The Challenges and Benefits of Blockchain in E-government

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Summary

Technology has been in existent for some time, and the government, through the e-government platforms, has found it useful in-service delivery. This paper aims to investigate the challenges and benefits of utilizing a relatively new concept to e-government which is Blockchain in KSA's e-government. This paper starts by defining the e-government concept, then introducing the concept of Blockchain and how the government uses it in its daily activities. The introduction part tries to create a connection between the internet and government service. Then, the paper focuses on reviewing previous studies about Blockchain technology. Most of the study relied on scientific journal articles or other recognized scholarly materials which demonstrated that the issue under research is not entirely new but has attracted the attention of others. The methodology of this study relies on reviewing the literature (secondary data) and conducting interviews with experts (primary data) since both techniques were the most feasible options based on the available resources. Our qualitative data have been analyzed using the thematic analysis technique. As a result of the paper, we come up with two themes which are the challenges and benefits of implementing Blockchain technology on e-government.

Key Words:
Blockchain, e-Government, Internet, technology.

1. Introduction

This study concern about two concepts, e-government and Blockchain. "E-government is defined as a way for governments to use the most innovative information and communication techno- loges, particularly web-based Internet applications, to provide citizens and businesses with more convenient access to government information and services, to improve the quality of the services and to provide greater opportunities to participate in democratic institutions and processes" [1]. On the other hand, Blockchain is simply a virtual series of blocks, not within the literally sense of these words. once we say the words "block" and "chain" during this context, we simply refer to digital information (the "block") hold on in a very public info (the "chain"). It consists of blocks store information regarding transactions, blocks store information regarding organization is taking part in transactions and blocks store information that distinguishes them from alternative blocks [2].

Governments have relied on their employees for safe storage and retrieval of information. Traditionally, the information was stored in paper files, which were then placed in safe wardrobes. Technology has advanced this to store the information in computers and cloud systems which have, for some time, been seen as secure. However, the same technology enables malicious elements to infuriate the systems and access the data, some of which are sensitive, leading to loss of money. Thus, in order to balance the usage of technology by securing the data and preventing malicious actions, blockchain can be seen as a solution to using technology especially in government who is responsible for all citizens.

Blockchain is increasingly becoming a necessity in daily life because it promises to solve some of the major world challenges. Blockchain entails the structuring of data such that the transactions and records are secure, transparent, and decentralized [2]. While using this technology, the records are stored in the form of blocks or chains, but under the authority of no single person such that every person concerned can see what is happening. Every person in the network can see the data, and once it is fed, it is challenging to alter or even change that information hence tamper-proof. The technology allows for the security of every transaction made since the user impends a signature as proof of authenticity where the data is then encrypted, further enhancing its security.

Many researches showed that different organizations, including governments, have adopted technology into their systems. In this case, most of the services are provided online through the e-government platforms that supposed to reduce time, eliminates corruption, and enhance efficiency in service delivery [3]. Although conservatives see technology as disruptive to the ordinary organizational functioning, it has a lot to offer for the people and government in general. The government has a lot of data in its possession, which requires retrieval either regularly or on-demand since it is the custodian of the citizens' information. Some of the data include births, death, employment, vehicle registration, debts, and everything that happens in and outside the country [4]. All the information is handled by people with the possibility of interference for personal benefits. It is for this reason, Blockchain technology proves to be important in storing and retrieval of the information.

Now, the research studies of Blockchain technology will be reviewed in the next section.

2. Literature review

Different scholars have engaged in various studies that seek to explore the uses of Blockchain technology in e-government. The Blockchain system seeks to solve this challenge by ensuring that the information is not only secure but also inaccessible by unauthorized people [5]. Currently, the technology is profoundly embraced by the private sector since the people here feel at a higher risk of loss. The private sector is also profit conscious and seeks to protect information as much as possible hence embraced the technology.

Some studies have revealed that governments experience a lot of challenges today related to dealing with data, which is sometimes sensitive and hence requires proper storage. Some of the data concerns the governments include data manipulation, integrity, breach, security, and privacy. These issues arise when the government cannot properly secure the information entrusted with it and which is consequently accessed by unwanted people. Some citizens fear of reaching the data by harmful people for malicious behavior or even committing crimes by using sensitive information such as using addresses to reach their victims. Blockchain technology addresses these fears and promises the government security of the information stored [4]. Although it is not fully embraced, in some of the countries, including the United States, China, Sweden, and the United Kingdom, are exploring the need to use the technology acts in the government sphere in the form of e-government.

Nowadays, technology is applicable in a wide range of government functions, including inventory, registry, and information exchange targeting hard and soft data. Some of the soft data includes information on votes, healthcare, patents, and ideas [6]. In all these cases, multiple elements are involved which expose the information to unwanted people. For instance, a patent is sensitive and is shared between the government and the owner, and exposing this information can expose it to be stolen, especially with the increased theft of copyright data. Here, the role of blockchain technology appears, as it works in the form of nodes where the network has the full copy of the information recorded with limited access.

Many pieces of research indicate that this is not an entirely new idea but has already been conceived and tested. Batubara et al., [7] describe the history of Blockchain technology by tracing it in 2008 with the inventions made by Satoshi Nakamoto. According to the researchers, one of the major uses of Blockchain in e-government is offering a secure, transparent, and auditable platform that allows government functions to go on without intermediaries. The study of Batubara et al., demonstrates that the technology

act as the go-between the citizen and the people [7]. Instead of government employing individuals to act, Blockchain does this work and, at the same time, ensure everything is secured.

There are multiple government functions provided through the e-government platforms, and this increases the types of transactions hence the need for Blockchain technology. According to Ølnes et al. (2018), for instance, the licensing department of the government is required to work with different other agencies like fire brigade, police, healthcare workers, and the municipality before allowing a demonstration or concert [8]. In most cases, this information is supposed to be secretive but involve different players [8]. Blockchain is useful in this case since it allows the concerned parties to exchange information without leaking it to undesired parties. Furthermore, according to Batubara et al. (2018), Blockchain technology is instrumental in facilitating payments in hostile environments [7]. These include environments infested with corruption since technology allows everything to be transparent. Some countries have already activated the role of Blockchain technology, for example Blockchain in countries like Honduras has enabled the government to provide better and transparent services.

Blockchain technology important because it affects many sectors such as Education and agricultural sectors.   In the field of Education, it is known that educational data is sensitive, and some governments have employed Blockchain technology to trace the authenticity and origin of the academic documents [9]. says that some of the information that is essential in the educational setting includes student's certificates, student data, faculty information, and certificate number. The information is required by different stakeholders at different periods, including schools and employers, and hence checking their authenticity and origin is of utmost importance. Governments are using the technology by including all this information in the Blockchain and ensuring that the concerned persons can see the movement of the information [9]. In this case, it is difficult for one party to alter the contents for selfish gain. Defense and security are always at the forefront of any country's progress and hence requires proper safeguard. Failure to safeguard security data exposes the country to attacks, which can be catastrophic. In this case, the government uses its e-government option to gather information from the public and share it within the security agencies. In the future, the government can take advantage of this innovation and transmit data between the security agencies, citizens, and data centers. The information provided must be secure to avoid it, falling in the hands of malicious individuals.

The importance of Blockchain in the agricultural sector, especially in this era, appears where the government is keen

on tracking production and quality. The world is increasingly turning to quality, and there are different government agencies keen on ensuring the implements used by farmers and food produced meets the set standards. In most cases, the food value chain is very long and involves different government agencies that put their information online for the customers and farmers to see.

For instance, pesticide manufacturers maintain a database with the government and the customer to ensure they are reachable if their products lead to negative impacts. Farmers, too, are stored in government databases to establish their quotas as well as buyers and manufacturers. Although these groups of people are well documented through the government's electronic system, there is no way they are connected. Blockchain can ship in here by ensuring that all the parties involved in the food value chain in one basket [4]. In this case, it will be possible for any person in the chain from the farmer to the consumer to trace the products. Keeping these records in a secure but accessible system will assist the government in monitoring production as well as quality.

Blockchain enables the government to facilitate the citizens' information through the online platform and hence facilitate easier retrieval. For instance, all the citizens' information, including educational qualification, home, car, job, and owner public records, are centralized, which provide one digital identity [9]. Although this has not been fully actualized, technology is playing a significant role in harnessing citizens' records. In the future, the bureaucracy experienced when dealing with governments, which will improve service delivery. If the technology fully rolled out, the citizens will experience reduced bias since every person will have equal access to government services.

Information exchange is vital between government agencies and the people and between the agencies themselves. According to Zhang et al. (2019), Blockchain technology has an impact on how the government exchanges information with the people and between agencies [10]. The effect has, however, not been realized but promises a better future for the government. The technology will enable the government to decentralize information, sharing an enhance credibility [10]. In most cases, the decision is made vertically before reaching the lower levels, while the technology can ensure the information remains secretive before reaching the ordinary people. According to Khan (2018), elections form the building block for any democratic government, and hence governments have invested heavily in enhancing their transparency and efficiency [11]. Since the 1970s, governments have invested in e-voting as a way of ensuring transparency in the process. These systems, however, record some faults that are easily mitigated by the Blockchain technology. Blockchain is applicable in the voting process by focusing on three main areas, including voters' anonymity, confidentiality, and verification [11].

The government is the custodian of citizen's reliable data, including the specific details of the people. For instance, it is the only one that can authenticate the people who are citizens and hence can vote [11].

In most cases, the government possesses the documents required for voting, for instance, identity cards, and hence has a great role in authenticating voters and establishing their eligibility. Although in most governments, the election process is left to an independent body, the government holds the authentic records and hence has a great role to play in the government through its e-government platforms. According to Yang et al. (2019), Blockchain technology has currently become one in every of the core technologies for secure knowledge sharing and storage over trustless and redistributed peer-to-peer systems [12]. E-government is amongst the systems that store sensitive data concerning voters, businesses and alternative affiliates, and so becomes the target of cyber attackers.

The common e-government systems are centralized. Fig.1 proposes a secure and redistributed e-government system supported the pool of Blockchain technology, that could be a semi-public and redistributed Blockchain systems consisting of a bunch of pre-selected entities or organizations responsible of agreement and choices creating for the good thing about the total network of peers. Additionally, a variety of e-government nodes are pre-selected to perform the tasks of user and dealings validation before being more to the Blockchain network. Consequently, e-government users of the pool of Blockchain network are given the rights to form, submit, access, and review transactions, as shown in Fig.1[12].
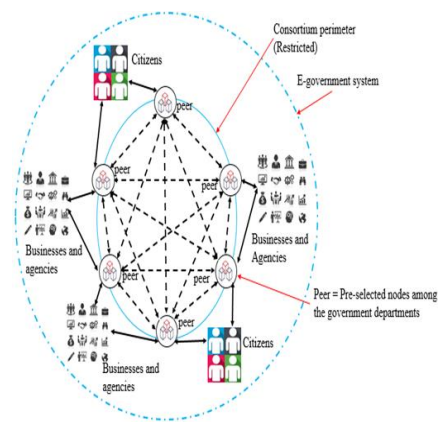

Fig. 1   Sample of how Blockchain works [12].

Based on previous studies, some researchers have studied the issue of technology and provided information that is essential in understanding blockchain functions. Others further look at the effects of the Blockchain technology in e-government, especially in the countries that already applied Blockchain technology. Now, after presenting

many studies which show the interest in Blockchain, our research methodology will be discussed.

3. Methodology

Methodology matters a lot in research since it validates the findings and enables the third party to follow the results and get similar conclusions. The methodology used must also be consistent with the type of research to come up with accurate information. As the technology of Blockchain is still relatively new, many people do not know about it, thus, we did not apply survey technique which normally targets many people, but we chose to review journal articles and made online interviews with a non-random purposeful sample of some of the experts in the field of technology. The methodology of the paper was chosen to answer what are the benefits and effects of Blockchain in e-governments. Applying the Blockchain technology in the public sector motivated the need to identify the potential effects on e-government services.

Firstly, regarding the secondary data, the sources used were products of research and documentation done by scholars in the field based on Blockchain and e-government. All the journal articles used for the research were published between 2016 and 2019, meaning they were fairly new and updated for the research in a field that is constantly changing. The few journal articles published before 2016 were included because they provided a history of the technology, which enabled the connection between the two. These resources provided firsthand or second-hand data on the issue.

But what is the status of Blockchain efforts within organizations and what are their plans for developing Blockchains in the near future? What do organizations see as the potential for Blockchains to disrupt their industry?

Secondly, regarding the primary data, we made four interviews with a non-random purposeful sample of experts. Our participants are Prof Omimah Bamsg the Vice Dean of the College of Computer Science and Engineering at the University of Jeddah. Dr. Alaa Ashmawi, the Deputy supervisor of the Cyber Security Center at the University of Jeddah. Dr. Ammar Muthanna, associate Professor and the Head of SDN laboratory at St Petersburg state at the university of telecommunications (Russia). Dr. Mansour Alrebdi is the manager in telecommunications and technology ministry.

The reason for conducting the interviews online is because we have done the research data collection in the period of COVID-19 quarantine in Saudi Arabia in March-April 2020.

4. Results and Analysis

The main questions in the interviews are presented below with their answers from the excerpts:

1.What are the biggest challenges to utilize Blockchain in KSA's e-government?

Alrebdi (2020) sees that there are three biggest challenges to utilize Blockchain in KSA's e-government which are:

- Blockchains are still an emerging technology
- Lack of understanding just what Blockchain can do/is good for
- Lack of experts skilled in Blockchain technology

On the other hand, Bamsag (2020), says "Saudi Arabia is ready to employ Blockchain as a secure infrastructure for e-transaction. Yasser (Governmental e-transaction program) needs to adopt this technology and formalize it among all governmental sectors". Furthermore, Ashmawi, 2020 says:" some of the biggest challenges for Blockchain adoption in KSA's government is the scalability and the lack of speed and talented developers". Nevertheless, Muthanna (2020) says "Blockchain is a cryptographically secured distributed ledger that records transactions chronologically, permanently, and unalterably. However, scalability, data security, interoperability, and the management of personally identifiable information are considered the main challenges of it."

2. From your experience, to what extent is e-government and large organization currently using Blockchain technology?

Alrebdi (2020) declares "In my opinion Blockchain technology is very important for e-government. It starts to be used in all around the world. Such a technology will fit with vision of Saudi Arabia. I think that the Blockchain technology will be the bright future of e-government". Bamsag (2020) further added "As far as I know, the deployment of Blockchain is individual efforts, some universities and other organizations started to employ it is certain transaction, but not on a large scale (Bamsag, 2020).

3. What is the role of Blockchain in e-government and what benefits specific to KSA citizens and organizations do you hope to obtain from using Blockchains?

Alrebdi (2020) asserts "There are many benefits such as services will be available for citizen all time, providing transparency and connecting information which make it easy for both citizens and government". Bamsag (2020) says "Blockchain, in simple term, about storing the transactions electronically in a way that it could be traceable, authentic, and non-changeable. These features are very important to provide a secure and efficient infrastructure to utilize e-government to its best. Ashmawi, 2020 added "The main advantage for using Blockchain is the decentralization and the authentication. The level of trust individuals put in any transaction can benefit largely from using Blockchain

because tampering is almost impossible to happen without detection. That goes the same way for government's transactions". Muthanna 2020 says "Blockchain-based solutions have the potential to make government operations more efficient and improve the delivery of public services, while simultaneously increasing trust in the public sector. Specifically, KSA citizens and organizations can benefit from using Blockchains technology where it can protect data, streamline processes, and reduce fraud, waste, and abuse while simultaneously increasing trust and accountability. In addition, Blockchain -based government model can share resources over a distributed ledger secured using cryptography. This structure eliminates a single point of failure and inherently protects sensitive citizen and government data. Furthermore, it has the following advantages:

- Secure storage of government, citizen, and business data.
- Reduction of labor-intensive processes.
- Reduction of excessive costs associated with managing accountability.
- Reduced potential for corruption and abuse.
- Increased trust in government and online civil systems."

The answers above as well as the review of literature have given us a glimpse of the current state of the Blockchain implementation and what are the future aspirations of this technology if applied to public and private sector services. Our qualitative data have been analyzed using the thematic analysis technique. The themes we found are as follows:
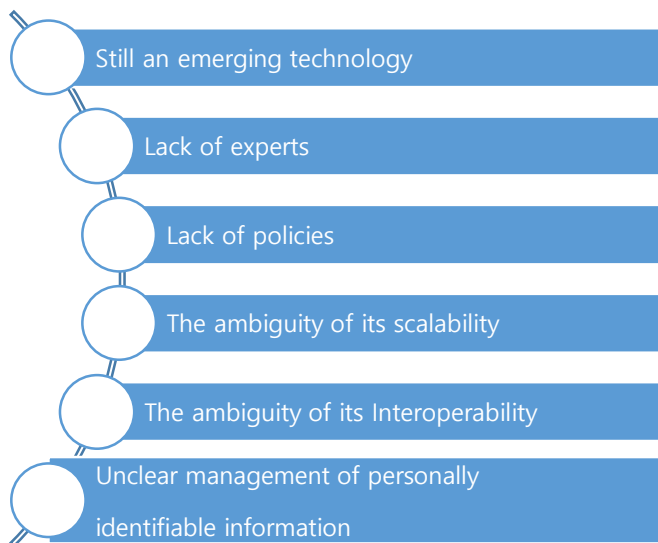
*Regarding the **challenges**:*

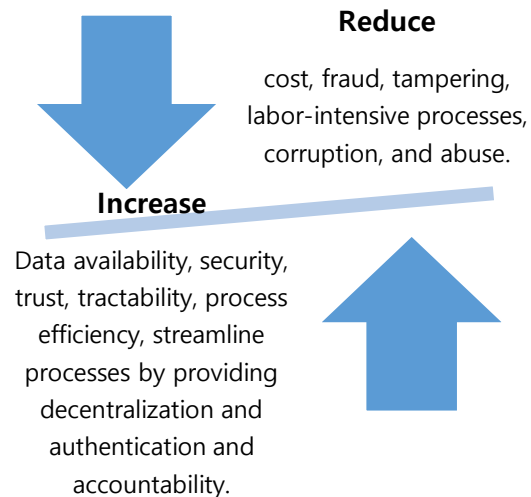Fig. 2   Challenges of applying Blockchain technology in e-government.

Fig. 3   Benefits of applying Blockchain technology in e-government.

5. Discussion

Data were collected from articles and focused on Blockchain and e-government issues, considering their coverage of different regions around the world. The Blockchain is a relatively new topic, and issues that have been used from recent sources. Although most governments have not fully integrated technology into their e-government operations, they are slowly showing signs of doing so in the future. However, the study lacks data from demographic samples because it depends largely on the information recorded and not on statistics.

Although E-government is not fully embraced in many countries, some of them including the United States, China, Sweden, and the United Kingdom, are exploring the need to use the technology acts in the government sphere in the form of e-government. So, Blockchain technology is relatively new around the world in general and in the Arab Gulf countries in particular and most people need to know more about it. Therefore, the e-government services in Saudi Arabia are still in the early stages of applying Blockchain. Applying Blockchain technology in e-government around the world will help to build trust between citizens and systems because Blockchain provides a high level of security and assures that citizens' sensitive data are protected.

As a result of our research we are presenting the role of Blockchain in e-government (see Fig. 2 and Fig. 3). In our two themes, we found six challenges and twelve benefits (including reducing some issues and increasing good things). Firstly, the challenges are centered around its nature as it considered as an emerging technology, lack of experts, lack of policies, and ambiguity of its scalability, interoperability and the management of personally identifiable information. Secondly, the theme of the

benefits which on one hand, Blockchain can increase availability, security, trust, tractability, process efficiency, authentication, and accountability. On the other hand, Blockchain can reduce cost, fraud, tampering, labor-intensive processes, corruption, and abuse. Most of them can accrue by preventing the corruption of changing the information since in the Blockchain the records are stored in the form of blocks or chains, but under the authority of no single person such that every person concerned can see what is happening. Every person in the network can see the data, and once it is fed, it is challenging to alter or even change that information hence tamper-proof.

6. Conclusion

Overall, the benefits of Blockchain technology are heaps, thus, government leaders should consider Blockchain as a solution for reducing costs and improving efficiency in the long term as it has proven effective in reducing redundancy, streamline processes, decrease audit burden, increase security, and ensure data integrity after building trust with citizens and assuring that sensitive data are secured.

With the rapid development of civilization in the Kingdom of Saudi Arabia, e-government services seek to build confidence with citizens and ensure that their data is protected to provide reliable infrastructure to activate Blockchain services in the long term. Unfortunately, as mentioned above that Blockchain technology is profoundly embraced more by the private sector since they feel at a higher risk of loss and they are profit conscious and seeks to protect information as much as possible hence embraced the technology. However, the governmental sector needs to embrace the technology more because they are responsible for all the citizens. E-government platforms started to think about creating a more secure environment in order to reach many objectives such as reducing service time, eliminating corruption, and enhancing efficiency in service delivery.

It is anticipated that by adding Blockchain technology to the e-government, citizens will trust the governmental services more and having such technology will protect data, reduce cost and improve efficiency. Lastly, Blockchain technology could be the future of services provided by the government, industry, banks, academia, and business. In particular, e-government using Blockchain can build trust, protect data, improve processes efficiency and reduce costs in the long term. Applying Blockchain in e-government will be useful and data will be available at all times and especially at critical times, as the crisis, we are currently facing COVID-19. Finally, further research can be done with different data (quantitative data for example) and with different contexts (like different countries).

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