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A Systematic Review on the Blockchain Technology in Education Field: Kazakhstan and Malaysia

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Abstract
The blockchain is one of developing technology that have been in use every day. The technology of the blockchain includes the distributed, decentralized nature and features such as the permanence record, and perceived to provide significant opportunities to overcome the weaknesses of the traditional method. The research aims at highlighting the existing issues related to the educational institutes especially in Kazakhstan and Malaysia that based on current studies and to find suitable blockchain features that could resolve the current issues. The comprehension reviewing the literature was conducted in order to get the strong evidence and support for this study. This paper will also explore blockchain features like decentralization, traceability and consensus that can be used for addressing the issues relating to educational institutions in Kazakhstan and Malaysia.

Keywords*: Blockchain technology; education; literature review; Kazakhstan; Malaysia.*

I. INTRODUCTION

Blockchain is basically a digital system with decentralization that enables one to keep records and also keep track of it. Every user has a node for this network so that they can maintain a public ledger copy. All transactions that are done in the database are verified by these users which comes to the advantage of not hiring any third party to do the job [1].

Education has evolved as a subject of central focus worldwide [2]. The features of blockchain architecture and design includes transparency, robustness, auditability and security [3]. The key to the interest in this technology is its ability to maintain data privacy and safety by transferring the input data from a centralized to a distributed system where no further changes or modifications are possible in the immutable blocks [4, 5].

Academic credentials needs to be recognized universally in order to verify the information. Blockchain technology in the field of education could streamline these processes of verification that can result in reduction of fraudulent claims of un-earned educational credits [1]. One of the examples is the use of blockchain technology by the University of Nicosia for storing academic certificates. Blockchain technology has the ability to resolve the issue of vulnerability, security, and privacy in such learning environments [6], which can be utilized for storing educational records [7].

In this paper, the reviewing of blockchain study was conducted in order to get deep understanding about blockchain technology in education.

II. LITERATURE REVIEW

A. Blockchain

Nakamoto (2008) [8] described about the blockchain technology and its use in solving the issues relating to maintenance of the transaction order as well as avoid double-spending. He was the man behind Bitcoin technology and he stated the order of transactions by grouping them in a constrained-size structure known as blocks. The network nodes are responsible for linkage of the blocks in a chronology. Each block consists of hash of the previous block in order to create a blockchain, which makes it robust [1, 9].

Blockchain is introducing radical change in the way we deal with assets interchange in the digital economy [8]. From the financial industry to the manufacturing and supply chain [10], affecting sectors as mining, petrochemical, pharmaceutical, agrofood, energy, automobile, and many of the global chain industries.

Nowadays the fully operative projects are few, focused in the financial industry, and many more in pilot evaluations or in conceptual consideration for other sectors as those mentioned above. The distributed and cryptographic nature of Blockchain operation and implementation is not less free of challenges [11].

B. Blockchain in education

Blockchain technology could bring significant benefits to education, including high security, low cost, enhancing

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students' assessments, better control of data access, enhancing accountability and transparency, identity authentication, enhancing trust, improving efficiency of students' records management, supporting learners' career decisions, and enhancing learners' interactivity [12].

Educational certificate management can also be enhanced by blockchain improving data security and trust in digital infrastructures [13], and for credit management (for instance, relevant to the European Credit Transfer and Accumulation System-ECTS) [7]. The blockchain platform allows only certified institutions under specific rules to access and modify the stored data.

In the formal learning context, this includes learning contents and outcomes as well as students' achievements and academic certificates [14]. The blockchain ledger can match all kinds of educational information with the user's unique ID [14].

Moreover, blockchain technology contributes to reducing degree fraud [14]. Blockchain assures the authenticity of the digital certificates as well as the identity of users [12]. Once blocks have been created, the authorized university will sign it using a private key. After that, a cryptographic hash of the course syllabus will be issued to ensure that no one can tamper with the content [12]. Blockchain distributed ledger is immutable and trustworthy. Thus, the reliability and authority are both ensured, which will significantly reduce degree fraud [14].

Universities or any educational institutions can build a trustworthy community by implementing secure and reliable blockchain-based systems [12].

C. Characteristics of Blockchain

Decentralization

In centralized transaction processing environment, each transaction needs to be validated through the centralized trusted party (e.g., banking system), that resulting to the cost and the performance decrees at the central point. With respect to the centralized IOT model, third party is no longer needed in blockchain. Consensus algorithms in blockchain are used to maintain data integrity and consistency [15].

Persistency

Once a transaction record is validated by a miner node (special nodes that validate the transaction) in a blockchain network its copy is broadcast on the entire network and that record is not deleted or rollback from entire blockchain [15].

Anonymity

In Blockchain nodes interact with the network using public key that use to addresses the node on entire blockchain network but not acknowledge the real identities of the user [15].

Security

Blockchain use the asymmetric cryptographic technique to secure the entire network. Asymmetric or public key cryptography contain 2 keys one public key and second private key. Public key is used by the node to addresses in blockchain network and private key is use by the node to signs the transaction that it initiates. Other nodes use their public key and compare it after hashing to their signature for checking the initiator node identification [16].

Scalability or more addressing space

Blockchain contains 160-bit address space where IPv6 address has 128-bit address space, A Blockchain address is 20 bytes or 160-bit hash of the general public key generated by ECDSA (Elliptic Curve Digital Signature Algorithm). Blockchain have 4.3 billion more Addresses over IPv6 [17].

Resilient backend

Every distributed node within the blockchain IOT network maintains a replica of the whole ledger. This helps in safeguarding the network form any potential failures and attacks [18].

High efficiency

Since the transaction removes the involvement of the third party and may proceed in Low-trust condition, the number of your time spent is obviously decrees whereas the efficiency is clearly increases [19].

Transparency

Changes made to public blockchain network are publicly viewable by all participants in the network. Moreover, all transactions are immutable, meaning they cannot be altered or deleted [20].

Smart contract

Smart contract is one of the most efficient aspects of the Ethereum introduced by Nick Szabo in 1994 [21]. Many programming languages are supported by Ethereum such as Solidity. Solidity is the most widespread used language and compiler. Using smart contract programs are written in which access rights and different policies are defined [16].

D. Blockchain in Kazakhstan

Evolving beyond its association with bitcoin, blockchain and other distributed ledger technologies can remove significant layers of complexity from global supply chains. It can facilitate greater trust and transparency between supply chain stakeholders, supporting the automation of administrative and commercial processes. Smart contract concepts will also create opportunities for new services and business models in logistics [22].

Most of the changes are related to the introduction of blockchain-based technologies. Kazakhstan was one of the first countries in the world to announce the adoption of the blockchain [23]. At the meeting of the Government of the Republic of Kazakhstan, the Minister of Education and Science of the Republic of Kazakhstan Yerlan Sagadiyev spoke about the convenience of the blockchain technology, which they plan to introduce in the field of education [24].

"Blockchain is total digital accessibility and mobility. This means that a teacher, parents or children will be able to download information from their mobile phone. Students should see their homework, grades, without leaving home."- listed at a government meeting the Minister.

In addition, according to the minister, inserting blockchain technology will ensure transparency in many educational structures [24]. According to the Yerlan Sagadiyev all information including governance scholarships, certificates and

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much more, will be on the portal in the public domain [25].

The prospect of development of the blockchain has been studied and discussed in Kazakhstan over the past four years. This process is directly related to the implementation of the large-scale program "Digital Kazakhstan". According to the experts, with the introduction of the blockchain, the digital transformation of traditional industries will be carried out and not only business technology will change, but also the concept of providing services [26].

E. Blockchain in Malaysia

The Ministry of Education is setting up a new consortium. Specifically, the consortium will be developing a system based on blockchain technology to verify degrees issued by Malaysian universities [27].

The Ministry is currently in preparations to use the blockchain platform to guarantee that degrees being offered in universities are all legitimate and verified. This process will be called "e-scroll system," of which idea came from the Council of ICT Deans of Malaysian universities [28].

According to a local media report, the idea of the consortium was proposed by the MoE in order to preserve the reputation and the integrity of Malaysian universities, to protect the rights of students, as well as to promote distributed ledger technology (DLT) [29].

Through blockchain, the Ministry of Education aims to resolve issues on:

1. Ensuring only bona fide students receive degrees—same with making sure that only those who took the courses will get the opportunity, not those with fake degrees [28];

2. Enabling the straightforward verification of degrees provided by Malaysian universities to companies and other organizations looking to hire candidates and confirm their credentials [28].

According to Ministry of Education the blockchain technology is secure and has the potential to increase the efficiency in authenticating genuine certificates (Star, 2018). Six universities – Universiti Utara Malaysia, Universiti Teknologi Malaysia, Universiti Sains Malaysia, Universiti Malaysia Terengganu, Universiti Teknologi Mara and the International Islamic University Malaysia (IIUM) – have formed a consortium to study and develop the tech involved [30].

IIUM, the current head of the consortium, has already developed a version of this degree verification tech, and has embedded the degree certificates of its newest cohort of PhD graduates – whose convocation took place on Saturday (10 Nov 2018) – into the blockchain [30].

It should also be noted that a system is already in place, created by the team headed by Prof Dato Dr. Norbik Bashah Idris from the International Islamic University Malaysia (IIUM). Using NEM blockchain, users can authenticate the validity of a degree by scanning a QR code printed on a university certificate [27].

III. METHODOLOGY

The methodology of this paper used is secondary sources method. This method has been selected to summarize or discuss the initially submitted information and this method evaluates, interprets or synthesizes the primary sources. These sources provide the additional information based on other researches. For example reviewing journals, academic books and articles.

Those method also helps to understand the level of uncertainty about what is known at the moment and what additional data from further studies is required.

Followings are the type of sources which reviewed for the additional information for this paper.

- Journal articles
- Web site
- Biographical works
- Textbooks
- Magazine and newspaper articles

IV. CONCLUSION

Blockchain is a novel technology enabling new forms of distributed software architectures, where components can find agreements on their shared states for decentralized and transactional data sharing across a large network of untrusted participants, without relying on a central integration point that should be trusted by every a component within the system.

This study examines the use of blockchain technology in education. We are currently facing issues such as document loss, corruption, validation of records, and absence of data security. In this paper, conducted a systematic review on the use of the Blockchain platform and the solutions of the problems that may point to a strong future direction for further use of the Blockchain platform in the field of education.

Blockchain technology can be effective in education, requiring safety, transparency and effectiveness in this sector. This study demonstrates that blockchain technology is a highly secure platform that can provide us with transparency on user data, help to prevent corruption, secure student academic records, and be used as a trusted and transparent system to share, secure and verify academic achievements for institutions and students.

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