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Research Article

Blockchain technology applications, concerns and recommendations for public sector

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ABSTRACT

Blockchain technology is being hailed as the next significant phenomenon, with potential near-term uses that might profoundly impact society and the economy. While the previous studies emphasized cryptocurrency research, our article focused more on the blockchain-based applications applied in public sectors. This review was conducted by collecting articles from different libraries, and the search strategy was applied Nvivo software was utilized to code the literature and extract the themes used to build the body of this research. Finally, the study identified several applications and concerns regarding adopting and implementing blockchain technology within these sectors and the recommendations offered by scholars to manage this technology successfully.

1. INTRODUCTION

Many people believe that blockchain technology will usher in a new computing era that will fundamentally alter the nature of all economic transactions and social norms. Although it has its upsides and downs in cryptocurrency, it is flourishing in other disciplines that we will cover in this paper. The widespread adoption of bitcoin led to the discovery of the blockchain technology that underpinned it. While blockchain first applications were limited to the financial sector, recent research has proven that the technology can also be utilized to build systems in other sectors. The accelerating adoption of such technology depends on various factors, including transparency, security, and independence from central authority by applying the P2P protocol to execute transactions.

This review article starts with demonstrating the research method and the tools used to conduct the research, like Nvivo 10 software, and the strategy followed to examine each collected article and apply the process of topic screening, identifying publication type, time range, and finally coding and theming. Next, we review blockchain applications in multiple disciplines besides cryptocurrency. Afterward, we raise the concerns and recommendations found in the literature to pave the way for future research to identify the issues and risks when dealing with blockchain technology. Finally, we conclude our review in the conclusion section.

2. RESEARCH METHOD

The digital libraries IEEE, ACM, Science Direct, and Springer Link were the primary sources of the publications we read. We pulled publications of good quality from the blockchain. Then, we evaluated the ones that were focused mainly on this subject. We rejected articles that needed to be written in English, lacked complete text, or were inaccessible using our available resources. Other steps and tools were implemented in order to fulfill the requirements of this research which are:

1. Topic screening: The authors make sure that the topic of each article must deal with blockchain technology and its applications.

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2. Publication type: Journal articles, book chapters, and other intellectual works were considered.
3. Publication time range: The time range was set between (2016-2020) to capture the most recent literature.
4. Nvivo 10 software was utilized to code each article and create nodes and, eventually, themes shown in figure 1.

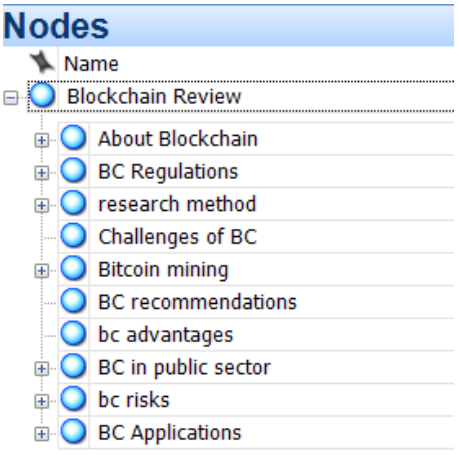

Fig.1. Research Nodes / Themes

3. BC APPLICATIONS

Blockchain technology is utilized heavily in cryptocurrency domains like bitcoin, Ethereum, and thousands of others. However, this is not the only domain that adopted blockchain technology; many others have employed it in their systems. Based on the literature, this article has identified several applications of blockchain technology in different domains besides cryptocurrency, especially in the public sector. One of the scholars has found that these applications were scattered among a range of public sectors that reach up to 16 public services affected by blockchain technology [1].

Today we have different blockchain applications in the public sector, finance, supply chain, healthcare, and IoT. The financial sector is most enthusiastic about adopting blockchain, followed by supply chain management.The following applications were collected from the literature by coding the themes using Nvivo software like the following:

3.1 Supply chain management

Supply chain management, also known as (SCM), is the process of actively managing the activities involved in the supply chain to maximize the value provided to customers and gain a sustainable advantage in the marketplace. It exemplifies a concerted effort on the part of the companies involved in the supply chain to design and operate supply chains in the most effective and efficient methods possible. The tasks involved in supply chain management include not only the creation of products but also their procurement, manufacture, and logistics, in addition to the information systems required to coordinate these operations. Several companies like Walmart, Provenance, Skuchain, and Everledger offered solutions based on blockchain technology for the management of supply chains [2, 3]

3.2 E-Voting system

The term "electronic voting system" refers to a specific type of software that facilitates the safe and efficient conduct of elections and votes by various groups. Online voting systems strike a balance between protecting voters' privacy, making ballots easily accessible, and meeting the organization's needs. While these systems may be compromised due to their centralized nature, it is controlled by a third party. That is when blockchain technology proposes itself by integrating with e-voting systems, proving to be a viable solution because of their many desirable qualities. These characteristics include privacy, security, transparency, accuracy, and decentralization (in which no centralized control exists). Most importantly, the ability to create an immutable system in which voters can cast their ballots from anywhere in the world using smart devices like mobile phones, personal computers, and voting machines [4].

3.3 E-governance

E-governance refers to utilizing information technology to improve the standard of services governments provide to their people. It is believed that this would also strengthen the link between public officials and the communities they serve, which will ultimately result in a democracy that is stronger, more accountable, and more inclusive. Over the past few years, a growing body of academic research on blockchain applications in the government sector has arisen [1]. While this is

happening, governments and public agencies worldwide are launching blockchain projects and developing early-stage applications [5]. By the year 2020, the city of Dubai will be the first in the world to undertake legally binding government transactions using blockchain technology [6].

3.4 Student management system (SMS)

A system designed to organize and track student data in which all student information is consolidated into a single database accessible across the institution. Whether housed locally or in the cloud, a student information system (SIS) facilitates data entry, storage, retrieval, and sharing among instructors and students while helping institutions conform to relevant laws and standards. Such a system requires a high level of security to maintain the student's records from manipulation and temperament. That is when blockchain can employ its technology to overcome the issues that centralized systems face daily. Scholars have identified applications of blockchain technology in the higher education sector and how they were integrated into their automated systems. For example, Birmingham research center and Nicosia universities have developed a blockchain-based system that interconnects multiple actors, which is shown in detail in figure 2 below [7].

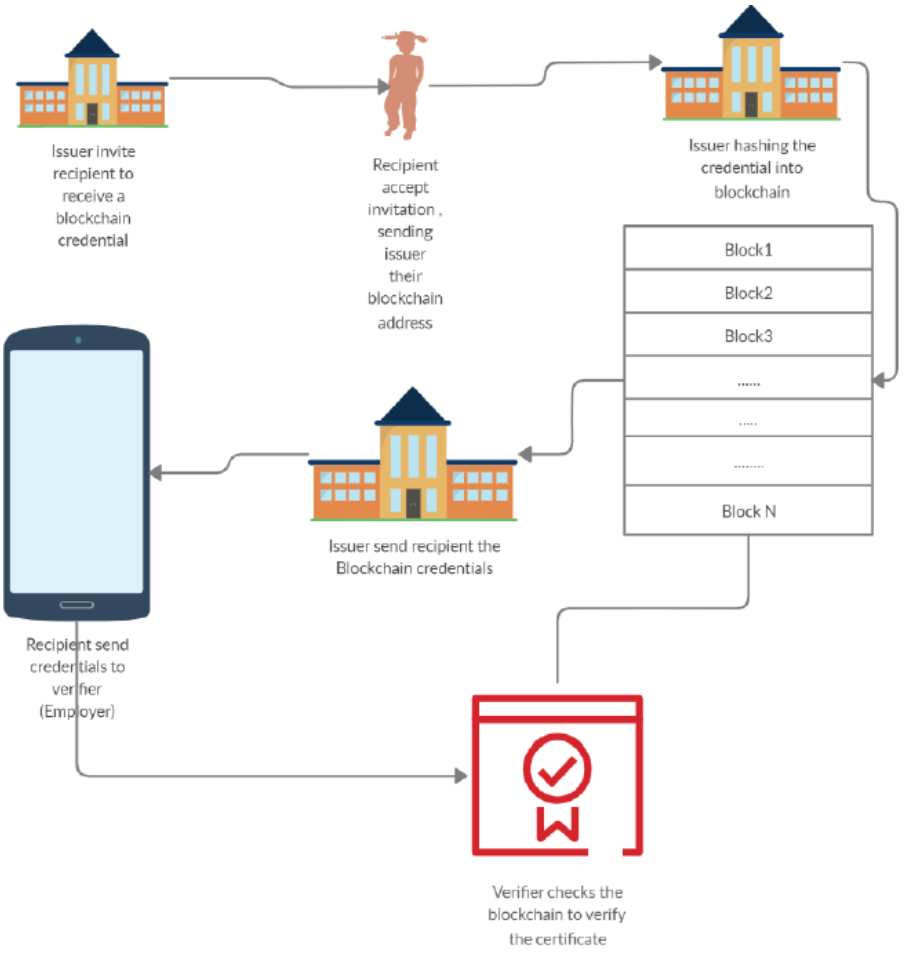

Fig.2. Blockcert system [8]

3.5 Islamic zakat collection

In Islamic economics, zakat refers to the required annual distribution of a certain percentage of one's possessions(nisab) to those in need. If a Muslim's wealth exceeds a specific threshold, then the zakat amount must be paid is set at nisab. Islam's poor are the intended beneficiaries of zakat donations, with the amount given to them determined by a formula that ensures the funds are distributed fairly and under Shari'ah law [5]. Since blockchain technology is transparent, unchangeable, and secure, the professor recommends employing it for zakat collection and distribution. If this method were implemented, it would help address global poverty, according to the scholar [9].

4. CONCERNS AND RECOMMENDATIONS

Research indicates a high price tag, problems, and risks associated with using blockchain, despite security being seen as a significant benefit it may provide. The scholar claims that blockchain technology is unreliable because it makes no guarantees about the integrity of the data it stores and because the technology is only as good as the people who use it. In addition, there is always the chance that the blockchain "key" could be stolen, or that the network will be subjected to a series of organized, malevolent assaults, or the hackers could find a vulnerability in the system that could lead to exploited by them [1, 10] . In addition, 882 million USD was stolen during the assaults of 2017–2018, with few of the perpetrators being caught or convicted in most incidents [11].

Blockchain technology is still a relatively young sector that multiple parties need help to adopt into their private or public sectors. In India, one of the scholars identified that there are issues like scalability, security and privacy breaches, limited transaction loads, and high (computational) costs. Besides, its technical problem might hinder the adoption process [2]. On the contrary, Dubai and Georgia established a blockchain adoption strategy in their government process by transforming their public records systems using blockchain [12].

Another significant concern arises regarding terrorism and the abuse of cryptocurrency due to the nature of blockchain, which offers anonymity to its users and without the supervision of central authorities, which might lead to radical financing of individuals in Iraq and Syria or any other location those radicals might exist. Scholars made suggestions for International bodies and corporate giants to take technological and legal precautions to stop blockchain-related cyber terrorism. Cyberterrorism can only be adequately combated via international cooperation between governments and international organizations [13]. In parallel, another scholar made another suggestion to increase awareness about blockchain technology among regulators and lawmakers to face the new security challenges, recognize the threats better, and enforce regulations that end or limit the activities of criminals and terrorists around the world [14].

5. CONCLUSION

This research reviewed the literature to identify the blockchain applications employed in public sectors. We discover multiple blockchain-based applications in different public sectors and how they elevate the performance of their systems by taking advantage of blockchain strengths, especially in security, transparency, and data accuracy. Although the blockchain provides such powerful attributes, there are still concerns that haunt these sectors regarding the implementation of blockchain within their workflow, especially in the field of security, high computational cost, privacy breaches, limited transaction loads, and criminal and terrorist activities. Finally, the study shed light on the recommendations provided by literature to overcome these concerns and issues like increasing the blockchain technology awareness among lawmakers and regulators and establishing a cooperation between governments and international organizations to eliminate any risks that might hinder the adoption and implementation of blockchain technology.

Conflicts Of Interest

None.

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