Blockchain Technology Trends in G20 Countries: The Case of Saudi Arabia

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Abstract
This study aims to explore the usage trends of blockchain technology in the G20 countries, with a particular focus on Saudi Arabia. As an emerging technology, blockchain is already being widely used in a number of industries including in the financial and supply chain sectors. For the purpose of this research, a questionnaire was developed to explore the adoption trends of blockchain technology in Saudi organizations. Saudi Arabia was chosen to be the case study for the research topic, as it is one of the largest oil producers in the world and holds the presidency of the G20 in 2020. The results of the study showed that some organizations in Saudi do not currently intend to implement blockchain technology and there is a lack of knowledge in some industries about this technology. Some of the obstacles preventing blockchain technology adoption were also identified.

Keywords: blockchain technology, Saudi organizations, Saudi Arabia, G20, information systems.

1. Introduction
In this study, the aim is to investigate the adoption and usage of blockchain technology within Saudi organizations. The research also proposes to identify possible obstacles that may contribute to preventing the use of blockchain technology in these organizations. Blockchain is a new technology that is changing the way in which organizations may operate in some cases, and many applications of this technology can be seen especially in the financial and supply chain sectors. In addition, the number of companies which are attempting to use blockchain technology in their activities is increasing (Magnier & Barban, 2018). There are several definitions of blockchain, and for the purpose of this paper, the following one has been adopted. Blockchain can be described as "tamper resistant digital ledgers implemented in a distributed fashion (i.e., without a central repository) and usually without a central authority (i.e., a bank, company or government)" (Yaga, Mell, Roby, & Scarfone, 2018, p. 1). Yaga et al. (2018) explain that blockchain enables a community of clients to record transactions using a shared ledger within the community in such a way that under usual operation of the blockchain network no transaction can be changed when published. Magnier & Barban (2018) add that blockchain is a new technology and a method of cryptography offering a great opportunity for lower cost, greater liquidity, more accurate records, and transparency of ownership.

Blockchain technology has a distributed data structure which integrates security, reliability, and centralization, and can also be considered as the central support technology for digital currency (Cai, Du, Gan, Zhang, & Huang, 2018). It is a revolutionary innovation and may be capable of forming a new economic system which can be called the blockchain economy and which may fundamentally change our understanding of governance (Beck, Müller-Bloch, & King, 2018). According to Magnier and Barban (2018), the increased usage of this new technology can create new risks, especially in corporate governance. They explain that blockchain is like a peer-to-peer system, where all participants can act as both supplier and consumer of information at the same time, unlike a server-based system where a server provides the information to all the clients (Magnier & Barban, 2018). Beck, Müller-Bloch, and King (2018) describe how the blockchain technology works, as follows:

• Each transaction is kept on the blockchain and stored in blocks
• All Data related to transactions are also stored within the blocks in a cryptographic data structure and Merkle tree is the most common type of data structure
• In a Merkle tree, each transaction is hashed and frequently paired, merged, and rehashed till only one hash remains, which called the Merkle root
Each block saves the Merkle root of the former block which generates a chain of data that is cryptographically secured and connected.

Every attempt to modify a transaction requires rehashing all the following blocks, not only the one that contains the transaction.

There are also some important features for users and corporations. Beck, Müller-Bloch, and King (2018) reported that blockchain can be characterized as a type of technology that gives clients confidence, with information that has not been tampered with, which guarantees trustworthiness to different agents who may not trust one another. In 2014, an Ethereum blockchain was released which enables smart contracts that enable diverse kinds of transactions, beyond simple cryptocurrency transfer, without the risk of downtime, censorship, or fraud (Beck et al., 2018; Buterin, 2014; Monsalve, Parra, & Diaz, 2017; Nofer, Gomber, Hinz, & Schiereck, 2017). As blockchain has become an extremely valuable technology and the blockchain economy is being recognized, academic research in this field has also increased (Beck, Avital, Rossi, & Thatcher, 2017; Beck et al., 2018; Tapscott & Tapscott, 2016).

In October 2020, digital currencies, as an application of blockchain technology, reached a historical moment when PayPal (as an electronic payment platform) announced the launch of its new services where users can sell, buy, and keep digital currency using their electronic wallets provided by PayPal. Such an announcement gives more credibility to digital currencies (e.g. Bitcoin and Libra) as they can be supported by payment platforms for use in online transactions. Previous studies, such as those by (Beck, Czepluch, Lollike, & Malone, 2016; Beck et al., 2018; Nærland, Müller-Bloch, Beck, & Palmund, 2017), suggest that blockchain technology can reduce both uncertainty and ambiguity, as well as being able to improve security in transactions, and this can be done by providing full transactional disclosure and a single truth for all network participants.

As mentioned, this present paper is an exploratory study as a part of ongoing work to investigate the trends of blockchain usage and is focused on the use of blockchain technology trends in the Group of Twenty (G20) countries, with a more specific focus on Saudi Arabia as a case study. Saudi Arabia was ranked 39th out of 141 countries in the Global Competitiveness Report in 2019, produced by the World Economic Forum (World Economic Forum, 2019). See Figure 1 for more details. This paper is also trying to contribute to the scholarly knowledge about the adoption of blockchain technology by providing evidence from Saudi Arabia.

In order to explore the blockchain trend in Saudi Arabia, a number of Saudi organizations will be surveyed in this study. The main objective is to answer the following two research questions:

1) Are Saudi organizations familiar with the concept of blockchain technology and the advantages and disadvantages of using it?
2) Are more Saudi organizations likely to adopt blockchain technology in the future?

The rest of this paper will be focused on answering these research questions by first providing a literature review of research papers in the field, then explaining the research method, and finally, presenting the results of the analysis, with implications for the research.

2. Literature Review

Blockchain technology is an emerging one that has attracted many businesses to invest in it, as the demand for such technology is projected to rise. Cai et al. (2018) predict that blockchain will be more widely used in the future due to its technological advantages, regardless of the fact that there are still some security risks.

According to Cong and He (2019), there are two areas of research on blockchain that are economically relevant. The first one is about using the blockchain mechanism for generating and maintaining a decentralized consensus, and this in turn can be divided into two main streams: analyzing the general process of consensus generation and studying the theoretical topics including incentive requirements and marketplace microstructure (Cong and He, 2019). The second area of research is about blockchain technology implications in real life, with higher research density (Cong and He, 2019). Table 1 shows some example of studies in both areas of research.

Table 1. Examples of blockchain technology studies

| Area of research                                      | Examples of studies                                                                 |
|------------------------------------------------------|-------------------------------------------------------------------------------------|
| Studies about mechanisms for generating decentralized consensus | (Biais, Bisière, Bouvard, & Casamatta, 2019; Cong, He, & Li, 2018; Easley, O’Hara, & Basu, 2017; Eyal & Sirer, 2014; Huberman, Leshno, & Moallemi, 2017; Kroll, Davey, & Felten, 2013; Nayak, Kumar, Miller, & Shi, 2016) |
| Real life implications of using blockchain technology | (Bartoletti & Pompianu, 2017; Cao, Cong, & Yang, 2018; Chiu & Koeppl, 2019; Cong, Li, & Wang, 2018a, 2018b; Harvey, 2016; Khapko & Zoican, 2018; Malinova & Park, 2018; Tinn, 2018; Yermack, 2017) |

Source: (Cong & He, 2019).

Blockchain technology has many applications in real life, and Nofer et al. (2017) illustrate some of its applications, as shown in Table 2. Magnier & Barban (2018) assess the possible implications of this technology that may arise in the near future, including issues such as how it may change the balance of power between managers, investors, shareholders, advisors, and other parties involved in corporate governance. Their research findings reveal that the main concern about the use of blockchain technology is the fact that it is not fully compliant with the requirements of all businesses in relation to transparency and permanence (Magnier & Barban, 2018). On the other hand, a purely decentralized blockchain would cost less as there would be no cost for an authority to oversee the blockchain; however, in their view, such a system could be open to fraud and robbery (Magnier & Barban, 2018). They also conclude that blockchain technology can affect corporate law and governance as well as causing a significant shift in the balance of power among the actors (Magnier & Barban, 2018). Furthermore, corporate governance may also take advantage of blockchain technology on democratic grounds; however, this may result in legal and financial risks for the business and its investors (Magnier & Barban, 2018).

Beck, Müller-Bloch, and King (2018) discuss the blockchain economy alongside the three dimensions of information technology’s governance, which are decision rights, accountability, and incentives. They explore these dimensions in a blockchain-based organization – a “decentralized autonomous organization” (DAO) – and analyze the Swarm City blockchain case to explore governance issues (Beck, Müller-Bloch, & King, 2018). They conclude that transactions which are enforced autonomously in smart contracts are quite different from transactions explained in the digital economy, and they also propose a research framework for IT governance in the blockchain economy (Beck, Müller-Bloch, & King, 2018).
Table 2. Some applications of blockchain technology

| Type                  | Description                                                                 |
|-----------------------|-----------------------------------------------------------------------------|
| Financial             | Microtransactions: Non-cash and reserve of exchange using cryptography to secure transactions. |
|                       | Cryptocurrency: Monera, Litecoin, Ripple, Monero, Bitcoin, Ethereum, Monero, and other private equity. |
| Insurance             | Compliance using public trust chains and without a third party. Verinos, Axiom, and other security protocols can be used on a blockchain-based identity market. Plus provers to tackle reconciliation challenges. |
| Privacy public        | Compressed authentication by privacy or not necessary anymore.                |
| Medical industry      | Disease registry and managing medical records ownership. Ethereum, and other protocols. |
| Decentralized storage | Sharing documents without the need of a third party by using a protocol.     |
| Decentralized Deform   | The blockchain reliably serves the communication of smart devices within the Internet of Things. |
| Anticounterfeiting     | Authenticity of products is verified by the blockchain network consisting of all members participating in electronic transactions (producers, manufacturers, marketplaces). |
| Internet applications | Blockchain for monitoring and verifying, decade goods, services (DDoS are controlled by every user in a decentralized way. |

Source: (Nofer et al., 2017).

Cai et al. (2018) describe the classification, architecture, and key technologies of blockchain. In addition, they briefly analyze blockchain security, which includes the access control mechanism, distributed denial of service (DDoS) attack defense mechanism, and fragment information leakage prevention mechanism (Cai et al., 2018). On the other hand, Monsalve et al. (2017), in a case study in Colombia, propose a model that would tolerate implementing a system in order to audit the management of the economic resources of the Colombian government; they also discuss the proper regulations required in order to facilitate such new technology. They clarify the architectural approach of the proposed system, as it is intended to decentralize information, dispense with intermediaries, and facilitate the auditing of state contracts, with the ultimate goal of achieving transparency through electronic government services. Monsalve et al. (2017) conclude that using blockchain technology could lead to a financial revolution in Colombia.

3. Research Method

In order to answer the research questions, a quantitative research method (Field, 2013; Hair, Black, Babin, & Anderson, 2010) was applied. To survey the opinions of employees, a questionnaire was developed to be used as a survey instrument, using Google forms. The questionnaire was available online in both Arabic and English. The target population of this study was employees in Saudi private organizations. Relevant hashtags were used to distribute the questionnaire through social media, including Twitter, and LinkedIn. The questionnaire was also distributed through WhatsApp specially in professional groups. After the data had been collected, SPSS software was used to conduct a frequency analysis. A five-point Likert scale, ranging from 1 (= strongly disagree) to 5 (= strongly agree) was applied in order to measure 26 items in parts two, three and four of the questionnaires.

4. Results

After the collected data had been screened, there were found to be 68 valid responses. The response rate is around 17%, and according Neuman (2000) response rates ranging from 10 to 50% are common for surveys studies, therefore, it can be argued that the results of this study have general validity. The collected data were analyzed, and the results of the analysis are presented in this section.

The questionnaire was divided into four parts: part one, general information; part two, adoption of blockchain; part three, organizational barriers to greater investment in blockchain; and part four, knowledge about blockchain. Depending on each respondent’s answer to the final question of part one, they were directed to either part two or part three. The final question of part one was: "Is your organization currently using blockchain technology?" The results of the frequency analysis of part one show that almost 16% of the respondents confirmed that their organization is currently using blockchain technology. These respondents were asked to complete parts three and four of the questionnaire. A further 25% were not sure whether their organizations were applying blockchain technology in some way, while the remainder of the respondents (representing almost 59%) stated that their organization does not use blockchain technology at present. These two groups were asked to complete parts two and four of the questionnaire. Table 3 shows the frequency analysis of the question about the current usage of blockchain technology in organizations, and Figure 2 illustrates the results of this question.
Table 3. The organization is currently using blockchain technology

| Valid | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------|-----------|---------|---------------|--------------------|
| No    | 40        | 58.8    | 58.8          | 83.8               |
| Yes   | 11        | 16.2    | 16.2          | 100.0              |
| Total | 68        | 100.0   | 100.0         |                    |

Figure 2. The organization is currently using blockchain technology

4.1 Knowledge about Blockchain

The results of the analysis of part four of the questionnaire, titled "knowledge about blockchain", will be presented first, as this part of the questionnaire was answered by all the respondents. There were ten items in total, and the results for the frequency analysis of the first item are presented in Table 4 and illustrated in Figure 3. As shown in Table 4, almost 75% of the respondents agreed with the statement "increasing the knowledge about blockchain technology and its business applications is the most appropriate way to determine its suitability for your organization's work".

Table 4. Increasing knowledge is the way to determine blockchain's suitability for the organization

| Valid | Frequency | Percent | Valid Percent | Cumulative Percent |
|-------|-----------|---------|---------------|--------------------|
| 1     | 1         | 1.5     | 1.5           | 1.5                |
| 2     | 3         | 4.4     | 4.4           | 5.9                |
| 3     | 13        | 19.1    | 19.1          | 25.0               |
| 4     | 21        | 30.9    | 30.9          | 55.9               |
| 5     | 30        | 44.1    | 44.1          | 100.0              |
| Total | 68        | 100.0   | 100.0         |                    |

Figure 3. Increasing knowledge is the way to determine blockchain's suitability for the organization

The results for the frequency analysis of the second item are presented in Table 5 and illustrated in Figure 4. As
shown in Table 5, almost 53% of the respondents agreed with the statement "your organization is interested in knowing more about blockchain technology and its business applications”.

Table 5. The organization's interest in knowing more about blockchain technology

| Frequency | Valid Percent | Cumulative Percent |
|-----------|---------------|--------------------|
| 1         | 3             | 4.4                |
| 2         | 5             | 7.4                |
| 3         | 24            | 35.3               |
| 4         | 22            | 32.4               |
| 5         | 14            | 20.6               |
| Total     | 68            | 100.0              |

Figure 4. The organization's interest in knowing more about blockchain technology

The results for the frequency analysis of the third item are presented in Table 6 and illustrated in Figure 5. As shown in Table 6, almost 73% of the respondents agreed with the statement "You need more knowledge about the details of blockchain technology and its applications in your organization’s work”.

Table 6. The need for more knowledge about the details of blockchain technology

| Frequency | Valid Percent | Cumulative Percent |
|-----------|---------------|--------------------|
| 1         | 1             | 1.5                |
| 2         | 3             | 4.4                |
| 3         | 14            | 20.6               |
| 4         | 21            | 30.9               |
| 5         | 29            | 42.6               |
| Total     | 68            | 100.0              |

Figure 5. The need for more knowledge about the details of blockchain technology
The results for the frequency analysis of the fourth item are presented in Table 7 and illustrated in Figure 6. As shown in Table 7, almost 83% of the respondents agreed with the statement "The best practice, before starting to apply the blockchain technique, is to consult with specialists in the field of this technique in order to choose the most appropriate way to adopt it".

Table 7. The best practice before starting the applying blockchain is to consult with specialists

| Frequency | Percent | Valid Percent | Cumulative Percent |
|-----------|---------|---------------|--------------------|
| 2         | 1       | 1.5           | 1.5                |
| 3         | 10      | 14.7          | 14.7               |
| Valid     | 4       | 33.8          | 50.0               |
| 5         | 34      | 50.0          | 100.0              |
| Total     | 68      | 100.0         | 100.0              |

Figure 6. The best practice before starting the applying blockchain is to consult with specialists

The results for the frequency analysis of the fifth item are presented in Table 8 and illustrated in Figure 7. As shown in Table 8, almost 83% of the respondents agreed with the statement "Staff in your organization may need training courses on blockchain technology".

Table 8. Staff may need training courses on blockchain technology

| Frequency | Percent | Valid Percent | Cumulative Percent |
|-----------|---------|---------------|--------------------|
| 1         | 1       | 1.5           | 1.5                |
| 2         | 3       | 4.4           | 5.9                |
| 3         | 7       | 10.3          | 16.2               |
| 4         | 13      | 19.1          | 35.3               |
| 5         | 44      | 64.7          | 100.0              |
| Total     | 68      | 100.0         | 100.0              |

Figure 7. Staff may need training courses on blockchain technology
The results for the frequency analysis of the sixth item are presented in Table 9 and illustrated in Figure 8. As shown in Table 9, almost 44% of the respondents agreed with the statement "Blockchain will be among the top five strategic priorities for your organization".

Table 9. Blockchain will be among the top five strategic priorities for the organization

| Frequency | Percent | Valid Percent | Cumulative Percent |
|-----------|---------|---------------|--------------------|
| 1         | 4       | 5.9           | 5.9                |
| 2         | 7       | 10.3          | 16.2               |
| 3         | 27      | 39.7          | 55.9               |
| 4         | 21      | 30.9          | 86.8               |
| 5         | 9       | 13.2          | 100.0              |
| Total     | 68      | 100.0         | 100.0              |

Figure 8. Blockchain will be among the top five strategic priorities for the organization

The results for the frequency analysis of the seventh item are presented in Table 10 and illustrated in Figure 9. As shown in Table 10, only 36% of the respondents agreed with the statement "Blockchain will be important but will not be in the top five strategic priorities", while almost 31% disagreed.

Table 10. Blockchain will be important, but will not be in the top five strategic priorities

| Frequency | Percent | Valid Percent | Cumulative Percent |
|-----------|---------|---------------|--------------------|
| 1         | 6       | 8.8           | 8.8                |
| 2         | 16      | 23.5          | 32.4               |
| 3         | 21      | 30.9          | 63.2               |
| 4         | 15      | 22.1          | 85.3               |
| 5         | 10      | 14.7          | 100.0              |
| Total     | 68      | 100.0         | 100.0              |

Figure 9. Blockchain will be important but will not be in the top five strategic priorities
The results for the frequency analysis of the eighth item are presented in Table 11 and illustrated in Figure 10. As shown in Table 11, almost 30% of the respondents agreed while almost 29% disagreed with the statement "Blockchain will be relevant, but not a strategic priority".

Table 11. Blockchain will be relevant, but not a strategic priority

|    | Frequency | Percent | Valid Percent | Cumulative Percent |
|----|-----------|---------|---------------|--------------------|
| 1  | 4         | 5.9     | 5.9           | 5.9                |
| 2  | 16        | 23.5    | 23.5          | 29.4               |
| 3  | 27        | 39.7    | 39.7          | 69.1               |
| 4  | 15        | 22.1    | 22.1          | 91.2               |
| 5  | 6         | 8.8     | 8.8           | 100.0              |
| Total | 68    | 100.0  | 100.0         |                    |

Figure 10. Blockchain will be relevant, but not a strategic priority

The results for the frequency analysis of the ninth item are presented in Table 12 and illustrated in Figure 11. As shown in Table 12, only 28% of the respondents agreed while almost 23% disagreed with the statement "Unsure (our organization has not reached a conclusion)".

Table 12. Unsure (the organization has not reached a conclusion)

|    | Frequency | Percent | Valid Percent | Cumulative Percent |
|----|-----------|---------|---------------|--------------------|
| 1  | 6         | 8.8     | 8.8           | 8.8                |
| 2  | 10        | 14.7    | 14.7          | 23.5               |
| 3  | 33        | 48.5    | 48.5          | 72.1               |
| 4  | 11        | 16.2    | 16.2          | 88.2               |
| 5  | 8         | 11.8    | 11.8          | 100.0              |
| Total | 68    | 100.0  | 100.0         |                    |

Figure 11. Unsure (the organization has not reached a conclusion)
The results for the frequency analysis of the tenth item are presented in Table 13 and illustrated in Figure 12. As shown in Table 13, almost 47% of the respondents disagreed with the statement "Blockchain will not be relevant to your organization’s work".

Table 13. Blockchain will not be relevant to the organization’s work

| Frequency | Percent | Valid Percent | Cumulative Percent |
|-----------|---------|---------------|-------------------|
| 1         | 16      | 23.5          | 23.5              |
| 2         | 16      | 23.5          | 47.1              |
| 3         | 18      | 26.5          | 73.5              |
| 4         | 14      | 20.6          | 94.1              |
| 5         | 4       | 5.9           | 100.0             |
| Total     | 68      | 100.0         | 100.0             |

Figure 12. Blockchain will not be relevant to the organization’s work

4.2 Adoption of Blockchain

The results of the analysis of part two of the questionnaire, titled "adoption of blockchain", are presented below. The second part contained six items and was only answered by respondents who had answered, "Not sure" or "No" in the last question of part one, about whether their organizations were currently applying blockchain technology in some way.

The results for the frequency analysis of the first item of part two are presented in Table 14. As shown in Table 14, only 33% of the respondents agreed with the statement "My organization is interested in adopting blockchain technology in its future work", while almost 10% disagreed with it.

Table 14. The organization is interested in adopting blockchain technology in its future work

| Frequency | Percent | Valid Percent | Cumulative Percent |
|-----------|---------|---------------|-------------------|
| 1         | 3       | 5.3           | 5.3               |
| 2         | 3       | 5.3           | 10.5              |
| 3         | 32      | 56.1          | 66.7              |
| 4         | 8       | 14.0          | 80.7              |
| 5         | 11      | 19.3          | 100.0             |
| Total     | 57      | 100.0         | 100.0             |

The results for the frequency analysis of the second item of part two are presented in Table 15. As shown there, almost 73% of the respondents agreed with the statement "Blockchain technology is widely expandable and will eventually achieve mainstream adoption".
The results for the frequency analysis of the third item of part two are presented in Table 16. It shows that only 22% of the respondents agreed while almost 28% disagreed with the statement "Your organization is planning to replace its current record systems by using blockchain technology".

Table 16. The organization is planning to replace current systems using blockchain technology

| Frequency | Percent | Valid Percent | Cumulative Percent |
|-----------|---------|---------------|--------------------|
| 1         | 4       | 7.0           | 7.0                |
| 2         | 12      | 21.1          | 28.1               |
| 3         | 28      | 49.1          | 77.2               |
| 4         | 10      | 17.5          | 94.7               |
| 5         | 3       | 5.3           | 100.0              |
| Total     | 57      | 100.0         | 100.0              |

The results for the frequency analysis of the fourth item of part two are presented in Table 17. As shown there, almost 53% of the respondents agreed with the statement "Your organization will lose a competitive advantage if we do not adopt blockchain technology".

Table 17. The organization will lose a competitive advantage if it does not adopt blockchain technology

| Frequency | Percent | Valid Percent | Cumulative Percent |
|-----------|---------|---------------|--------------------|
| 1         | 2       | 3.5           | 3.5                |
| 2         | 9       | 15.8          | 19.3               |
| 3         | 15      | 26.3          | 45.6               |
| 4         | 14      | 24.6          | 70.2               |
| 5         | 17      | 29.8          | 100.0              |
| Total     | 57      | 100.0         | 100.0              |

The results for the frequency analysis of the fifth item of part two are presented in Table 18. As shown there, almost 47% of the respondents disagreed with the statement "Blockchain technology will disrupt the industry in which your organization is involved".

Table 18. Blockchain technology will disrupt the industry in which the organization is involved

| Frequency | Percent | Valid Percent | Cumulative Percent |
|-----------|---------|---------------|--------------------|
| 1         | 13      | 22.8          | 22.8               |
| 2         | 14      | 24.6          | 47.4               |
| 3         | 19      | 33.3          | 80.7               |
| 4         | 6       | 10.5          | 91.2               |
| 5         | 5       | 8.8           | 100.0              |
| Total     | 57      | 100.0         | 100.0              |

The results for the frequency analysis of the sixth item of part two are presented in Table 19. As shown there, almost 24% of the respondents agreed while nearly 21% disagreed with the statement "blockchain is overhyped".

Table 19. Blockchain is overhyped

| Frequency | Percent | Valid Percent | Cumulative Percent |
|-----------|---------|---------------|--------------------|
| 1         | 13      | 22.8          | 22.8               |
| 2         | 14      | 24.6          | 47.4               |
| 3         | 19      | 33.3          | 80.7               |
| 4         | 6       | 10.5          | 91.2               |
| 5         | 5       | 8.8           | 100.0              |
| Total     | 57      | 100.0         | 100.0              |
Table 19. Blockchain is overhyped

|   | Frequency | Percent | Valid Percent | Cumulative Percent |
|---|-----------|---------|---------------|--------------------|
| 1 | 2         | 3.5     | 3.5           | 3.5                |
| 2 | 10        | 17.5    | 17.5          | 21.1               |
| 3 | 31        | 54.4    | 54.4          | 75.4               |
| 4 | 7         | 12.3    | 12.3          | 87.7               |
| 5 | 7         | 12.3    | 12.3          | 100.0              |
| **Total** | **57** | **100.0** | **100.0** | **100.0** |

4.3 Organizational Barriers to Greater Investment in Blockchain

The results of the analysis of part three of the questionnaire, titled "organizational barriers to greater investment in blockchain", are presented below. Part three was only answered by respondents who answered "Yes" in the last question of part one, about whether their organizations were currently applying blockchain technology in some way. So those 11 respondents answered the third part of the questionnaire as they are using the technology in their organizations.

The results for the frequency analysis of the first item of part three showed almost 63% of the respondents agreed with the statement "implementation (replacing existing legacy systems) is a barrier", while the results for the second item in this part showed almost 72% of the respondents agreed with the statement "regulatory issues are a barrier". The results for the third item of part three showed almost 54% of the respondents agreed with the statement "potential security threats are a barrier", and those for the fourth item of part three showed almost 91% of the respondents agreed with the statement "lack of in-house capabilities (skills and understanding) is a barrier".

Almost 81% of the respondents agreed with the fifth item of part three, "uncertain return on investment (ROI) is a barrier" and almost 63% of them agreed with the statement "concerns over sensitivity of competitive information is a barrier", which was the sixth item of part three. The seventh item of part three showed almost 72% of the respondents agreed with the statement "blockchain technology is unproven and this is a barrier", while the eighth item of part three showed almost 81% of the respondents agreed with the statement "not being currently identified as a business priority is a barrier". The results for the frequency analysis of the ninth item of part three showed almost 54% of the respondents agreed with the statement "we don’t see any barrier", and finally, the tenth item of part three showed almost 81% of the respondents agreed with the statement "not sure / there are other barriers".

5. Discussion

In this section, the above results will be discussed further and the answers to the research questions will be presented. The first research question is "Are Saudi organizations familiar with the concept of blockchain technology and the advantages and disadvantages of using it?". The results of part two suggest that there is a lack of knowledge about this technology in some Saudi private organizations and therefore a need to educate them more about it. This includes knowledge about how it works and the applications that are relevant to these organizations, as well as ascertaining the advantages and disadvantages of such technology.

The second question of this research is "Are more Saudi organizations likely to adopt blockchain technology in the future?". To answer this research question, some of the results of part two will be discussed in this section, as follows. Only 33% of the respondents agreed that their organization was interested in adopting blockchain technology in the future, and less than 10% disagreed, while almost 56% of the respondents chose option 3 (neutral). For the statement "Your organization is planning to replace current systems of record using blockchain technology", only 22% of the respondents agreed, nearly 28% disagreed, and almost 49% chose to remain neutral. Finally, almost 53% of the respondents agreed that their organization would lose a competitive advantage if they did not adopt blockchain technology.

Based on these results, it seems that there is no great interest from Saudi private organizations to adopt blockchain technology, regardless of the fact that the respondents believe blockchain is a valuable technology for their organization and work. This may mean that respondents are not fully aware of their organization’s strategic direction or they are unaware of their organization’s future investment in the information technology field.

To identify some of the barriers to blockchain technology adoption, the results of part three will be discussed here. The barriers identified are the following:

1. Lack of in-house capabilities (skills and understanding) in blockchain technology.
2. Uncertain return on investment (ROI) in blockchain technology.
3. Blockchain technology is not currently identified as a business priority.
4. Blockchain technology is unproven.
5. Regulatory issues.

6. Conclusion
Blockchain technology as an emerging technology has potential for the future, as many researchers have predicted. According to the results of the present paper, many Saudi private organizations are not yet planning to adopt blockchain in their work practices and there is a lack of knowledge in the Saudi industry about such technology. On the other hand, many respondents think that blockchain technology will be important in the future. Several barriers were identified in this study that are preventing Saudi private organizations from adopting blockchain technology. These barriers include the lack of in-house capabilities who are specializing in such technology, the uncertain return on investment, blockchain technology is not currently identified as a business priority, the technology is unproven and there are regulatory issues. This research has some limitations as it is focused only on Saudi Arabia and the sample size is small. However, blockchain technology is predicted to be used widely in the future, so the results of the present study indicate that more research is needed to address the obstacles that may slow the adoption process.

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