Ryan Fugger in 2012, which gives service under the name of Ripple (XRP), a crypto money dealt in stock markets, and RippleNet as a supplier of infrastructure for financial service institutions. The systems of XRP and RippleNet utilise from the same infrastructure properties. Through RippleNet, the contracted banks and its offices in different countries all around the world provide the services of fast and safe money transfer from one point to another point with the help of block chain technology. The company has offices in San Francisco, New York, London, Sidney, India, Singapore and Luxemburg. Contrary to other crypto currencies, the service points, company managers and those making investment in the

company are displayed transparently on the authorised website. While security and distributed ledger systems are the same as those of Bitcoin, it differs from Bitcoin in terms of the ones keeping the distributed ledger, the company's own nodes and the nodes determined by the commission beforehand. In Ripple system, because of the fact that all the nodes have been solved and are known, the problem of Byzantine Generals has been completely solved. This system is called as UNL (Unique Node List). In order for transactions to be performed upon Ripple system, transaction instructions of at least 40% of more than one hundred UNLs should match up with each other. Those matching data are carried into draft blocks and more than one voting is performed so as to be approved by UNL nodes. When matching at the rate of 80% is enabled as a result of voting, a new block exists in distributed ledger (Ali et al., 2019). As in the Bitcoin system, transaction records are open to public and are anonymous (Jani, 2018).

XRP is the third greatest crypto currency following Bitcoin and Ethereum in terms of market value (Gupta & Sadoghi, 2018). Ripple is dealt with the abbreviation of XRP in various crypto money stock markets. Ciaian, Rajcaniova and Kancs (2018) measured the change observed in values of Bitcoin and sixteen subcoins between the years of 2013-2016 with Autoregressive Distributed Lag (ARDL) model analysis. As a result, it was found that the macro economic and financial developments did not form a significant difference upon the value of XRP and the changes experienced in Bitcoin prices did not influence XRP. Fry (2018) practised rational bubble model for crypto currencies and detected bubble in Bitcoin and Ethereum while no bubble was detected in XRP. He explains that the reason why no bubble exists in Ripple stems from technological superiority of Ripple over Bitcoin.

XRP can perform 50,000 transactions while Bitcoin can make 7 transactions and Ethereum 14 ones in a second (Koens & Poll, 2018). When an increasing number of users is added into the inefficacy of Bitcoin in that it performs 7 transactions in a second, waits and losses of time become indispensable (Monrat, Schelén & Andersson, 2019). As well as waiting for 10 minutes to perform a transaction in Bitcoin, three blocks are required to be formed so as to understand that the transaction has been executed and become definite and six blocks are required in order to see that it is impossible to turn back. Briefly, the transaction becomes definite and irrevocable. Through XRP system, this transaction is performed only in four seconds (Armknecht et al., 2015).

There is no central unit to be applied when an incorrect operation is performed in Bitcoin. It is nearly impossible to get the money back when you have sent money to an unwanted person. While there are no systems to be addressed in other

crypto currencies, a firm named Ripple Lab. exists in XRP, in which the banks of Santander and Standard Chartered make investment. The headquarters of this firm is in the USA, with offices in various countries. In the event that you perform an incorrect operation, it is possible to apply to the banks operating with Ripple headquarters and offices.

The miners are not needed to operate XRP as in Bitcoin. A 100 million in crypto money was prepared during foundation phase (Jani, 2017). The miners constitute one of the most criticized issues of Bitcoin. The electricity spent for a transaction performed by miners is found to be equal to monthly electricity consumption of a house in the UK (Truby, 2018).

In RippleNet system, although it is not obligatory to buy XRP for money transfer, the money transfer operations are charged. Along with the increasing number of users in Bitcoin system, the money transfer operations which were free at the beginning have become 0.10 € (Boucher, Nascimento, & Kritikos, 2017), which can increase and change in accordance with the amount of Bitcoin to be transferred. In the event that the demand for Bitcoin continues, it is estimated that the price will rise much more.

In the present study, the banking actions focus on Ripple rather than XRP actions. In this respect, RippleNet provides fast and safe money transfer through contracted banks by working based upon block chain technology. RippleNet is a solution partner that will provide benefits and opportunities for banks and business. The present customers of Ripple are mostly comprised of companies and financial institutions (Xiao, Zhang, Lou, & Hou, 2020).

Ripple provides service with more than 300 institutions in forty countries, and offers fast and economical money transfer to companies and institutions through contracted banks. The money transfer system has been divided into two different categories; the first of which involves members (i.e. banks and financial institutions) and the second one involves users (companies and customers) (Wang et al., 2019). Giving information about the extent of the service provided and the institutions worked together through some examples will be useful for understanding the issue.

An agreement was signed between Ripple and Standard Chartered (the UK), National Australia Bank (Australia), Mizuho Financial Group (Japan), BMO Financial Group (Canada), Siam Commercial Bank (Thailand) and Shanghai Huarui Bank (People's Republic of China) for pilot scheme in September 15, 2016 (Patterson, 2016). Furthermore, an agreement was made between ten financial

institutions and Ripple in April 26, 2017. The agreed institutions involve financial institutions such as MUFG (Japan), BBVA (Spain), SEB (Sweden), Akbank (Turkey), Axis Bank (India), YES BANK (India), SBI Remit (Japan), Cambridge Global Payments (Canada), Star One Credit Union (the USA) and eZforex.com (the USA). A partnership agreement was signed between American Express and Ripple in terms of money transfer except for card actions on November 16, 2017 (Ripple Team, 2017). Moreover, a partnership agreement was signed between Ripple and Moneygram on January 11, 2018 (Truby, 2018). An agreement was made between Ripple and Saudi Arabia Money Authority (SAMA) and Kingdom of Saudi Arabia Bank on February 2, 2018 over shifting to pilot scheme. SAMA and KSA are formal central banks of the Kingdom of Saudi Arabia and the institutions managing monetary policies (Sanlısoy & Ciloglu, 2019).

3. CONCLUSION

The present study is believed to have made a contribution to understanding the block chain technology and Ripple, improvement of long waiting periods experienced during money transfer, payment and banking actions of the businesses, evaluation of views regarding protection from risks of exchange rate and to the related studies (Al-Rjoub, 2021). The study utilised the method of literature search, which was found to contribute to determination of the scope of research problems, development of new research topics, elimination of useless methods, finding possible future studies and forming an idea about the methods to be used (Gultekin & Bulut, 2017). As a result of literature review conducted throughout the present study, only one study examining the relationship between SWIFT and Ripple was confronted. The study carried out by Qiu, Zhang and Gao (2019) suggests that the new systems like Ripple will change greatly the market of offshore transfer within 5 or 10 years.

The globalisation of the world has paved the way for removal of the borders and made it possible to have access to all geographies from China to the USA via the internet in the living room. While business has removed national borders and works through internet network for 7 days and 24 hours, the fact that the actions of EFT and SWIFT are performed only during weekdays between 08:00 a.m and 17:00 p.m gives damage not only to domestic trade but also to foreign trade. The mobile application developed by Ripple and Santander Bank provides opportunity to send money at an amount between 10 or 10.000 Sterlin to twenty one countries through Euro exchange and to the USA through dollars exchange (Santander Bank, 2019). The increase in those apllication will bring about increase in

satisfaction of customers for banks and the opportunity of instant transaction for businesses.

The business transfer or receive money as a result of export and import actions to other countries, and hence restricting those actions to office hours affects the business negatively. When you buy something abroad for your business, the product arrives and you want to pay for it, you will have to wait for 2-4 working days. Armknecht et al. (2015) realized that Ripple created a new distributed accounting records book within a few seconds at a rate of 99%. In the remaining 1%, this duration changes between 30 or 40 seconds, while this percentile declined below twenty seconds in the first two months of 2015.

In transactions performed through the RippleNet, it will be avoided that the institutions are blamed for laundering and tax evasion due to transactions performed through Bitcoin. Thus, the business and institutions will not be discredited. Moreover, the incidences of tax loss and post taxation will not exist since the states collect taxes through banks.

The losses which are possible to be experienced between the first price of a commercial item purchased from international markets and its price when the payment is performed are called exchange rate risk. The fluctuation in foreign currency in our country is a factor affecting the business negatively. In market conditions where 1 $ was worth 4.57 ₺ on July 6, 2018; 4.87 ₺ on July 11, 2018; 4.73 ₺ on July 23, 2018; 5.06 ₺ on August 2, 2018, the return of trade in the amount of 1 million ₺ or 1 million $ displays daily change. Whereas 1 million ₺ in the pocket of a tradesman costs 218,819 $ on July 6, 2018, it cost 205,339 $ on July 11, 2018 (doviz.com). Because the business will not have to wait and get money instantly thanks to fast money transfer through Ripple, they will not be influenced by exchange risk. In the same vein, the banks will minimise customer objections and loss of customers and remove the costs of supplementary staff for transaction follow-up.

The action of double accounting of one transfer or spending stemming from the banking system is called as double posting. The distributed accounts book developed by Ripple will prevent the incidences of double posting. Furthermore, the use of distributed account book will prevent the need for the business and the banks to search for how the money has been spent. Since this system also performs the reconciliation actions with record book, the time, expenditure and workforce spent for interbank reconciliation actions will be reduced, which in turn will contribute to the banks and business positively.

The use of Ripple transfer system in international payments will enable an opportunity for more affordable (approximately 60%) and faster money transfer with the help of direct transactions (Ripple Team, 2017). Furthermore, the idea of using block chain for interbanks money transfer by Ripple has influenced other business and institutions. For instance, SWIFT tries to perform money transfer through use of Hyperledger block chain tecnology with the participation of 34 banks (SWIFT, 2018b).

The system formed by Ripple becomes a turning point in terms of banking actions. However, transfer from one country to another is limited due to low number of members of RippleNet system. Even if the country has this system, the number of banks and financial institutions is limited as well. For example, in Turkey, this system is practiced only by Akbank. For the customers who do not have an account at Akbank, the use of this system may not seem practical and applicable.

For the business, not only Ripple but also block chain technolgies enabling different solutions are available. Handling containers used by Maersk with block chain technology achieve 300 $ saving per container (Diordiiev, 2018). With the agreement made by Maersk with IBM upon block chain issue, the product named TradeLens existed. According to the explanation made by IBM (IBM, 2018), TradeLens has reduced packaging costs of the products carried by the ships of Maersk performing in USA line in the ratio of 40% and made thousands of dollars profit.

The block chain technology is an innovation presenting many opportunities and capabilities together and providing diversity in terms of practice for the business and banks. The fact that the business focus upon block chain technology instead of crypto money which is not based upon any authority and has unsteady market price and banks find appropriate solutions for themselves will increase the profitability as in the example of Maersk and enhance competitiveness by achieving saving in terms of time and workforce.

References

1. Aggarwal, S., Chaudhary, R., Aujla, G.S., Kumar, N., Choo, K.-K.R. & Zomaya, A.Y. (2019). Blockchain for smart communities: Applications, challenges and opportunities. *Journal of Network and Computer Applications*, 144, 13-48.
2. Ali, M.S., Vecchio, M., Pincheira, M., Dolui, K., Antonelli, F. & Rehmani, M.H. (2019). Applications of blockchains in the internet of things: A comprehensive survey. *IEEE Communications Surveys & Tutorials*, 21 (2), 1676-1717.
3. Al-Rjoub, A.M.S. (2021). A financial Stability Index for Jordan. *Journal of Central Banking Theory and Practice*, 10 (2), 157-178. http://dx.doi.org/10.2478/jcbtp-2021-0018
4. Armknecht, F., Karame, G.O., Mandal A., Youssef F. & Zenner E. (2015). Ripple: Overview and Outlook. *In Trust and Trustworthy Computing*, ed. Conti M., Schunter M. & Askoxylakis I., 163-180. Basel: Springer International Publishing.
5. Bonneau, J., Miller, A., Clark, J., Narayanan, A., Kroll, J.A. & Felten, E.W. (2015). SoK: Research perspectives and challenges for Bitcoin and cryptocurrencies. In Proc. IEEE Symp. Secur. Privacy, May 2015, 104–121.
6. Boucher, P., Nascimento, S. & Kritikos, M. (2017). *How Blockchain Technology Could Change Our Lives*. Brussels: European Parliamentary Research Service (EPRS).
7. BTC.com (2020). Pool Distribution, https://btc.com/stats/pool (Accessed 11.10.2019).
8. Ciaian, P., Rajcaniova, M. & Kancs, A. (2018). Virtual relationships: Short- and long-run evidence from Bitcoin and altcoin markets. *Journal of International Financial Markets, Institutions and Money*, 52, 173-195.
9. Diordiiev, V. (2018). Blockchain Technology and Its Impact on Financial and Shipping Services. *Institute for Market Problems and Economic and Ecological Research of National Academy of Sciences of Ukraine*, 2 (1), 51-63.
10. Doviz.com (Noktacom Medya İnternet Hiz. San. ve Tic. A.Ş.) (2019). https://kur.doviz.com/serbest-piyasa/amerikan-dolari#, (Accessed 11.10.2019).
11. European Central Bank (ECB) (2015). *Virtual Currency Schemes–A Further Analysis*, Frankfurt.: European Central Bank (ECB).
12. Foley, S., Karlsen, J.R. & Putniņš, T.J. (2018). Sex, Drugs, and Bitcoin: How much illegal activity is financed through cryptocurrencies?. *Review of Financial Studies*, Advance online publication. http://dx.doi.org/10.2139/ssrn.3102645

13. Fry, J. (2018). Booms, busts and heavy-tails: The story of Bitcoin and cryptocurrency markets?. *Economics Letters*, 171, 225-229.

14. Griffin, J.M. & Shams, A. (2018). Is Bitcoin Really Un-Tethered? Advance online publication. http://dx.doi.org/10.2139/ssrn.3195066 (Accessed 11.10.2019)

15. Gupta S. & Sadoghi M. (2018). Blockchain Transaction Processing. In Encyclopedia of Big Data Technologies. ed. Sakr S. & Zomaya A. Basel: Springer International Publishing AG. https://doi.org/10.1007/978-3-319-63962-8_333-1

16. Gulec, T. & Aktaş, H. (2019). Kripto para birimi piyasalarında etkinliğin uzun hafıza ve değişen varyans özelliklerinin testi yoluyla analizi. *Eskişehir Osmangazi Üniversitesi İktisadi ve İdari Bilimler Dergisi*, 14 (2), 491-510.

17. Gultekin Y. & Bulut, Y. (2017). Bitcoin Ekonomisi: Bitcoin Eko-Sisteminden doğan yeni sektörler ve analizi. *Adnan Menderes Üniversitesi SBE Dergisi*, 3 (3), 82-92.

18. IBM (2018). Trade Lens, http://newsroom.ibm.com/2018-08-09-Maersk-and-IBM-Introduce-TradeLens-Blockchain-Shipping-Solution, (Accessed 11.10.2019)

19. Jani S. (2018). An Overview of Ripple Technology & Its Comparison with Bitcoin Technology. https://www.researchgate.net/publication/322436263, (Accessed 11.10.2019)

20. Karakose, İ.S. (2017), Elektronik Ödemelerde Blok Zinciri Sistematiği ve Uygulamaları, Erciyes Üniversitesi Sosyal Bilimler Enstitüsü, Master Thesis, Kayseri.

21. Kaygın, E., Topçuoğlu, E. & Ozkes, S. (2018). *Bitcoin sistem ve özelliklerinin iş ahlakı kapsamında incelenmesi. İş Ahlakı Dergisi*, 11 (2), 165-192.

22. Khalilov, K.M.C., Gündebahar, M. & Kurtulmuşlar, İ. (2017). *Bitcoin ile Dünya ve Türkiye'deki Dijital Para Çalışmaları Üzerine Bir İnceleme*. https://ab.org.tr/ab17/bildiri/100.pdf, (Accessed 11.10.2019).

23. Koc, C. (2019). Türk Ceza Kanununda Kişisel Verilerin Kaydedilmesi Sucu TCK m 135. *Legal Hukuk Dergisi*, 17 (199), 2839-2867.

24. Koens, T. & Poll, E. (2018). What Blockchain Alternative Do You Need?, In Data Privacy Management, Cryptocurrencies and Blockchain Technology, ed. Alfaro, J.G., Joancomartí, J.H., Livraga, G. and Rios, R., 113-129. Basel:Springer International Publishing.

25. Kuwait Turk (Kuveyt Türk Katılım Bankası A.Ş.) (2019). https://www.kuveytturk.com.tr/kobi/nakit-yonetimi/odeme-yonetimi/doviz-transferi-swift, (Accessed 11.10.2019).

26. Luburić, R. (2020). Crisis Prevention and the Coronavirus Pandemic as a Global and Total Risk of Our Time. *Journal of Central Banking Theory and Practice*, 10 (1), 55-74. http://dx.doi.org/10.2478/jcbtp-2021-0003

27. Monrat, A.A., Schelén, O. & Andersson, K. (2019). A survey of blockchain from the perspectives of applications, challenges, and opportunities. *IEEE Access*, 7, 117134-117151.

28. Nakamoto, S. (2008), Bitcoin: A Peer-to-Peer Electronic Cash System, www.bitcoin.org, (Accessed 11.10.2019).

29. Patterson, D. (2016), Ripple Adds Several New Banks to Global Network, https://ripple.com/ripple_press/ripple-adds-several-new-banks-global-network/, (Accessed 11.10.2019)

30. Qiu, T., Zhang, R. & Gao, Y. (2019). Ripple vs. SWIFT: Transforming cross border remittance using blockchain technology. *Procedia Computer Science*, 147, 428-434.

31. Ripple Team (2017). American Express Introduces Blockchain-enabled, Cross-border Payments, https://ripple.com/ripple_press/american-express-introduces-blockchain-enabled-cross-border-payments/, (Accessed 11.10.2019).

32. Sanlisoy, S. & Ciloglu, T. (2019). An investigation on the crypto currencies and its future. *International Journal of eBusiness and eGovernment Studies*, 11 (1), 69-88.

33. Santander Bank (2019). https://www.santander.com/csgs/Satellite?appID=santander.wc.CFWCSancomQP01&canal=CSCORP&cid=1278712674240&empr=CFWCSancomQP01&leng=pt_PT&pagename=CFWCSancomQP01%2FGSNoticia%2FCFQP01_GSNoticiaDetalleImpresion_PT48, (Accessed 11.10.2019)

34. Schwartz, D., Youngs, N. & Britto, A. (2014). The ripple protocol consensus algorithm. https://ripple.com/files/ripple_consensus_whitepaper.pdf. (Accessed 11.10.2019).

35. SWIFT, (2018a). Annual Review, https://www.swift.com/file/62596/download?token=5cf760oV (Accessed 11.10.2019).

36. SWIFT, (2018b) SWIFT completes landmark DLT proof of concept, https://www.swift.com/news-events/news/swift-completes-landmark-dlt-proof-of-concept), (Accessed 11.10.2019).

37. TCMB (Türkiye Cumhuriyeti Merkez Bankası) (2019). Ödeme Sistemleri http://eftemkt.tcmb.gov.tr/odemeSistemleri_TR.htm, (Accessed 11.10.2019). Reference in the paper?

38. Truby, J. (2018), Decarbonizing Bitcoin: Law and policy choices for reducing the energy consumption of Blockchain technologies and digital currencies. *Energy Research & Social Science*, 44, 399-410.

39. Uzer, B. (2017), *Sanal para birimleri*, Ankara: Türkiye Cumhuriyet Merkez Bankası Ödeme Sistemleri Genel Müdürlüğü.

40. Xiao, Y., Zhang, N., Lou, W. & Hou, T.Y. (2020). A survey of distributed consensus protocols for blockchain networks. I*EEE Communications Surveys & Tutorials (Early Access)*, https://doi.org/10.1109/COMST.2020.2969706

41. Wang, Q., Zhu, X., Ni, Y., Gu, L. & Zhu, H. (2019). Blockchain for the IoT and industrial IoT: A review. *Internet of Things*, Available Online: https://doi.org/10.1016/j.iot.2019.10 0 081

42. Wong, T.L., Lau, W.Y. & Yip, T.M. (2020). Cashless Payments and Economic Growth: Evidence from Selected OECD. Countries. *Journal of Central Banking Theory and Practice*, 9 (SI), 189-213. http://dx.doi.org/10.2478/jcbtp-2020-0028

43. Zheng Z., Xie S., Dai, H., Chen, X. & Wang, H. (2017). An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends, 2017 *IEEE 6th International Congress*, 557-564.