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A literature review of blockchain characteristics, implementations and challenges

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Abstract— **Blockchain is a growing innovation consisting of a sequence of blocks containing data in a non-central network. This technology facilitates the processes of transactions by the use of cryptocurrencies which omit intermediary fees and save time, besides proving an environment of privacy, safety and trust. Blockchain also make the implementations of digital contracts, electronic medical records and drug tracking conceivable. Accordingly, the aim of this review is to draw a simple basic knowledge of blockchains, and how its characteristics and applications could change the future of financial and health intuitions, besides showing the challenges, research gaps and prospective further studies.**

Keywords— Blockchain, decentralization, nodes, cryptocurrencies, digital contracts, medicine counterfeiting.

I. INTRODUCTION

Thousands of years ago humans acknowledged that food is a necessity for life which meant it has a value so it was the first payment method in history (Söze, 2019). However, its value was not everlasting because there was no available way of keeping the food refrigerated, so valuable and rare metals were used afterwards for example gold which has an everlasting value, but difficult to excavate and that led to the use of banknotes eventually (Söze, 2019). Nowadays, exchanging money can occur either digitally or physically; the physical way does not require an intermediate, but it cannot be transacted via miles, while digital money transactions require an intermediate, for example, a bank which authorize the process and requires a commission (Lewis, 2018). As illustrated by Ollhoff (2017), when writing a literature review a professional practice is to write about a research question not a research topic which will contribute in making the scope of the review narrower and not shallow. Accordingly, this literature review will explore the technology of blockchain alongside its current and prospective applications financially to a less extent because its understanding is essential for digesting healthcare applications which will be discussed to a larger extent, besides the possible challenges and research gaps.

II. THE RISE OF CRYPTOCURRENCY AND BLOCKCHAIN

During the financial crisis of 2008, an anonymous person or a group took the name of Satoshi Nakamoto introduced a new platform on which transactions could be performed using cryptocurrencies which is not regulated or established by governments and do not require intermediates or centralized authority, but it works in a decentralized way (Tapscott et al., 2016). The Blockchain is a global shared database consisting of a sequence of blocks and each block is created whenever a new peer-to-peer transaction is done, and then copied and transferred to every single user in the Blockchain (Söze, 2019). The nodes or miners have a role of grouping the assets transfers as blocks, besides verifying the validity of each movement by ensuring that there is enough balance of money whenever a transaction is made (Casino et al., 2019). A prime example for that is if user X is making a transaction to user Y, user X balance is checked to ensure he is the owner of the asset through tracking the previous transactions in the spreadsheet which will reveal that user X owns this asset and the ownership of it had passed to him through a previous operation, when the check is done and the users agrees on the process a new block is formed (Lewis et al., 2017).

Moreover, after the verification of each money transfer and creation of a block the new block must be chained to the preceding one using a hash which is a unique encrypted string, by other means each block has a fingerprint and timing and when a new block is created a new fingerprint and timing are generated for it. In addition to preserving the previous fingerprint and timing which makes fraud or stealing cryptocurrency unattainable because the hacker will have to alter the fingerprint of the block in all the spreadsheets distributed to every single user (Lewis, 2018 ; Tapscott et al., 2016).

III. ADVANTAGES OF BLOCKCHAINS OVER CONVENTIONAL SYSTEMS

Firstly, it omits the need for centralized systems because the transaction is operated through peer-to- peer networking instead of the need of an intermediate party, as a result this leads to omitting the fees taken by banks to verify the operation (Zheng et al., 2018). Accordingly, it offers trust because there is a universal spreadsheet of the whole data available for everyone and there are protocols which accredit every possible transaction and once it is processed it is unchangeable (Ali et al., 2020). Secondly, the transactions are made anonyms without revealing users' identities which help in preventing private data leakage (Zheng et al., 2018). However, the anonymity is guaranteed as long as the user does not reveal his generated random address which is used for transactions with other users without revealing each other identities (Trivedi et al., 2021). Thirdly, the ability of auditing as all the transactions have fingerprints or hash alongside the timing of the operation, so users can trace and validate any information in the blockchain and trace the chain of owners of any particular asset (Zheng et al., 2018 ; Tapscott et al., 2016).

Furthermore, as indicated by Taylor et al. (2020), and Tapscott et al. (2016), blockchain technology could be a safer alternative because it stores data in a non-mutational way; after verifying the received data the block is formed and cannot be altered, besides generating a hash to each new generated block. Then these data are spread all over the network of users and each user has the same exact copy of

data, by other means the data is universal and not stored in a central database so the systems will no longer be susceptible for central attacks because data is decentralized (Taylor et al. 2020 ; Tapscott et al. 2016). It can be reiterated that hackers will have to attack every single user in the blockchain to alter his spreadsheet copy which is unattainable.

Finally, according to Makridakis et al. (2019), the implementation of Blockchain could provide a quicker way of processing transactions which will take minutes and could be done in anytime and not limited to bank operating hours or bank holidays, especially because Lewis et al. (2017) mention that the current system of transferring money requires authority validations when the movement is international, and it takes several days to process. In a brief, none of the sources mentioned above have identified how this growing system will be able to stand against the strength of businessmen and authorities controlling financial institutions which are responsible for their influence and wealth, because as mentioned by Makridakis et al. (2019), and (Zheng et al., 2018), applying this idea will omit the intermediate fees and intervention.

IV. CURRENT AND PROSPECTIVE APPLICATIONS

One application of blockchain is Binance platform which was established by China in 2017; it was moved then to Malta after governmental restrictions on cryptocurrencies, and is considered one of the most platforms in which day-to-day exchanges occur using cryptocurrencies (Disli et al., 2022). Binance expansion has led many businessmen to start gambling on it as a mean of claiming benefits afterwards while the currency is still unstable and some businessmen are subject to loss (Mallick, 2020). Furthermore, Skeldon (2022), states that Google revealed that the number of searches for Binance in the United Kingdom has increased around 500 times since the platform has reached an agreement of cooperation with the footballer legend Cristiano Ronaldo. In a brief, the authors have viewed the bright side of the innovation without mentioning its misuse in dark web and how this can be challenged.

Another application is digital contracts especially because physical properties consume a lot of time in the process of verifying its ownership and by intermediates approvals so by using blockchains the execution time of the process of transferring ownership of physical assets will be less than usual (Lewis et al., 2017). Therefore, the idea of digital contracts could omit the need for bank institutions and advocates because every asset owner will be recorded in the blockchain and the property could be transferred to a new owner through peer-to-peer agreement (Nofer et al., 2017). Likewise, Che et al. (2018) explain that blockchain contracts are processed by codes and cannot be altered or manipulated by an intermediate, besides it will not require intermediary fees, while Makridakis et al. (2019) provide an example of a platform which has implemented digital contracts called Chainlink which extend the concept of digital contracts into making an online market with the ability of trading and selling items, and after verifying its ownership and agreeing on the transaction the ownership of the items passes to the new user through a digital contract. Moreover, as mentioned by Niloy et al. (2021), there were trials of using smart contracts on Binance system and it showed favorable outcomes. It can be observed that the authors did not acknowledge that his idea is unattainable unless governments adopt it because the owners of assets with a digital contract might be seen as illegitimate owners by courts and might lose their purchased property.

Tervoort et al. (2020) in their scoping review were illustrating how healthcare systems are being attacked by hackers and their main focus was directed towards old medical devices breaches, but they also provided an insight on the breaches of patients medical records and how its more worthy to be stolen than master cards because by having access to it hackers can obtain medicines and make false insurance claims. While Tervoort et al. (2020) have provided possible current solution of securing old medical devices, on the contrary, Azaria et al. (2016) took another approach of proposing a possible way of decentralizing patient medical records using blockchain technology through a system responsible for storing digital patient records by using the concept of digital contracts by forming blocks containing the medical data of each block's owner , besides being accessible easily by their trusted care providers if they have permitted this access. Additionally, the system sends alerts to patients of any updates made into their record and they can either accept or deny the updates, besides implementing the concept of smart contracts which allows the patient to allocate an access for their providers with a limited viewing time (Azaria et al., 2016). However, it should be noted that the proposal did not include any implementations yet or testing.

Counterfeit medicines are also becoming a global issue because many countries are affected by it, and these medicines do not include active ingredients and might include different active ingredients which in both cases carry a risk to patient's safety (Glass, 2014). As a result, the use of Blockchain could be a possible way to solve these problems as each medicine box will be considered a transaction which will be added to a block with a fingerprint and a timing, and this information cannot be altered by frauds (Monrat et al., 2019). Consequently, Musamih et al. (2021) have proposed a platform based on blockchains digital contracts technology which connect patients, companies, distributors and healthcare facilities in one database with the ability of sharing information, tracking the shipment of medicines and making transactions using cryptocurrencies. Similarly, Huang et al. (2018) demonstrate a platform that has the ability of tracking the medicines from the production process until being delivered to the patient using Bitcoin as the payment method, they have highlighted a solution for one of the challenges of blockchains which is the storage space, and their solution is by setting an expiry date for the block corresponding to the expiry date of the drug itself. It worth mentioning that this idea could be extended to the ability of the patient to delete the block whenever he receives or takes the drug.

Comparatively, Jamil et al. (2019) took an approach of integrating a platform for both of the above mentioned issues since they are overlapping, as they have proposed a platform which can store medical records between patients and health institutions, besides tracking medicines throughout the whole logistics process, but the authors admitted that the testing still requires more participants to check its attainability on larger scales. However, these papers have showed the efficacious side of this implementation without mentioning the long logistics process including the long chain of distributers in which the fingerprinted drugs could be

exchanged for counterfeit while keeping the packaging intact.

V. CHALLENGES

As mentioned by Lewis et al. (2017), consensus is one of the challenges facing blockchains because whenever a transaction is done or a new block is formed it has to be accepted by all the network users; they suggest the use of permissioned network which gives a number of users the ability to control the process of accepting new blocks into the blockchain system. However, it might be a drawback because those allocated users could be considered third parties.

Another challenge discussed by Lewis et al. (2017) is the ability of blockchains to expand because the process of adding new blocks and updating the available data requires considerable processing time which might affect the subsequent process confirmation, besides the vast space required for storing the data in the blockchain. In other words, as mentioned by Monrat et al. (2019), there will be a limited number of transactions per minutes alongside a delay in the process of creating new blocks and chaining them to the blockchain as well. Furthermore, in the field of healthcare it was proposed by Huang et al. (2018) to link the expiry date of drug to the expiry date of the block in the blockchain system. Lastly, the potentiality of its acceptance by authorities because blockchains work in the way of decentralization which is considered the opposite way of how monetary authorities work and how they are able to control the economy of nations, so it would be a challenge for authorities to accept blockchains to undertake part of its roles (Monrat et al., 2019).

VI. CONCLUSION

After this literature review has manifested the concepts of blockchain including its advantages and challenges, besides exploring the current and possible implementations in healthcare and financial institutions. It can be reiterated that blockchain healthcare applications requires more investigation and research and what is delaying its implementation on a larger scale is that the applications require being tested on a larger scale, and that the applications are not adopted by large institutions who can fund it or make partnership with the researchers proposing it as suggested by Azaria et al. (2016). On the other hand, cryptocurrencies are growing, and the platforms are paying effort in terms of advertisement to increase the expansion of these currencies exchange. For instance, Binance have started its marketing campaign by making a partnership with Cristiano Ronaldo (Skeldon, 2022). For further study, there is still a need of proposing how decentralization could be applied while preserving the influence and presence of governments which might lose a considerable portion of it when omitting the role of central banks and the payment of taxes because this might be the reason why cryptocurrencies are banned in several countries for example China as mentioned by Chen et al. (2022).

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FINAL GRADE

GENERAL COMMENTS

Instructor

88/100

GRADING FORM: CO7115 ASST 2 (2020)

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88

REVIEW PAPER

Paper presents a generally relevant topic to the students chosen programme of study. The paper here presents an overview of some complex topics and provides a reasonably good level of depth and critique as to the chosen research field. I like that you have chosen to reflect back on the same paper from the first assessment to expand on it, which is good to see.

45

ADDITIONAL FEATURES

Good synthesis here of multiple academic sources and sound evaluation. Discussing some of the limitations of the studies and strengths although some aspects are vaguer/brief but nonetheless a genuinely very good attempt.

15

FORMAT & ACADEMIC WRITING

Very good handling of the source material here. Opting to discuss the works through paraphrasing vs direct quotation which is good. The paper sets out a structure and adheres to it. Template is followed with demonstrated competence in academic writing and presentation.

18

REFERENCING & SOURCES

- correctly formatted citations, in APA style - correctly formatted reference list, in APA style [10%]

Good use of in-text citations and end of document references, all appear to be correct.

10