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A Framework to Evaluate Readiness for Blockchain Technology Implementation

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Abstract

In recent years, Blockchain technology has been recognized as one of the most important new technologies affecting businesses and society, with a very bright future ahead. This technology is known as one of the most critical technologies of industry 4. Given that Blockchain technology is a new concept, before implementing it, the organization must understand it and be prepared to accept it; otherwise, the organization will incur irreparable damages. The main purpose of this study is to provide a framework within which organizations can evaluate their readiness to implement Blockchain technology. For this purpose, after a library study and systematic literature review, this study provided the initial research framework using the meta-synthesis method. Finally, the Lawshe model was applied to validate the proposed framework for the organization's readiness to implement Blockchain technology. Based on the findings, the final established framework included seven main dimensions, including Blockchain-based business strategy, operations of a distributed system, culture, people in Blockchain decentralized network, decentralized governance, technology, and Blockchain-based product traceability. Besides, 37 main criteria affected these dimensions, which can help companies increase the level of Blockchain technology readiness. Finally, this framework was used to measure the readiness of an airline company. According to the results of the analysis, Blockchain-based business strategy, culture, and Blockchain-based product traceability showed a medium level of readiness.

Moreover, none of the main dimensions of Blockchain technology readiness were sufficiently prepared in this case study. This paper suggests practical recommendations to improve the level of Blockchain technology readiness for the managers.

Keywords: Blockchain technology, Readiness framework, Systematics review, Meta-synthesis, Logistics.

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Introduction

Nakamoto first identified the idea of Blockchain technology in 2008 in an article titled " Bitcoin: A Peer-to-Peer Electronic Cash System." The first Blockchain implementation was Bitcoin. The first purpose of the main application of Blockchain technology was to implement a cryptocurrency exchange system. But bitcoin technology and Blockchain are far more than economically applicable (Swan, 2018). Blockchain technology is a peer-to-peer information technology network that holds digital asset records in a distributed ledger(Min, 2019). One of the essential benefits of Blockchain technology is automation, building trust, reducing costs, and providing network-level security (Alketbi et al., 2018; L. Hughes, Dwivedi, Misra, Rana, et al., 2019). Cryptocurrencies such as bitcoin have become increasingly important in recent years.. Thus, Blockchain technologies that fuel cryptocurrencies can expand into other business applications even more profoundly. (A. Hughes et al., 2019). There are so many applications for Blockchain technology which include as follows: energy sector (Andoni et al., 2019), supply chain (Min, 2019; Queiroz & Fosso Wamba, 2019), Governance (Allessie et al., 2018; Ølnes et al., 2017c), healthcare(McGhin et al., 2019), and Internet of things (IoT) (Hassan et al., 2019). Logistics (Meyer et al., 2019a; Tijan, Aksentijević, et al., 2019) is another sector that has started using Blockchain technology widely, and researchers are going to evaluate the findings in this case.

Blockchain technology implementation is a long, complicated and costly process usually accompanied by many challenges (Koteska et al., 2017). Therefore, assessing readiness in the early stages of implementing this emerging technology is essential to identify the organizations' weaknesses that will later increase the possibility of failure. Consequently, as the delinquencies decreased, companies can save a lot of money, leading to increased success. There is no appropriate infrastructure in so many developing countries, and they don't have the basic requirements to implement Blockchain technology (Thakur et al., 2019a). Thus, they are only eager to use it because of the trend around the world, and as a result, It would be a failure to implement Blockchain technology.. For this purpose, organizations need to identify the critical factors affecting their readiness before taking any steps to implement this technology.

Our contributions are summarized as follows:

1) Based on the literature review, the of most researches was mainly on the challenges and potential benefits of Blockchain technology .Our study was a systematic literature review to identify the most critical dimensions and factors affecting the readiness of Blockchain technology implementation via setting a comprehensive framework.

2) Based on the former studies, no specific readiness framework was offered to the logistic sector.

3) The majority of the previous studies were quantitative ones. In this study, a qualitative meta-synthesis and quantitative Lawshe method were applied to provide a new, more comprehensive interpretation of the findings beyond the breadth and depth of the original studies and broaden the range of concepts.

4) This study also sought to act as a guide with the best practices for assisting developers, executives, managers, and investors with unveiling the critical success factors of Blockchain projects in a more systematic way.

5) The study also evaluated the Blockchain readiness framework in a case study, and through this, some solutions were recommended to enterprises, to improve their readiness, and detect their weaknesses.

In the second part, the literature review is discussed, and in the third part, the research method is stated. The fourth section deals with analysing findings, which have seven steps. In the fifth section, the proposed readiness framework is validated, and in section six, the final framework is suggested. Next, in section seven, this study used the framework to evaluate an airline company's readiness. Finally, Discussion and conclusion have come in the last parts of this paper.

Literature review

This section aims to achieve the primary goal of this paper, a comprehensive framework for Blockchain technology readiness, so the main criteria affecting Blockchain technology implementation readiness were identified systematically. In this regard, the studies over the past few years have been reviewed. In Table 1, the most important criteria with their definitions were summarized

Table 1. The most important criteria to evaluate the readiness of Blockchain technology implementation based on systematic literature review

Criteria	Definition	Sources
The willingness of leaders to cooperate	Organization's leader's interest in Blockchain technology application and implementation	(S. Prasad et al., 2018; Queiroz & Fosso, 2019a; Zhang, 2019)
Workforce training	The requirement of human resources and sufficient skills in the organization	(Galenovich et al., 2018; Li et al., 2019a; Rao & Clarke, 2019; Scholl & Bolívar, 2019; Thakur et al., 2019b)
Energy management	Plenty of energy is needed to implement the Blockchain technology that needs proper management	(Ahl et al., 2019; Koteska et al., 2017; Li et al., 2019a; Min, 2019; Ølnes et al., 2017a; S. Prasad et al., 2018; Tavares et al., 2020)
Business model alignment	Choosing the suitable business model because old business models are not capable of implementing this technology	(Ahl et al., 2019; Behnke & Marijn, 2019; S. Prasad et al., 2018)
Smart contracts	Self-executing contracts are implemented according to the rules mentioned in Blockchain technology	(Ahl et al., 2019; Alketbi et al., 2018; Andrian et al., 2018; Du et al., 2019; Gao et al., 2018; Gökalp et al., 2018; S. Kamble et al., 2018; Koteska et al., 2017; Li et al., 2019a; Min, 2019; Nawari & Ravindran, 2019; Thakur et al., 2019b; Wang et al., 2019b; Yang, 2019)
Society awareness to understand Blockchain technology	It is necessary to create the required awareness at the community level since this technology is very new,	(A. Hughes et al., 2019; L. Hughes, Dwivedi, Misra, & Rana, 2019; S. S. Kamble et al., 2019a)
Malicious attacks	Exposure to multiple attacks that access information in the system.	(Gao et al., 2018; Hassan et al., 2019; S. S. Kamble et al., 2019a; Li et al., 2019a; Makhdoom et al., 2019a)
Transparency of process	The assets and transactions for all shareholders are momentarily clear.	(Atlam & Wills, 2018; Casino et ;Gökalp et al., 2018; al., 2019a) S. S. Kamble et al., 2019a; Meyer et al., 2019b; Queiroz & Fosso, 2019b; Tijan, Aksentijevi, et al., 2019; Umarovich et al., 2017; Wang et al., 2019a; Zhao, Liu, Lopez, Lu, Elgueta, Chen, & Mileva, 2019)
Distributed ownership of data	Anyone in the distributed chain Blockchain system is responsible for maintaining it.	(Benbunan-fich & Castellanos, 2018; S. Kamble et al., 2018; Nawari & Ravindran, 2019)
Compliance with Government rules	The rules used in the Blockchain must comply with the rules laid down by the government.	(Cedric Hebert et al., 2019; S. Kamble et al., 2018; Lai & Lee Kuo Chuen, 2018; Li et al., 2019a; Min, 2019)
Management of private and public keys	Management of private keys, prevent the loss of public keys and use of new keys at the distribution	(Alketbi et al., 2018; Lai & Lee Kuo Chuen, 2018; Mcghin et al.,

	network level	2019; Thakur et al., 2019b)
Identity management of users	The process of authentication should be done through the licensing of each individual	(Alketbi et al., 2018; Atlam & Wills, 2018; Gao et al., 2018; Lai & Lee Kuo Chuen, 2018; Moin et al., 2019)
Users data privacy	The details of the transactions are known only to the account holder, and the public can view transactions, but their details are not known to individuals.	(Al-Jaroodi & Mohamed, 2019; Alexopoulos & Vasilomanolakis, 2018; Angelis & Ribeiro da Silva, 2018; Casino et al., 2019b; Gao et al., 2018; Gökalp et al., 2018; Hassan et al., 2019; L. Hughes, Dwivedi, Misra, & Rana, 2019; Koteska et al., 2017; Lai & Lee Kuo Chuen, 2018; Makhdoom et al., 2019a; Meyer et al., 2019b; Moin et al., 2019; Ølnes et al., 2017b; S. Prasad et al., 2018; Rao & Clarke, 2019; Tavares et al., 2020; Unterweger et al., 2018; Zhao, Liu, Lopez, Lu, Elgueta, Chen, & Mileva, 2019)
Data confidentially	Restrict access to information so that only authorized persons have the necessary access	(Atlam & Wills, 2018; Behnke & Marijn, 2019; Koteska et al., 2017; Lai & Lee Kuo Chuen, 2018; S. Prasad et al., 2018; Tijan, Aksentijević, et al., 2019)
Interoperability in the Blockchain network	Ability to communicate different elements of the system through their technical specifications	(Angelis & Ribeiro da Silva, 2018; Casino et al., 2019b; Lai & Lee Kuo Chuen, 2018; Li et al., 2019a; Makhdoom et al., 2019b; Mcghin et al., 2019; Moin et al., 2019; Umarovich et al., 2017)
Data integrity	The data stored in the blocks cannot be fixed or replaceable	(Alexopoulus et al., 2017; Alketbi et al., 2018; Makhdoom et al., 2019a; Moin et al., 2019; Ølnes et al., 2017b; Scholl & Bolívar, 2019)
Blockchain network Scalability	One of the system features is to show how far the system can operate on a similar scale and sustainably.	(Atlam & Wills, 2018; Casino et al., 2019b; Gao et al., 2018; Gökalp et al., 2018; Kruglova & Dolbezhkin, 2018; Makhdoom et al., 2019a; Memon et al., 2019; Meyer et al., 2019b; Min, 2019; Moin et al., 2019; Mundra, 2018; O'Donoghue et al., 2019; Onik et al., 2019; S. Prasad et al., 2018; Yang, 2019; Zhao, Liu, Lopez, Lu, Elgueta, Chen, & Mileva, 2019)
Blockchain skill shortage	The need for sufficient specialist forces with the necessary expertise to implement the technology	(Benbunan-fich & Castellanos, 2018; Min, 2019; Mundra, 2018; Pantielieieva et al., 2018; S.

		Prasad et al., 2018; Sander et al., 2018; Thakur et al., 2019b; Wibowo & Hw, 2018; Zhao, Liu, Lopez, Lu, Elgueta, Chen, & Mileva, 2019)
Security	Protecting the system from possible hazards and attacks that may occur in the early stages and causing irreparable damage	(Al-Jaroodi & Mohamed, 2019; Andoni et al., 2019; Atlam & Wills, 2018; Casino et al., 2019a; L. Hughes, Dwivedi, Misra, & Rana, 2019; S. S. Kamble et al., 2019b; Kruglova & Dolbezhkin, 2018; Makhdoom et al., 2019a; Mcghin et al., 2019; Moin et al., 2019; Ølnes et al., 2017b; Pantielieieva et al., 2018; S. Prasad et al., 2018; Rao & Ms, 2019; Tavares et al., 2020; Thakur et al., 2019b; Umarovich et al., 2017)
Cost-efficiency of Blockchain-based distributed network	The stages of implementing this technology are costly, and financial planning is required to implement technology.	(Aggarwal et al., 2019; Andoni et al., 2019; Angelis & Ribeiro da Silva, 2018; Gausdal et al., 2018; Gökalp et al., 2018; L. Hughes, Dwivedi, Misra, & Rana, 2019; Ivashchenko et al., 2018; Koteska et al., 2017; Meyer et al., 2019b; Mundra, 2018; Ølnes et al., 2017b; Pantielieieva et al., 2018; A. Prasad et al., 2008; Schuetz & Venkatesh, 2019; Unterweger et al., 2018; Zhao, Liu, Lopez, Lu, Elgueta, Chen, & Mileva, 2019)
Trust on Blockchain decentralized network	Existence of third parties, programmers, and the Trusted network as a whole to implement this emerging technology	(Allessie et al., 2018; Moin et al., 2019; Nawari & Ravindran, 2019; Ølnes et al., 2017b; S. Prasad et al., 2018; Queiroz & Fosso Wamba, 2019; Rao & Clarke, 2019)
Resource maintenance	Maintain existing resources at the network level , including information, human resources, and data	(Angelis & Ribeiro da Silva, 2018; Atlam & Wills, 2018; Queiroz & Fosso Wamba, 2019)
Usability	This means that the API in the Blockchain chain is simple and easy to use.	(Atlam & Wills, 2018; S. S. Kamble et al., 2019b; Koteska et al., 2017; Queiroz & Fosso Wamba, 2019)
Suitability	The potential for the organization as well as the real the problem that requires Blockchain technology to solve	(Andoni et al., 2019; Atlam & Wills, 2018; Cedric Hebert et al., 2019; Lai & Lee Kuo Chuen, 2018)
Latency	It is about time characteristic, which is an integral part of the internet.	(Casino et al., 2019a; L. Hughes, Dwivedi, Misra, & Rana, 2019; Koteska et al., 2017; Thakur et al., 2019b;

		Zhao, Liu, Lopez, Lu, Elgueta, Chen, & Mileva, 2019)
Data management	The set of processes for obtaining, testing, storing and protecting data	(Casino et al., 2019b; Galvez et al., 2018; Makhdoom et al., 2019a; Moin et al., 2019)
Data Availability	Ensure that all necessary data is always available When needed	(Gao et al., 2018; Moin et al., 2019; Ølnes et al., 2017b; Pantielieieva et al., 2018)
Reliable interconnection of nodes	The data is stored in different sections through a the consortium and the information is changed only when all authorized people On the network have an agreement on it.	(Alketbi et al., 2018; Angelis & Ribeiro da Silva, 2018; Koteska et al., 2017; Kruglova & Dolbezhkin, 2018; Meyer et al., 2019b; Ølnes et al., 2017b; Scholl & Bolívar, 2019)
Decentralized system resilience	The system set should not have the minor error And should not depend on smaller groups.	(Li et al., 2019a; Min, 2019; Ølnes et al., 2017b)
Distributed Storage	Part of the computer system where data is stored	(Makhdoom et al., 2019a; Mcghin et al., 2019; Nawari & Ravindran, 2019; Onik et al., 2019; S. Prasad et al., 2018; Yang, 2019; Zhao, Liu, Lopez, Lu, Elgueta, Chen, & Mileva, 2019)
Access control	Restrict access to physical or virtual resources at the system level	(Makhdoom et al., 2019a; Mcghin et al., 2019; Moin et al., 2019; Pantielieieva et al., 2018; Tavares et al., 2020; Umarovich et al., 2017)
Blockchain network Throughput	The number of transactions transferred per second in the distributed network	(Koteska et al., 2017; Makhdoom et al., 2019a; O'Donoghue et al., 2019; Zhao, Liu, Lopez, Lu, Elgueta, Chen, & Mileva, 2019)
Liability along with Blockchain network	In case of lost or damaged items, everyone at the network, the level is responsible, and the lost item is tracked due to system integrity	(Aggarwal et al., 2019; Alexopoulus et al., 2017; Casino et al., 2019a; Meyer et al., 2019b)
Speed of asset shipments	Asset transfer processes at the network level should be performed without delay.	(Andoni et al., 2019; Casino et al., 2019a; Gausdal et al., 2018; L. Hughes, Dwivedi, Misra, & Rana, 2019; Meyer et al., 2019a; Mundra, 2018; Tavares et al., 2020)
Anonymity	Unclear identity for fear of legal or social problems	(Gao et al., 2018; Moin et al., 2019)
Authorization	A security mechanism to identify the user's Interests and access to resources such as data and services	(Alketbi et al., 2018; Moin et al., 2019)
User control	The ability to control devices	(Ivashchenko et al., 2018; Moin et al., 2019)
User Authentication	When an account is opened on the Blockchain network and no one else can use that account	(Alketbi et al., 2018; Andrian et al., 2018; Koteska et al., 2017; Mcghin et al., 2019)
Blockchain technology	The consortium protocols should be accessed by	(Aggarwal et al., 2019;

standardization	anyone with access to the network level.	Kruglova & Dolbezhkin, 2018; Moin et al., 2019; O'Donoghue et al., 2019; S. Prasad et al., 2018; Thakur et al., 2019a; Umarovich et al., 2017)
Blockchain Consensus mechanism	The mechanism used in the Blockchain network to achieve Consensus and prevent error at the distribution network level	(Alexopoulus et al., 2017; Casino et al., 2019b; Du et al., 2019; Gao et al., 2018; Makhdoom et al., 2019a; Nawari & Ravindran, 2019; Yang, 2019)
Blockchain System integration	Blockchain technology has many applications. This technology is called integration with other units, which requires high cooperation and security issues.	(Al-Jaroodi & Mohamed, 2019; Andrian et al., 2018; Makhdoom et al., 2019b; Meyer et al., 2019a; S. Prasad et al., 2018; Tavares et al., 2020)
Management of Blockchain-specific risks	Manage risks related to money laundering, financial terrorism, and sanctions that need proper planning	(Angelis & Ribeiro da Silva, 2018; Cédric Hebert & Di Cerbo, 2019; Ivashchenko et al., 2018; S. S. Kamble et al., 2019a; Min, 2019; Nawari & Ravindran, 2019; Umarovich et al., 2017; Wibowo & Hw, 2018)
User engagement	One of the critical factors for the success of Blockchain technology implementation is the user experience and perceived value.	(Ahl et al., 2019; S. Prasad et al., 2018)
Exchange of competitive information	Enables interactive enterprise data exchange and sharing networks	(Peterson et al., 2016; Wang et al., 2019b)
Industry collaboration	A strong value-creation network is needed to implement Blockchain technology.	(S. Prasad et al., 2018; Umarovich et al., 2017)
Control and rules	Establish a set of specific rules to protect the transferred transactions and maintain the data of all partners across the distributed network	(Alketbi et al., 2018; Andoni et al., 2019; Angelis & Ribeiro da Silva, 2018; Benbunan-Fich & Castellanos, 2018; Gökalp et al., 2018; A. Hughes et al., 2018; Ivashchenko et al., 2018; Makhdoom et al., 2019a; Meyer et al., 2019a; Moin et al., 2019; Onik et al., 2019; Pantielieieva et al., 2018; Zhao, Liu, Lopez, Lu, Elgueta, Chen, & Boshkoska, 2019)

Methdology

This paper is qualitative research, conducted by the application of meta-synthesis. The library research method was used to collect information, and through systematic literature review, appropriate sources were refined and selected. Finally, a conceptual framework was developed by analyzing the data by meta-synthesis and coding method. In meta-synthesis, new and fundamental themes and metaphors were explored through various qualitative studies; thus, current knowledge is expanded, and a comprehensive and holographic view of issues is created (Zimmer, 2006). Sandelowski and Barroso introduced a seven-step process to perform the meta-synthesis, which was also used in the present study (Sandelowski and Barroso 2006). The seven steps of this method are displayed in Figure 1.

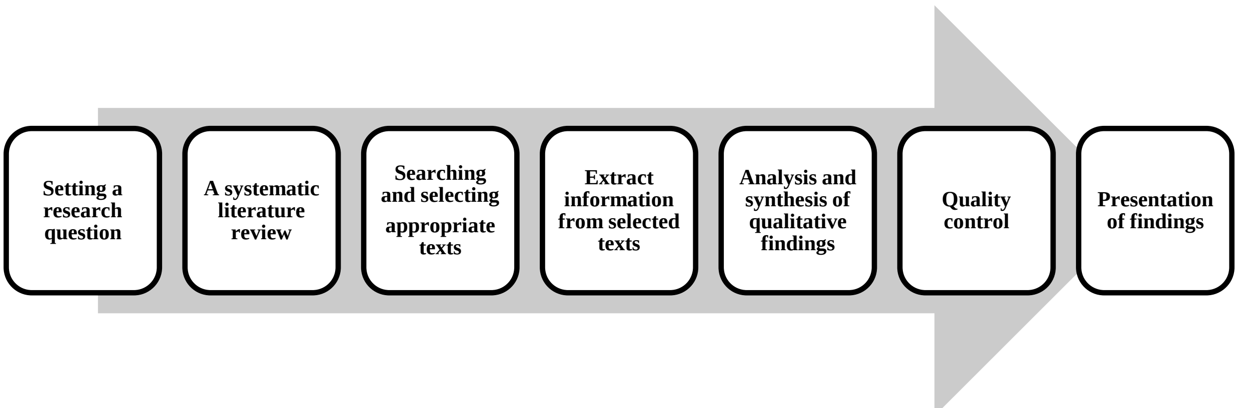

Figure1. The steps of the meta-synthesis method

Results

The steps of implementing the meta-synthesis method are as follows:

Step 1: Set up the research questions

The first step in implementing the meta-synthesis method is to identify the research questions. In the meta-synthesis method, since the researcher's approach is exploratory, they have to define "What" kinds of questions. In this paper, the researcher’s goal was to provide a Blockchain technology readiness framework. Therefore, the research question were: What are the appropriate dimensions and criteria for Blockchain technology implementation readiness?

Step 2: Systematic literature review

In the second step, using the systematic literature review, valid and relevant articles related to the research topic were identified. At this stage, first, a proper and suitable database for searching articles was selected. ScienceDirect search engine was used for this research. Besides, a search was made on the Scopus database to ensure full access to relevant articles. The systematic review of this research began on the 25th of June 2019 and continued until 6th August 2019. Then proceed through the selected keywords (Blockchain readiness and Blockchain implementation), Which were identified in the initial review of related articles; a search was made to extract valid documents related to the research topic during 2016-2020 in two mentioned databases. Finally, 1831 articles were identified, and the researcher stored and categorized them in Mendeley scientific resource management software. Table 2 shows the criteria for choosing articles.

Table 2. Criteria to accept or not to accept articles

Criteria	Acceptance condition	Not accepted condition
Article's language	English	Anything except English
Subject of study	The subject is about readiness and implementation of Blockchain technology.	Items other than the subject mentioned is not accepted.
Study output	The output of study should provide a model or architecture or framework of criteria affecting Blockchain technology implementation readiness	Items not related to the criteria affecting Blockchain technology implementation readiness are rejected.
Type of study	Articles need to be published in valid and related journals and conferences and reliable books.	Personal comments and sites, unpublished articles, unrelated articles, and books are rejected.
Information status and research method	The author and journal information are complete. The research method should be clear and valid	Articles with incomplete information are rejected.

Step 3. Searching and selecting related articles

The evaluation and selection process from the resources collected in Mendeley software and resources obtained from searching in databases was done in several stages. At the screening stage, the search results in each database is compared with the sources collected by Mendeley, and are omitted if they are identical. In addition, resources that could not be evaluated and used in later stages due to the lack of access to their full text were removed. Then, by examining the title, abstract, and searching for the phrase in the full text of the search results, irrelevant sources were removed. In addition, non-English sources and sources outside the journal articles, conference papers, books were excluded from the evaluation process. As a result, the identified sources were reduced to 96 ones after the screening stage. After reading the entire content, 60 papers related to the primary purpose of the research were selected. All reviewed resources from the screening stage were stored and categorized in Mendeley resource management and organizing software to make it easier to access.

The article selection process is shown in Figure 2, and the number of selected articles is displayed in Figure 3.

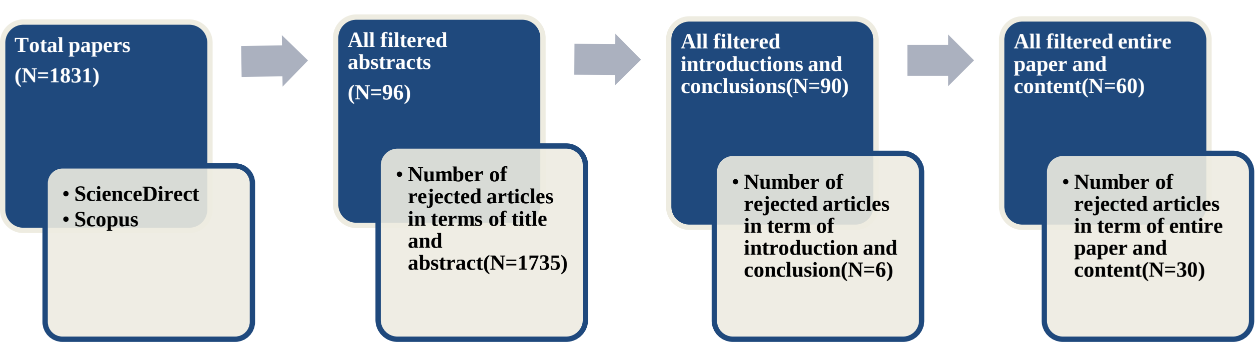

Figure 2. The process of searching and selecting articles

The frequency of 60 papers obtained from the year 2016 based on the year of their publication is shown in the following chart, which shows the increasing interest of researchers in researching Blockchain technology. The results are shown in Figure 3.

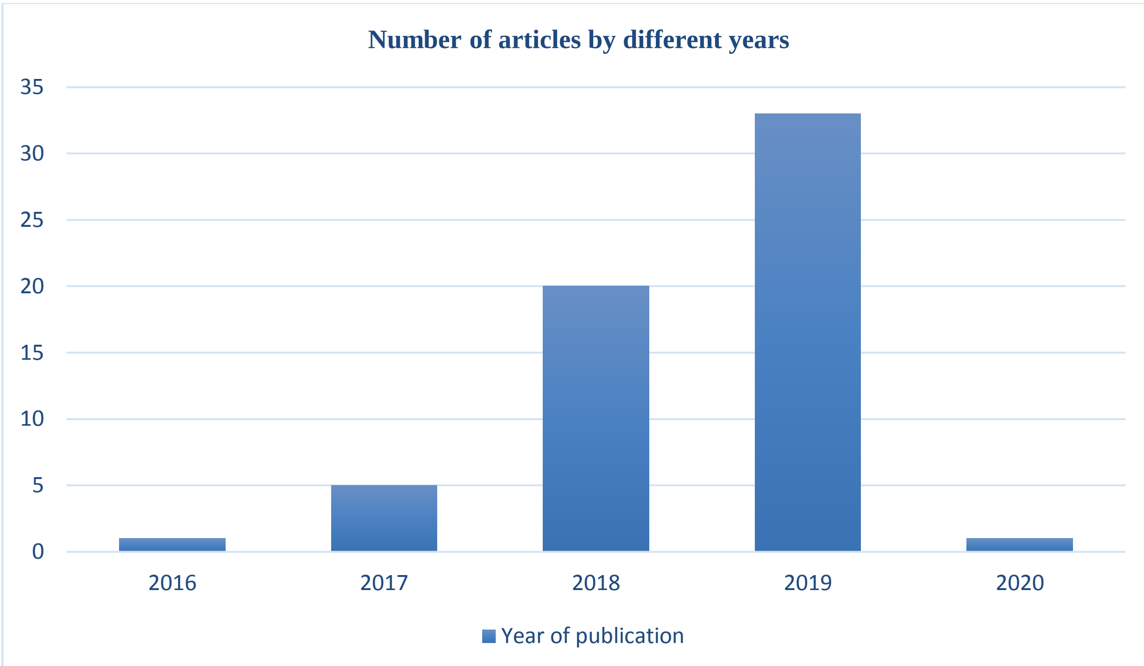

Figure 3. Number of selected research articles by different years

Step 4. Extract articles information

In this step, the selected papers were examined. The relevant codes were extracted from the text of the documents using the open coding method arising from the ground theory based on the research question. In this regard, creating concepts from the combination of codes and creating categories from the combination of concepts has made a general image under study (Strauss and Corbin 1994).

Step 5. Analysis and synthesis of qualitative findings

According to the research purpose, related codes were identified and extracted at this stage while reviewing selected papers. Codes of a similar essence were then categorized and formed themes, followed by similar category themes. More than 458 codes were extracted in the coding process, and during the analysis process, some codes were deleted, combined, orclassified. From the classification and aggregation of codes, nine main concepts were formed. Finally, the concepts were categorized into three categories. Table 4. lists the codes and concepts of each category, as well as the sources of each.

Step 6. Quality control

Some researchers introduced open coding as a tool for assessing reliability (Khastar 2009). In this method, people are asked to re-encode one of the documents. If the opinions of two people about the coded codes were convergent, the reliability is confirmed. A Kappa coefficient is used to evaluate the convergence of the calculated codes. When the kappa coefficient is less than 0.2 indicates poor agreement between 0.2 to 0.4 moderate, 0.4 to 0.6 relatively high, 0.6 to 0.8 high, and more than 0.8 almost complete. (Landis and Koch 1977) The results of calculating kappa statistics are presented in Table 3. Kappa coefficient of 0.641 indicated a relatively good agreement, and in addition, a significance level of less than 0.05 suggests a relationship between the encodings made on the selected document.

Table 3. A test comparing the coding of a researcher and an expert on one of the selected documents

Symmetric Measures				
	Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Measure of Agreement Kappa	.641	.102	6.138	.000

Step 7. Presentation of findings

In Table 4., the final results of a systematic review of documents based on the meta-synthesis method are given. The extracted codes were extracted in a subset of seven categories: Blockchain-based business strategy, decentralized governance, culture, people in Blockchain decentralized network, operations of a distributed system, technology, and Blockchain-based traceability. Therefore, in analyze of Blockchain technology implementation readiness, all these categories should be considered.

Table 4. Code, concept, and category categorization

Category	Concept	Code	Reference
Business	Blockchain_based Business Strategy	Business model alignment	(Ahl et al., 2019; Behnke & Marijn, 2019; S. Prasad et al., 2018)
		Energy management	(Ahl et al., 2019; Koteska et al., 2017; Li et al., 2019a; Min, 2019; Ølnes et al., 2017a; S. Prasad et al., 2018; Tavares et al., 2020)
		Cost-efficiency of Blockchain-based distributed network	(Aggarwal et al., 2019; Andoni et al., 2019; Angelis & Ribeiro da Silva, 2018; Gausdal et al., 2018; Gökalp et al., 2018; L. Hughes, Dwivedi, Misra, & Rana, 2019; Ivashchenko et al., 2018; Koteska et al., 2017; Meyer et al., 2019b; Mundra, 2018; Ølnes et al., 2017b; Pantielieieva et al., 2018; Schuetz & Venkatesh, 2019; Unterweger et al., 2018; Zhao, Liu, Lopez, Lu, Elgueta, Chen, & Mileva, 2019)
		Resource maintenance	(Angelis & Ribeiro da Silva, 2018; Atlam & Wills, 2018; Queiroz & Fosso Wamba, 2019)
		Management of Blockchain-specific risks	(Angelis & Ribeiro da Silva, 2018; Cédric Hebert & Di Cerbo, 2019; Ivashchenko et al., 2018; S. S. Kamble et al., 2019a; Min, 2019; Nawari & Ravindran, 2019; Umarovich et al., 2017; Wibowo & Hw, 2018)
		Suitability	(Andoni et al., 2019; Atlam & Wills, 2018; Cedric Hebert et al., 2019; Lai & Lee Kuo Chuen, 2018)
	Decentralized Governa	Compliance with Government rules	(Cedric Hebert et al., 2019; S. Kamble et al., 2018; Lai & Lee Kuo Chuen, 2018; Li et al., 2019a; Min, 2019)
		Blockchain	(Aggarwal et al., 2019; Kruglova & Dolbezhkin, 2018; Moin et al.,

	nce	technology standardization	2019; O'Donoghue et al., 2019; S. Prasad et al., 2018; Thakur et al., 2019a; Umarovich et al., 2017)
		Control and rules	(Alketbi et al., 2018; Andoni et al., 2019; Angelis & Ribeiro da Silva, 2018; Benbunan-Fich & Castellanos, 2018; Gökalp et al., 2018; A. Hughes et al., 2018; Ivashchenko et al., 2018; Makhdoom et al., 2019a; Meyer et al., 2019a; Moin et al., 2019; Onik et al., 2019; Pantielieieva et al., 2018; Zhao, Liu, Lopez, Lu, Elgueta, Chen, & Boshkoska, 2019)
		Smart Contract	(Ahl et al., 2019; Alketbi et al., 2018; Andrian et al., 2018; Du et al., 2019; Gao et al., 2018; Gökalp et al., 2018; S. Kamble et al., 2018; Koteska et al., 2017; Li et al., 2019a; Min, 2019; Nawari & Ravindran, 2019; Thakur et al., 2019b; Wang et al., 2019b; Yang, 2019)
		Distributed ownership of data	(Benbunan-fich & Castellanos, 2018; S. Kamble et al., 2018; Nawari & Ravindran, 2019)
Social	Culture	Society awareness for Blockchain technology understanding	(A. Hughes et al., 2019; L. Hughes, Dwivedi, Misra, & Rana, 2019; S. S. Kamble et al., 2019a)
		Industry collaboration	(S. Prasad et al., 2018; Umarovich et al., 2017)
		Exchange of competitive information	(Peterson et al., 2016; Wang et al., 2019b)
	Distributed leadership	The willingness of leaders to cooperate	(S. Prasad et al., 2018; Queiroz & Fosso, 2019a; Zhang, 2019)
	People in Blockchain decentralized network	Blockchain skill shortage	(Benbunan-fich & Castellanos, 2018; Min, 2019; Mundra, 2018; Pantielieieva et al., 2018; S. Prasad et al., 2018; Sander et al., 2018; Thakur et al., 2019b; Wibowo & Hw, 2018; Zhao, Liu, Lopez, Lu, Elgueta, Chen, & Mileva, 2019)
		Workforce training	(Galenovich et al., 2018; Li et al., 2019a; Rao & Clarke, 2019; Scholl & Bolívar, 2019; Thakur et al., 2019b)
Operation and support	Operations of distributed system	Management of private and public keys	(Alketbi et al., 2018; Lai & Lee Kuo Chuen, 2018; Mcghin et al., 2019; Thakur et al., 2019b)
		Identity management of users	(Alketbi et al., 2018; Atlam & Wills, 2018; Gao et al., 2018; Lai & Lee Kuo Chuen, 2018; Moin et al., 2019)
		Users data privacy	(Al-Jaroodi & Mohamed, 2019; Alexopoulos & Vasilomanolakis, 2018; Angelis & Ribeiro da Silva, 2018; Casino et al., 2019b; Gao et al., 2018; Gökalp et al., 2018; Hassan et al., 2019; L. Hughes, Dwivedi, Misra, & Rana, 2019; Koteska et al., 2017; Lai & Lee Kuo Chuen, 2018; Makhdoom et al., 2019a; Meyer et al., 2019b; Moin et al., 2019; Ølnes et al., 2017b; S. Prasad et al., 2018; Rao & Clarke, 2019; Tavares et al., 2020; Unterweger et al., 2018; Zhao, Liu, Lopez, Lu, Elgueta, Chen, & Mileva, 2019)
		Data Confidentially	(Atlam & Wills, 2018; Behnke & Marijn, 2019; Koteska et al., 2017; Lai & Lee Kuo Chuen, 2018; S. Prasad et al., 2018; Tijan, Aksentijević, et al., 2019)
		Latency	(Casino et al., 2019a; L. Hughes, Dwivedi, Misra, & Rana, 2019; Koteska et al., 2017; Thakur et al., 2019b; Zhao, Liu, Lopez, Lu, Elgueta, Chen, & Mileva, 2019)

		Data integration	(Alexopoulus et al., 2017; Alketbi et al., 2018; Makhdoom et al., 2019a; Moin et al., 2019; Ølnes et al., 2017b; Scholl & Bolívar, 2019)
		Blockchain network Scalability	(Atlam & Wills, 2018; Casino et al., 2019b; Gao et al., 2018; Gökalp et al., 2018; Kruglova & Dolbezhkin, 2018; Makhdoom et al., 2019a; Memon et al., 2019; Meyer et al., 2019b; Min, 2019; Moin et al., 2019; Mundra, 2018; O'Donoghue et al., 2019; Onik et al., 2019; S. Prasad et al., 2018; Yang, 2019; Zhao, Liu, Lopez, Lu, Elgueta, Chen, & Mileva, 2019)
		Distributed Storage	(Makhdoom et al., 2019a; Mcghin et al., 2019; Nawari & Ravindran, 2019; Onik et al., 2019; S. Prasad et al., 2018; Yang, 2019; Zhao, Liu, Lopez, Lu, Elgueta, Chen, & Mileva, 2019)
		Speed of transport assets	(Andoni et al., 2019; Casino et al., 2019a; Gausdal et al., 2018; L. Hughes, Dwivedi, Misra, & Rana, 2019; Meyer et al., 2019a; Mundra, 2018; Tavares et al., 2020)
		Blockchain network Throughput	(Koteska et al., 2017; Makhdoom et al., 2019a; O'Donoghue et al., 2019; Zhao, Liu, Lopez, Lu, Elgueta, Chen, & Mileva, 2019)
		Interoperability in Blockchain network	(Angelis & Ribeiro da Silva, 2018; Casino et al., 2019b; Lai & Lee Kuo Chuen, 2018; Li et al., 2019a; Makhdoom et al., 2019b; Mcghin et al., 2019; Moin et al., 2019; Umarovich et al., 2017)
		Blockchain System integration	(Al-Jaroodi & Mohamed, 2019; Andrian et al., 2018; Makhdoom et al., 2019b; Meyer et al., 2019a; S. Prasad et al., 2018; Tavares et al., 2020)
		Usability	(Atlam & Wills, 2018; S. S. Kamble et al., 2019b; Koteska et al., 2017; Queiroz & Fosso Wamba, 2019)
	Technolo gy	Blockchain Security	(Al-Jaroodi & Mohamed, 2019; Andoni et al., 2019; Atlam & Wills, 2018; Casino et al., 2019a; L. Hughes, Dwivedi, Misra, & Rana, 2019; S. S. Kamble et al., 2019b; Kruglova & Dolbezhkin, 2018; Makhdoom et al., 2019a; Mcghin et al., 2019; Moin et al., 2019; Ølnes et al., 2017b; Pantielieieva et al., 2018; S. Prasad et al., 2018; Rao & Ms, 2019; Tavares et al., 2020; Thakur et al., 2019b; Umarovich et al., 2017)
		Access control	(Makhdoom et al., 2019a; Mcghin et al., 2019; Moin et al., 2019; Pantielieieva et al., 2018; Tavares et al., 2020; Umarovich et al., 2017)
		Data Availability	(Gao et al., 2018; Moin et al., 2019; Ølnes et al., 2017b; Pantielieieva et al., 2018)
		Data management	(Casino et al., 2019b; Galvez et al., 2018; Makhdoom et al., 2019a; Moin et al., 2019)
		Authorization	(Alketbi et al., 2018; Moin et al., 2019)
		User Authentication	(Alketbi et al., 2018; Andrian et al., 2018; Koteska et al., 2017; Mcghin et al., 2019)
		User control	(Ivashchenko et al., 2018; Moin et al., 2019)
		Anonymity	(Gao et al., 2018; Moin et al., 2019)
		Malicious attacks	(Gao et al., 2018; Hassan et al., 2019; S. S. Kamble et al., 2019a; Li et al., 2019a; Makhdoom et al., 2019a)
		Blockchain Consensus mechanism	(Alexopoulus et al., 2017; Casino et al., 2019b; Du et al., 2019; Gao et al., 2018; Makhdoom et al., 2019a; Nawari & Ravindran, 2019; Yang, 2019)
		Decentralized system resilience	(Li et al., 2019a; Min, 2019; Ølnes et al., 2017b)
	Custome rs	User engagement	(Ahl et al., 2019; S. Prasad et al., 2018)
	Blockcha in_based	Transparency of process	;Gökalp et al., 2018; S. S. (Atlam & Wills, 2018; Casino et al., 2019a Kamble et al., 2019a; Meyer et al., 2019b; Queiroz & Fosso, 2019b;

	products traceability		Tijan, Aksentijevi, et al., 2019; Umarovich et al., 2017; Wang et al., 2019a; Zhao, Liu, Lopez, Lu, Elgueta, Chen, & Mileva, 2019)
		Reliable interconnection of nodes	(Alketbi et al., 2018; Angelis & Ribeiro da Silva, 2018; Koteska et al., 2017; Kruglova & Dolbezhkin, 2018; Meyer et al., 2019b; Ølnes et al., 2017b; Scholl & Bolívar, 2019)
		Liability along with Blockchain network	(Aggarwal et al., 2019; Alexopoulus et al., 2017; Casino et al., 2019a; Meyer et al., 2019b)
		Trust on Blockchain decentralized network	(Allessie et al., 2018; Moin et al., 2019; Nawari & Ravindran, 2019; Ølnes et al., 2017b; S. Prasad et al., 2018; Queiroz & Fosso Wamba, 2019; Rao & Clarke, 2019)

Research validation

The method of collecting research data was the use of secondary data (past articles and research). Most researchers agree that one of the following two methods can be used to validate the output of the meta-synthesis method (Norouzi, et al. 2014):

- Benefit from the opinion of experts in confirming research achievements;
- Provide a comprehensive conclusion using new case studies.

In this study, to validate, the opinions of experts was used to confirm the achievement of the research. In this way, 25 experts related to Blockchain Technology, were selected by snowball method, validated the proposed framework. Snowball sampling is a non-probability method, which involves a random selection of subjects. This method is most effective when the population members are not easily accessible. The researcher first identifies a group of people, and after gathering data, he/she asks them to recommend similar cases for the study. This process will continue in a chain-like manner until data saturation(Naderifar et al., 2017). The experts demographic characteristic is shown in Table 5.

Table 5. Expert demographic characteristics

		Organizational Value Panel	
Years of experience	1-2	8	
	3-6	11	
	>6	6	
	Professor	6	
	Associate professor	4	
	Assistant professor	4	
	Visiting Professor	4	
	PhD	7	
Age	< 30	7	
	31-40	10	
	41-50	3	
	>51	5	

The Lawshe method was also used to validate the framework. In the proposed Lawshe model for content analysis, the opinion of experts about the proposed framework in the Likert scale of three sets, including " I agree and usage of it is necessary", "It is useful, but it is not necessary to use it", "I disagree, and its usage is not necessary" was received. To calculate the mean of the judgments, the quantitative numbers 0,1, and 2 were considered for them, respectively. According to the formula of Lawshe, quantities of CVR and CVI were calculated by the relation number (1) and (2). According to Lawshe model Minimum, an acceptable amount of CVR for 25 experts is 0.37 (Ayre & Scally, 2014).

$$CV = \frac{n_e - \frac{N}{2}}{\frac{N}{2}} \quad (1)$$

$$CVI = \frac{Number\ of\ experts\ who\ choose\ \text{"}neccessary\text{"}\ and\ \text{"Not neccessary but } useful\text{"}\ items}{N} \quad (2)$$

n_e In *this* formula is a number of experts who have chosen to agree to completely agree.

N Indicates the total number of experts who participated in the questionnaire(LAWSHE, 1975).

Admission criteria are as follows:

- Unconditional acceptance of options with a CVR value greater than 0.37
- Acceptance of options with a CVR value between 0 and 1, and The numerical mean of the judgments is equal to or greater than 1.5. This situation shows that more than half of the experts agreed with the necessity of the option.

The results of the Lawshe method are shown in Table 6.

Table 6. Content validity ratio and numerical mean of judgments by concept, codes, and categories

Category	Concept	Code	CVR	MnJ	CVI	Status
Business	Blockchain_based Business Strategy	Business model alignment	0.36	1.56	0.84	Accepted
		Energy management	0.2	1.2	0.68	Rejected
		Cost-efficiency of Blockchain-based distributed network	0.36	1.56	0.84	Accepted
		Resource maintenance	0.12	1.28	0.76	Rejected
		Management of Blockchain-specific risks	0.36	1.56	0.88	Accepted
		Suitability	-0.12	1.32	0.88	Rejected
	Decentralized Governance	Compliance with Government rules	0.36	1.56	0.84	Accepted
		Blockchain technology standardization	0.28	1.6	0.92	Accepted
		Control and rules	0.02	1.24	0.72	Rejected
		Smart Contract	0.6	1.68	0.88	Accepted
		Distributed ownership of data	0.28	1.52	0.84	Accepted
Social	Culture	Society awareness for Blockchain technology	0.44	1.6	0.88	Accepted

		understanding				
		Industry collaboration	0.44	1.64	0.92	Accepted
		Exchange of competitive information	0.28	1.52	0.88	Accepted
	Distributed leadership	The willingness of leaders to cooperate	-0.28	1.28	0.76	Rejected
	People in Blockchain decentralized network	Blockchain skill shortage	0.36	1.52	0.84	Accepted
		Workforce training	0.28	1.52	0.88	Accepted
Operation and support	Operations of distributed system	Management of private and public keys	0.6	1.72	0.92	Accepted
		Identity management of users	0.76	1.76	0.88	Accepted
		Users data privacy	0.6	1.68	0.88	Accepted
		Data Confidentially	0.76	1.8	0.92	Accepted
		Latency	0.28	1.52	0.88	Accepted
		Data integration	0.76	1.84	0.96	Accepted
		Blockchain network Scalability	0.36	2.54	0.84	Accepted
		Distributed Storage	0.6	1.76	0.96	Accepted
		Speed of transport assets	0.2	1.4	0.8	Rejected
		Blockchain network Throughput	0.36	1.56	0.88	Accepted
		Interoperability in Blockchain network	0.36	1.56	0.88	Accepted
		Blockchain System integration	0.52	1.64	0.88	Accepted
		Usability	0.44	1.68	0.96	Accepted
	Technology	Blockchain Security	0.52	1.64	0.88	Accepted
		Access control	0.52	1.68	0.92	Accepted
		Data Availability	0.52	1.72	0.96	Accepted
		Data management	0.36	1.6	0.92	Accepted
		Authorization	0.52	1.68	0.92	Accepted
		User Authentication	0.76	1.8	0.92	Accepted
		User control	-0.12	1.24	0.8	Rejected
		Anonymity	0.28	1.44	0.8	Rejected
		Malicious attacks	0.36	1.52	0.84	Accepted
		Blockchain Consensus mechanism	0.6	1.64	0.84	Accepted
		Decentralized system resilience	0.36	1.52	0.84	Accepted
	Customers	User engagement	0.28	1.44	0.8	Rejected
	Blockchain_based products traceability	Transparency of process	0.44	1.52	0.84	Accepted
		Reliable interconnection of nodes	0.44	1.64	0.92	Accepted
		Liability along Blockchain network	0.44	1.6	0.88	Accepted
		Trust on Blockchain decentralized network	0.6	1.64	0.88	Accepted

According to the results of the Lawshe method, the final framework was illustrated in the following Figure. According to this analysis, two dimensions of distributed leadership and customers were eliminated. Also, criteria of energy management, resource maintenance, suitability, leader's willingness to cooperate, user engagement, speed of transport assets, control and rules, *user* control, and anonymity had a CVR lower than 0.37; their Mean was less than 1.5. Thus, they were removed from the original framework. Besides calculating the reliability of our questionnaire, the researchers used Cronbach's alpha method in SPSS software. The reliability of the expert questionnaire was 0.959, which was higher than 0.7 and showed that the questionnaire had high reliability, and it shown in Table 7.

Table 7. Reliability of questionnaire by Cronbach's Alpha

Reliability Statistics	
Cronbach's Alpha	N of Items
959	55

The final framework of Blockchain technology implementation readiness

Based on the analyses performed in the previous sections and getting inspired by the research by Piscine (Piscini et al., 2017) and Schumacher (Schumacher et al., 2016), the framework of Blockchain technology implementation readiness is presented in Figure 4. The final framework includes seven main dimensions of Blockchain-based business strategy, Blockchain-based product traceability, Operations of a distributed system, culture, People in Blockchain decentralized network, decentralized governance, and technology. In addition, 37 main criteria affected these dimensions.

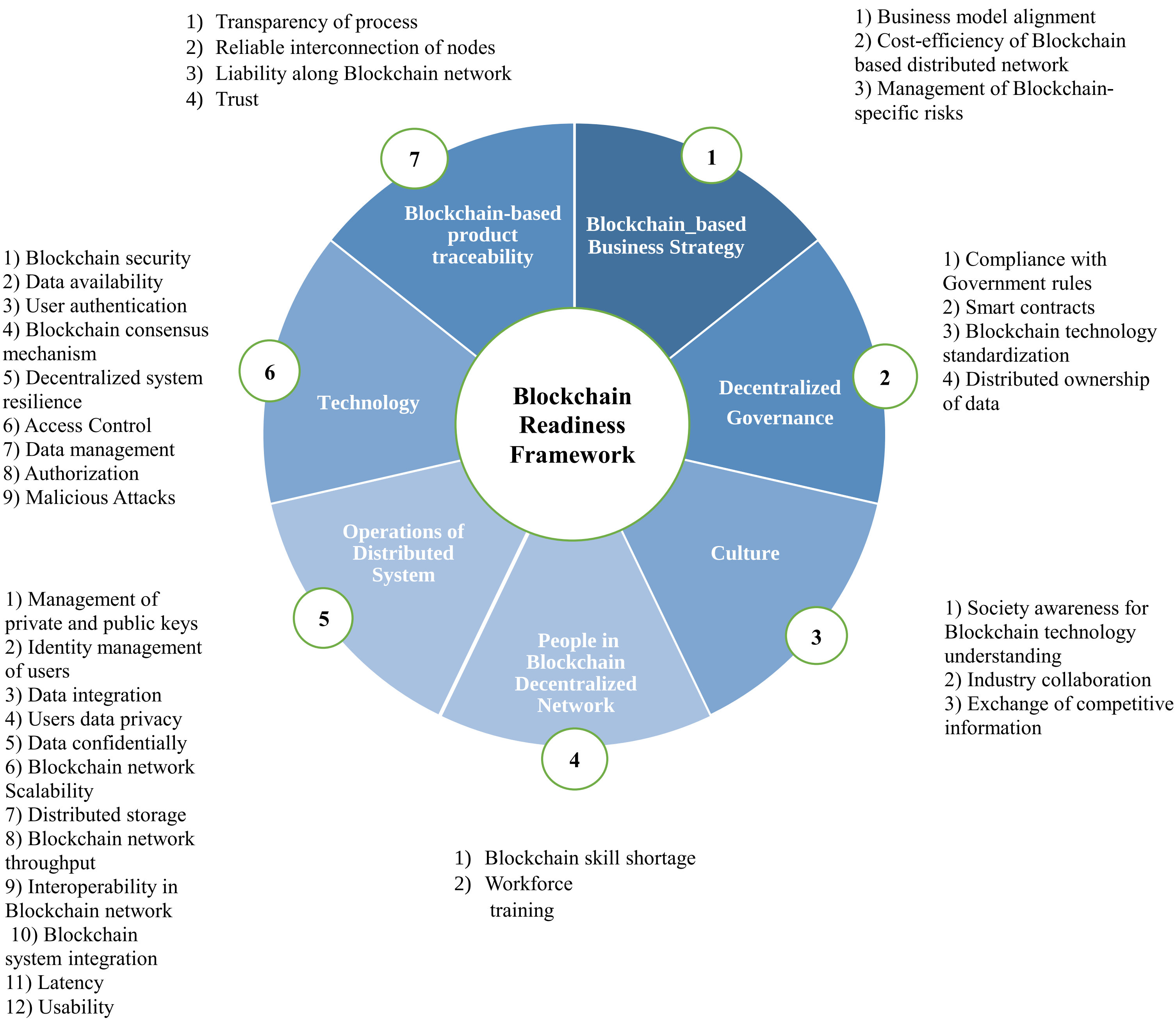

Figure 4. The final framework for Blockchain technology implementation

Application of the research framework to a case study

In this study, a framework was used to assess the readiness of Blockchain technology implementation in a Logistic company. For this purpose, a questionnaire was distributed among the airline company employees, and 28 people answered the questionnaire. Therefore, employees were asked to evaluate each criteria readiness according to the Likert Scale of five sets, including from one to five. In this regard, score one showed that the criteria was not implemented in the company, and score five proved that the criteria were entirely implemented in the case study. The demographic characteristics of the employees are presented in Table 8.

Table 8. The demographic characteristics of employees

		Organizational Value Panel	
Years of experience	3-4	4	
	5-6	4	
	7-8	7	
	>8	13	
Degree	Bachelor Degree	7	
	Master Degree	19	
	Ph.D. Degree	2	
Organizational sector	Management and supervision	9	
	Administrative	8	
	Technical	11	

In this section, after collecting the questionnaires, the data obtained from each questionnaire were entered into the SPSS software. They were analyzed by performing the One-sample t-test to evaluate the implementation readiness of this technology. After examining the significance level and comparing the upper and lower limits at the 0.95 level of confidence, the company's status of dimensions and criteria was determined. The results of this analysis are shown in Table 9 and Table 10.

Table 9. Status of dimension's readiness in Case Study

One-Sample Test							
	Test Value = 3						
	t	Mean	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference		
					Lower	Upper	Readiness
Blockchain_based Business Strategy	.559	3.0700	.633	.07000	-.4691	.6091	Medium
Decentralized Governance	-1.327	2.7150	.277	-.28500	-.9687	.3987	Poor
Culture	.511	3.1767	.660	.17667	-1.3118	1.6651	Medium
People in blockchain decentralized network	-4.571	2.6800	.137	-.32000	-1.2094	.5694	Poor
Operations of a distributed system	-.340	2.9683	.740	-.03167	-.2365	.1732	Poor
Technology	-.171	2.9767	.869	-.02333	-.3383	.2917	Poor
Blockchain_based products traceability	.891	3.2775	.438	.27750	-.7133	1.2683	Medium

Table 10. Status of criteria's readiness in Case Study

One-Sample Test							
	Test Value = 3						
	t	Mean	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference		
					Lower	Upper	Readiness
Blockchain-based business alignment	1.063	3.21	.297	.214	-.20	.63	Medium
Management of Blockchain-specific risks	.867	3.18	.394	.179	-.24	.60	Medium
Compliance to Government rules	-1.730	2.68	.095	-.321	-.70	.06	Poor
Blockchain technology standardization	1.513	3.32	.142	.321	-.11	.76	Medium
Smart Contract	-3.195	2.32	.004	-.679	-1.11	-.24	Poor
Distributed ownership of data	-2.555	2.54	.017	-.464	-.84	-.09	Poor
Society awareness to understand Blockchain technology	-3.334	2.50	.002	-.500	-.81	-.19	Poor
Industry Collaboration	3.315	3.64	.003	.643	.24	1.04	High
Exchange of competitive information	2.499	3.39	.019	.393	.07	.72	High
Blockchain skill shortage	-2.091	2.61	.046	-.393	-.78	-.01	Poor
workforce training	-1.317	2.75	.199	-.250	-.64	.14	Poor
Management of private and public keys	-2.274	2.57	.031	-.429	-.82	-.04	Poor
Identity management of users	1.353	3.29	.187	.286	-.15	.72	Medium
Users data privacy	1.549	3.29	.133	.286	-.09	.66	Medium
Data Confidentially	1.492	3.29	.147	.286	-.11	.68	Medium
Latency	1.613	3.29	.118	.286	-.08	.65	Medium
Data integration	.593	3.11	.558	.107	-.26	.48	Medium
Blockchain network scalability	1.140	3.21	.264	.214	-.17	.60	Medium
Distributed Storage	-.648	2.89	.523	-.107	-.45	.23	Poor
Blockchain network Throughput	-1.769	2.71	.088	-.286	-.62	.05	Poor
Blockchain system Integration	-.441	2.93	.663	-.071	-.40	.26	Poor
Interoperability in blockchain network	-2.174	2.61	.039	-.393	-.76	-.02	Poor
Usability	-4.382	2.43	.000	-.571	-.84	-.30	Poor
Security	-1.426	2.75	.165	-.250	-.61	.11	Poor
Access control	1.987	3.36	.057	.357	-.01	.73	Medium
Data availability	.402	3.07	.691	.071	-.29	.44	Medium
Data Management	-1.317	2.75	.199	-.250	-.64	.14	Poor
Authorization	-2.174	2.61	.039	-.393	-.76	-.02	Poor
Malicious attacks	-.941	2.86	.355	-.143	-.45	.17	Poor
Blockchain Consensus mechanism	-1.317	2.75	.199	-.250	-.64	.14	Poor
Decentralized system resilience	-1.655	2.75	.109	-.250	-.56	.06	Poor
Transparency of process	1.567	3.25	.129	.250	-.08	.58	Medium
Reliable interconnection of nodes	-4.382	2.43	.000	-.571	-.84	-.30	Poor
Loability along with Blockchain network	6.408	3.89	.000	.893	.61	1.18	High
Trust	3.382	3.54	.002	.536	.21	.86	High
User authentication	6.408	3.89	.000	.893	.61	1.18	High

All criteria and dimensions at the significance level (p) < 0.05 and a mean>3 are considered as highly prepared to implement Blockchain Technology. This paper considered the scale of the research questionnaire five values (from 5 to 1). Therefore, each dimension's hypothetical mean and, subsequently, each criterion was 3 (5 + 1). Therefore, the hypothetical average was 3. Besides, if the (p) > 0.05 but the mean was higher than three, the readiness level was considered as medium. As a result, Blockchain_based business strategy, culture, Blockchain_based products traceability have a medium readiness level, but other dimensions have poor readiness levels. In addition, according to one sample test, analysis of criteria, industry collaboration, exchange of competitive information, User Authentication, Liability along with Blockchain network, and trust have a high level of Blockchain technology readiness. Besides, calculating the reliability of questionnaire, Cronbach's alpha method was used in SPSS software, and the reliability of the expert questionnaire was 0.891, which was higher than 0.7 and showed that the questionnaire had high reliability.

Figure 5 shows the level of Blockchain technology readiness of the organization in all dimensions.

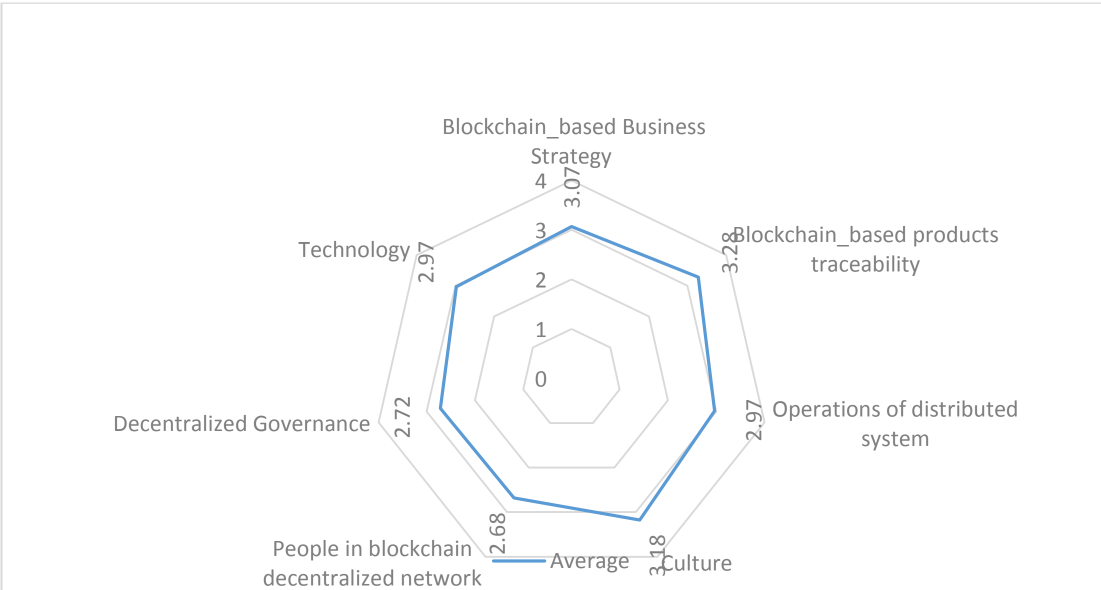

Figure 5. Radar chart visualizing airline company Blockchain readiness in seven dimensions

Discussion

This study provided a framework to evaluate the readiness of Blockchain technology implementation. This framework has seven dimensions, including Blockchain-based business strategy, Decentralized governance, culture, people in Blockchain decentralized network, Operations of a distributed system, technology, and Blockchain-based product traceability. However, Some of the readiness dimensions did not gain the required scores at two distributed leadership and customers level, according to the scores of the experts. In this regard, there were observed to be irrelevant to the Blockchain readiness framework, and they were eliminated from the initially suggested conceptual framework. This finding deviates from previous studies, which viewed leadership criteria as one of the critical success factors of Blockchain technology (S. Prasad et al., 2018). This might be because Blockchain technology is one of the most valuable trends in the industry. Consequently, all companies would follow this globally famous trend, and it does not rely on the leader's interest.

Unlike the study of Prasad and Ahl (S. Prasad et al., 2018)(Ahl et al., 2019), in this research, customers and their engagement were eliminated from the proposed framework according to the score of experts. On the other hand, some studies support the Blockchain readiness framework in this study. In the research, distributed governance was one of the main dimensions of the readiness framework. In two studies, governance was one of the critical issues that must be noticed while implementing Blockchain technology and this supports the present framework(Yang, 2019)(Allessie et al., 2018). People in Blockchain decentralized network and technology dimension in this study were both primary dimensions in Blockchain technology implementation assessment approved by the research done by Wibowo (Wibowo & Hw, 2018). In addition, more studies support that people in Blockchain decentralized network is a must-have issue to be noticed (Ahl et al., 2019)(Li et al., 2019b). Operations of a distributed system are suggested to be as one of the critical dimensions that have 12 criteria. It is considered one of the primary steps in implementing Blockchain in research done by Lai and Chuen (Lai & Lee Kuo Chuen, 2018). Finally, Blockchain-based product traceability is supported to be one of the proper dimensions of Blockchain readiness framework by the study done by Behke and Janssen(Behnke & Marijn, 2019).

According to the literature review, most of the previous studies focused on Blockchain technology benefits, challenges, and applications (Rao & Clarke, 2019)(Hassan et al., 2019)(Moin et al., 2019) while this study revealed a valuable readiness assessment framework of Blockchain technology in logistics. In the research done by Meyer (Meyer et al., 2019a), a framework of Blockchain requirements in the Logistic section only focused on two organizational and performance dimensions. However, this study provided a more comprehensive framework to learn about Blockchain technology criteria in the logistic section.

This paper had some limitations, including the insufficient knowledge of all employees to answer the questionnaire's questions. It was also challenging to assess the readiness of Iran's transportation industry due to the large size of the community and its high costs.

Conclusion

Moving toward industry 4.0 and applying new technologies such as Blockchain technology in companies and deploying them in organizations can be a positive step towards improving the status of companies in Iran. However, before implementing this technology to prevent future financial and non-financial losses, companies must be prepared to implement the new technology. In this study, the main goal was to provide a framework to evaluate the Blockchain technology implementation readiness. Thus, by using a systematic literature review, the most critical criteria were identified. Based on the meta-synthesis approach, an initial framework were proposed to assess the readiness of Blockchain technology implementation. The final framework was presented after getting information from Blockchain technology experts through distributing questionnaires. This framework comprised seven main dimensions of Blockchain_based strategy, Blockchain_based products traceability, distributed system operations, people in Blockchain decentralized network, culture, decentralized governance, and technology. Each of these dimensions were also affected by criteria. For instance, the Blockchain-based business strategy dimension included cost-efficiency of Blockchain-based distributed network, Management of Blockchain-specific risks, and business model alignment.

In the next step, applying this framework in an airline service company was evaluated by getting data from the employees to calculate the level of readiness. Then, through a statistical test, the company's readiness was assessed by a one-sample t-test. According to the statistical analysis results in this company, none of the dimensions had a sufficient readiness to implement Blockchain technology. In addition, distributed system operations, people in the decentralized Blockchain network, decentralized governance, and technology dimensions were less prepared than other dimensions. As a result, to increase the readiness of Blockchain technology implementation, more focus should be placed on these dimensions. According to the findings, the company can benefit from a better level of readiness in awareness industry collaboration and exchange of information to improve the dimension of people by getting help from the industry collaboration. As a result, the company can get financial aid to train an appropriate workforce in Blockchain technology. So there won't be a lack of skill in this new coming technology. In addition, based on the low level of readiness in Operation and technology dimensions, it is suggested that the company start learning about new concepts and should have requirements in Blockchain technology in the technical section and their usage process. The results have shown that the company had poor readiness in governance. As a result, setting their specific rules and standards that fit their condition and the principles regulated by the government is suggested. So, exploring the government's standards and regulations is a critical step. This research provided organizations with a framework for assessing the readiness of Blockchain technology implementation to consider all the dimensions and criteria that affect them, enhance their readiness, and prevent financial and non-financial losses during Blockchain technology implementation.

Given that the present study was done to set a Blockchain technology readiness framework, it is possible to examine the maturity model of an organization for the implementation of Blockchain technology for future research. Checking the readiness of Blockchain implementation in the transport industry and larger samples can be a good option for future research. In addition, since Blockchain technology has many applications, this framework for evaluating implementation readiness can be explored in other industries.

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Conflict of interest

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues including plagiarism, informed consent, misconduct, data fabrication and, or falsification, double publication and, or submission, and redundancy have been completely witnessed by the authors.

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References

Aggarwal, S., Chaudhary, R., Aujla, G. S., Kumar, N., Choo, K. K. R., & Zomaya, A. Y. (2019). Blockchain for smart communities: Applications, challenges and opportunities. *Journal of Network and Computer Applications*, *144*, 13–48. https://doi.org/10.1016/j.jnca.2019.06.018

Ahl, A., Yarime, M., Tanaka, K., & Sagawa, D. (2019). Review of blockchain-based distributed energy : Implications for institutional development. *Renewable and Sustainable Energy Reviews*, *107*(November 2018), 200–211. https://doi.org/10.1016/j.rser.2019.03.002

Al-Jaroodi, J., & Mohamed, N. (2019). Blockchain in Industries: A Survey. *IEEE Access*, *7*(c), 36500–36515. https://doi.org/10.1109/ACCESS.2019.2903554

Alexopoulos, N., & Vasilomanolakis, E. (2018). *Towards Blockchain-Based Collaborative*. 107–118. https://doi.org/10.1007/978-3-319-99843-5

Alexopoulus, N., Vasilomanolakis, E., Ivanko, natalia reka, & Muhlhauser, M. (2017). DMA Optimal Layout for Protection of Water Distribution Networks from Malicious Attack. *CRITIS 2017:International Conference on Critical Information Infrastructures Security*, *1*, 84–96. https://doi.org/10.1007/978-3-319-99843-5

Alketbi, A., Nasir, Q., & Talib, M. A. (2018). Blockchain for government services-Use cases, security benefits and challenges. *2018 15th Learning and Technology Conference, L and T 2018*, 112–119. https://doi.org/10.1109/LT.2018.8368494

Allessie, D., Sobolewski, M., & Vaccari, L. (2018). Identifying the true drivers of costs and benefits of blockchain implementation for public services. *ACM International Conference Proceeding Series*, *1*, 1–2. https://doi.org/10.1145/3209281.3209405

Andoni, M., Robu, V., Flynn, D., Abram, S., Geach, D., Jenkins, D., McCallum, P., & Peacock, A. (2019).

Blockchain technology in the energy sector: A systematic review of challenges and opportunities. *Renewable and Sustainable Energy Reviews*, *100*(February 2018), 143–174. https://doi.org/10.1016/j.rser.2018.10.014

Andrian, H. R., Kurniawan, N. B., & Suhardi. (2018). Blockchain Technology and Implementation : AA Systematic Literature Review. *2018 International Conference on Information Technology Systems and Innovation, ICITSI 2018 - Proceedings*, 370–374. https://doi.org/10.1109/ICITSI.2018.8695939

Angelis, J., & Ribeiro da Silva, E. (2018). Blockchain adoption: A value driver perspective. *Business Horizons*. https://doi.org/10.1016/J.BUSHOR.2018.12.001

Atlam, H. F., & Wills, G. B. (2018). Technical aspects of blockchain and IoT. In *Advances in Computers* (1st ed.). Elsevier Inc. https://doi.org/10.1016/bs.adcom.2018.10.006

Ayre, C., & Scally, A. J. (2014). Critical values for Lawshe's content validity ratio: Revisiting the original methods of calculation. *Measurement and Evaluation in Counseling and Development*, *47*(1), 79–86. https://doi.org/10.1177/0748175613513808

Behnke, K., & Marijn, M. F. W. H. A. J. (2019). International Journal of Information Management Boundary conditions for traceability in food supply chains using blockchain technology. *International Journal of Information Management*, *March*, 1–10. https://doi.org/10.1016/j.ijinfomgt.2019.05.025

Benbunan-fich, R., & Castellanos, A. (2018). *Digitalization of Land Records : From Paper to Blockchain Digitalization of Land Records : From Paper to Blockchain*. *November*.

Benbunan-Fich, R., & Castellanos, A. (2018). Digitization of Land Records: From Paper to Blockchain. *ICIS 2018 Proceedings*.

Casino, F., Dasaklis, T. K., & Patsakis, C. (2019a). A systematic literature review of blockchain-based applications: Current status, classification and open issues. *Telematics and Informatics*, *36*(May 2018), 55–81. https://doi.org/10.1016/j.tele.2018.11.006

Casino, F., Dasaklis, T. K., & Patsakis, C. (2019b). Telematics and Informatics A systematic literature review of blockchain-based applications : Current status , classification and open issues. *Telematics and Informatics*, *36*(November 2018), 55–81. https://doi.org/10.1016/j.tele.2018.11.006

Du, W. (Derek), Pan, S. L., Leidner, D. E., & Ying, W. (2019). Affordances, experimentation and actualization of FinTech: A blockchain implementation study. *Journal of Strategic Information Systems*, *28*(1), 50–65. https://doi.org/10.1016/j.jsis.2018.10.002

Galenovich, A., Lonshakov, S., & Shadrin, A. (2018). Blockchain Ecosystem for Carbon Markets , Environmental Assets , Rights , and Liabilities : Concept Design and Implementation. In *Transforming Climate Finance and Green Investment with Blockchains*. Elsevier Inc. https://doi.org/10.1016/B978-0-12-814447-3.00017-3

Galvez, J. F., Mejuto, J. C., & Simal-gandara, J. (2018). Trends in Analytical Chemistry Future challenges on the use of blockchain for food traceability analysis. *Trends in Analytical Chemistry*, *107*, 222–232. https://doi.org/10.1016/j.trac.2018.08.011

Gao, W., Hatcher, W. G., & Yu, W. (2018). A survey of blockchain: Techniques, applications, and challenges. *Proceedings - International Conference on Computer Communications and Networks, ICCCN*, *2018-July*(i). https://doi.org/10.1109/ICCCN.2018.8487348

Gausdal, A. H., Czachorowski, K. V., & Solesvik, M. Z. (2018). Applying Blockchain technology: Evidence from Norwegian companies. *Sustainability (Switzerland)*, *10*(6), 1–16. https://doi.org/10.3390/su10061985

Gökalp, E., Gökalp, M. O., Çoban, S., & Eren, P. E. (2018). Analysing opportunities and challenges of integrated blockchain technologies in healthcare. *Lecture Notes in Business Information Processing*, *333*, 174–183. https://doi.org/10.1007/978-3-030-00060-8_13

Hassan, M. U., Rehmani, M. H., & Chen, J. (2019). Privacy preservation in blockchain based IoT systems: Integration issues, prospects, challenges, and future research directions. *Future Generation Computer Systems*, *97*, 512–529. https://doi.org/10.1016/j.future.2019.02.060

Hebert, Cedric, Cerbo, F. Di, Hebert, C., & Cerbo, F. Di. (2019). Secure Blockchain in the Enterprise : A Methodology. *Pervasive and Mobile Computing*, 101038. https://doi.org/10.1016/j.pmcj.2019.101038

Hebert, Cédric, & Di Cerbo, F. (2019). Secure blockchain in the enterprise: A methodology. *Pervasive and Mobile Computing*, *59*, 101038. https://doi.org/10.1016/j.pmcj.2019.101038

Hughes, A., Park, A., Kietzmann, J., & Archer-brown, C. (2018). Beyond Bitcoin : What blockchain and distributed ledger technologies mean for fi rms. *Business Horizons*. https://doi.org/10.1016/j.bushor.2019.01.002

Hughes, A., Park, A., Kietzmann, J., & Archer-Brown, C. (2019). Beyond Bitcoin: What blockchain and distributed ledger technologies mean for firms. *Business Horizons*, *62*(3), 273–281. https://doi.org/10.1016/J.BUSHOR.2019.01.002

Hughes, L., Dwivedi, Y. K., Misra, S. K., & Rana, N. P. (2019). International Journal of Information Management Blockchain research , practice and policy : Applications , benefits , limitations , emerging research themes and research agenda ☆. *International Journal of Information Management*, *49*(April), 114–129. https://doi.org/10.1016/j.ijinfomgt.2019.02.005

Hughes, L., Dwivedi, Y. K., Misra, S. K., Rana, N. P., Raghavan, V., & Akella, V. (2019). Blockchain research, practice and policy: Applications, benefits, limitations, emerging research themes and research agenda. *International Journal of Information Management*, *49*(February), 114–129. https://doi.org/10.1016/j.ijinfomgt.2019.02.005

Ivashchenko, A., Polishchuk, Y., & Britchenko, I. (2018). Implementation of ICO European best practices by SMEs. *Economic Annals-XXI*, *169*(1–2), 67–71. https://doi.org/10.21003/ea.V169-13

Kamble, S., Gunasekaran, A., & Arha, H. (2018). Understanding the Blockchain technology adoption in supply chains-Indian context. *International Journal of Production Research*, *0*(0), 1–25. https://doi.org/10.1080/00207543.2018.1518610

Kamble, S. S., Gunasekaran, A., & Sharma, R. (2019a). International Journal of Information Management Modeling the blockchain enabled traceability in agriculture supply chain. *International Journal of Information Management*, *April*, 1–16. https://doi.org/10.1016/j.ijinfomgt.2019.05.023

Kamble, S. S., Gunasekaran, A., & Sharma, R. (2019b). Modeling the blockchain enabled traceability in agriculture supply chain. *International Journal of Information Management*, *May*, 1–16. https://doi.org/10.1016/j.ijinfomgt.2019.05.023

Koteska, B., Karafiloski, E., & Mishev, A. (2017). Blockchain implementation quality challenges: A literature review. *CEUR Workshop Proceedings*, *1938*, 11–13.

Kruglova, I. A., & Dolbezhkin, V. A. (2018). in the Financial Sector. *2018 International Conference on Artificial Intelligence Applications and Innovations (IC-AIAI)*, 47–50. https://doi.org/10.1109/IC-AIAI.2018.00016

Lai, R., & Lee Kuo Chuen, D. (2018). Blockchain-From Public to Private. In *Handbook of Blockchain, Digital Finance, and Inclusion* (1st ed., Vol. 2). Elsevier Inc. https://doi.org/10.1016/B978-0-12-812282-2.00007-3

LAWSHE, C. H. (1975). a Quantitative Approach To Content Validity. *Personnel Psychology*, *28*(4), 563–575. https://doi.org/10.1111/j.1744-6570.1975.tb01393.x

Li, J., Greenwood, D., & Kassem, M. (2019a). Automation in Construction Blockchain in the built environment and construction industry : A systematic review , conceptual models and practical use cases. *Automation in Construction*, *102*(February), 288–307. https://doi.org/10.1016/j.autcon.2019.02.005

Li, J., Greenwood, D., & Kassem, M. (2019b). Blockchain in the built environment and construction industry: A systematic review, conceptual models and practical use cases. *Automation in Construction*, *102*(August 2018), 288–307. https://doi.org/10.1016/j.autcon.2019.02.005

Makhdoom, I., Abolhasan, M., Abbas, H., & Ni, W. (2019a). Blockchain's adoption in IoT: The challenges, and a way forward. *Journal of Network and Computer Applications*, *125*(September 2018), 251–279. https://doi.org/10.1016/j.jnca.2018.10.019

Makhdoom, I., Abolhasan, M., Abbas, H., & Ni, W. (2019b). Journal of Network and Computer Applications Blockchain ' s adoption in IoT : The challenges , and a way forward. *Journal of Network and Computer Applications*, *125*(September 2018), 251–279. https://doi.org/10.1016/j.jnca.2018.10.019

McGhin, T., Choo, K. K. R., Liu, C. Z., & He, D. (2019). Blockchain in healthcare applications: Research challenges and opportunities. *Journal of Network and Computer Applications*, *135*(September 2018), 62–75. https://doi.org/10.1016/j.jnca.2019.02.027

Mcghin, T., Choo, K. R., Zhechao, C., & He, D. (2019). Journal of Network and Computer Applications Blockchain in healthcare applications : Research challenges and opportunities. *Journal of Network and Computer Applications*, *135*(February), 62–75. https://doi.org/10.1016/j.jnca.2019.02.027

Memon, M., Hussain, S. S., Bajwa, U. A., & Ikhlas, A. (2019). Blockchain beyond Bitcoin: Blockchain Technology Challenges and Real-World Applications. *Proceedings - 2018 International Conference on Computing, Electronics and Communications Engineering, ICCECE 2018*, 29–34. https://doi.org/10.1109/iCCECOME.2018.8658518

Meyer, T., Kuhn, M., & Hartmann, E. (2019a). Blockchain technology enabling the Physical Internet : A synergetic application framework. *Computers & Industrial Engineering*. https://doi.org/10.1016/j.cie.2019.07.006

Meyer, T., Kuhn, M., & Hartmann, E. (2019b). Blockchain technology enabling the Physical Internet: A synergetic application framework. *Computers and Industrial Engineering*, *136*, 5–17. https://doi.org/10.1016/j.cie.2019.07.006

Min, H. (2019). Blockchain technology for enhancing supply chain resilience. *Business Horizons*, *62*(1), 35–45. https://doi.org/10.1016/J.BUSHOR.2018.08.012

Moin, S., Karim, A., Safdar, Z., Safdar, K., Ahmed, E., & Imran, M. (2019). Securing IoTs in distributed blockchain: Analysis, requirements and open issues. *Future Generation Computer Systems*, *100*, 325–343. https://doi.org/10.1016/j.future.2019.05.023

Mundra, S. (2018). Blockchain initiatives and implementation. *Information Services and Use*, *38*(3), 187–189. https://doi.org/10.3233/ISU-180022

Naderifar, M., Goli, H., & Ghaljaie, F. (2017). Snowball Sampling: A Purposeful Method of Sampling in Qualitative Research. *Strides in Development of Medical Education*, *14*(3). https://doi.org/10.5812/sdme.67670

Nawari, N. O., & Ravindran, S. (2019). *Blockchain and the built environment : Potentials and limitations*. *25*(June). https://doi.org/10.1016/j.jobe.2019.100832

O'Donoghue, O., Vazirani, A. A., Brindley, D., & Meinert, E. (2019). Design choices and trade-offs in health care blockchain implementations: Systematic review. *Journal of Medical Internet Research*, *21*(5), 1–13. https://doi.org/10.2196/12426

Ølnes, S., Ubacht, J., & Janssen, M. (2017a). *Blockchain in government : Bene fi ts and implications of distributed ledger technology for information sharing*. *34*(October), 355–364. https://doi.org/10.1016/j.giq.2017.09.007

Ølnes, S., Ubacht, J., & Janssen, M. (2017b). Blockchain in government: Benefits and implications of distributed ledger technology for information sharing. *Government Information Quarterly*, *34*(3), 355–364. https://doi.org/10.1016/j.giq.2017.09.007

Ølnes, S., Ubacht, J., & Janssen, M. (2017c). Blockchain in government: Benefits and implications of distributed ledger technology for information sharing. *Government Information Quarterly*, *34*(3), 355–364. https://doi.org/10.1016/J.GIQ.2017.09.007

Onik, M. M. H., Aich, S., Yang, J., Kim, C.-S., & Kim, H.-C. (2019). Blockchain in Healthcare: Challenges and Solutions. In *Big Data Analytics for Intelligent Healthcare Management*. Elsevier Inc. https://doi.org/10.1016/b978-0-12-818146-1.00008-8

Pantielieieva, N., Krynytsia, S., Zhezherun, Y., Rebryk, M., & Potapenko, L. (2018). Digitization of the economy of Ukraine: Strategic challenges and implementation technologies. *Proceedings of 2018 IEEE 9th International Conference on Dependable Systems, Services and Technologies, DESSERT 2018*, 508–515. https://doi.org/10.1109/DESSERT.2018.8409186

Peterson, K., Deeduvanu, R., Kanjamala, P., & Boles, K. (2016). *A Blockchain-Based Approach to Health Information Exchange Networks*. *1*, 1–10.

Prasad, A., Heales, J., & Heales, J. (2008). *Information Technology and Business Value : How Complementary IT Usage Platform and Capable Resources Explain IT Business Value Variation Information Technology and Business Value : How*.

Prasad, S., Shankar, R., Gupta, R., Roy, S., Shankar, R., & Roy, S. (2018). *A TISM modeling of critical success factors of blockchain based cloud services services*. https://doi.org/10.1108/JAMR-03-2018-0027

Queiroz, M. M., & Fosso, S. (2019a). International Journal of Information Management Blockchain adoption challenges in supply chain : An empirical investigation of the main drivers in India and the USA. *International Journal of Information Management*, *46*(November 2018), 70–82. https://doi.org/10.1016/j.ijinfomgt.2018.11.021

Queiroz, M. M., & Fosso, S. (2019b). International Journal of Information Management Blockchain adoption challenges in supply chain : An empirical investigation of the main drivers in India and the USA. *International Journal of Information Management*, *46*(September 2018), 70–82. https://doi.org/10.1016/j.ijinfomgt.2018.11.021

Queiroz, M. M., & Fosso Wamba, S. (2019). Blockchain adoption challenges in supply chain: An empirical investigation of the main drivers in India and the USA. *International Journal of Information Management*, *46*(September 2018), 70–82. https://doi.org/10.1016/j.ijinfomgt.2018.11.021

Rao, A. R., & Clarke, D. (2019). Perspectives on emerging directions in using IoT devices in blockchain applications. *Internet of Things*, 100079. https://doi.org/10.1016/j.iot.2019.100079

Rao, A. R., & Ms, D. C. (2019). PT US CR. *Internet of Things*, 100079. https://doi.org/10.1016/j.iot.2019.100079

Sander, F., Semeijn, J., & Mahr, D. (2018). The acceptance of blockchain technology in meat traceability and transparency. *British Food Journal*, *120*(9), 2066–2079. https://doi.org/10.1108/BFJ-07-2017-0365

Scholl, H. J., & Bolívar, M. P. R. (2019). Regulation as both enabler of technology use and global competitive tool: The Gibraltar case. *Government Information Quarterly*, *May*, 1–13. https://doi.org/10.1016/j.giq.2019.05.003

Schuetz, S., & Venkatesh, V. (2019). Blockchain, adoption, and financial inclusion in India: Research opportunities. *International Journal of Information Management*. https://doi.org/10.1016/j.ijinfomgt.2019.04.009

Swan, M. (2018). Blockchain for Business: Next-Generation Enterprise Artificial Intelligence Systems. *Advances in Computers*, *111*, 121–162. https://doi.org/10.1016/BS.ADCOM.2018.03.013

Tavares, B., Correia, filipe figueiredo, Restivo, A., Faria, joao pascoal, & Aguiar, A. (2020). *A Survey of Blockchain Frameworks and Applications*. *942*, 22–32. https://doi.org/10.1007/978-3-030-17065-3

Thakur, V., Doja, M. N., Dwivedi, Y. K., Ahmad, T., & Khadanga, G. (2019a). Land records on Blockchain for implementation of Land Titling in India. *International Journal of Information Management*, *April*, 0–1. https://doi.org/10.1016/j.ijinfomgt.2019.04.013

Thakur, V., Doja, M. N., Dwivedi, Y. K., Ahmad, T., & Khadanga, G. (2019b). Land records on Blockchain for implementation of Land Titling in India. *International Journal of Information Management*, *March*, 0–1. https://doi.org/10.1016/j.ijinfomgt.2019.04.013

Tijan, E., Aksentijevi, S., & Ivani, K. (2019). *Blockchain Technology Implementation in Logistics*. https://doi.org/10.3390/su11041185

Tijan, E., Aksentijević, S., Ivanić, K., & Jardas, M. (2019). Blockchain technology implementation in logistics. *Sustainability (Switzerland)*, *11*(4). https://doi.org/10.3390/su11041185

Umarovich, A. A., Gennadyevna, V. N., Vladimirovna, A. O., & Alexandrovich, S. R. (2017). *Block Chain and Financial Controlling in the System of Technological Provision of Large Corporations ' Economic Security*. *XX*(3), 3–12.

Unterweger, A., Knirsch, F., Leixnering, C., & Engel, D. (2018). Lessons Learned from Implementing a Privacy-Preserving Smart Contract in Ethereum. *2018 9th IFIP International Conference on New Technologies, Mobility and Security, NTMS 2018 - Proceedings*, *2018-Janua*, 1–5. https://doi.org/10.1109/NTMS.2018.8328739

Wang, Y., Singgih, M., Wang, J., & Rit, M. (2019a). Making sense of blockchain technology : (How) will it transform supply chains ? *International Journal of Production Economics*. https://doi.org/10.1016/j.ijpe.2019.02.002

Wang, Y., Singgih, M., Wang, J., & Rit, M. (2019b). Making sense of blockchain technology : How will it transform supply chains ? *Intern. Journal of Production Economics*, *211*(February), 221–236. https://doi.org/10.1016/j.ijpe.2019.02.002

Wibowo, S., & Hw, E. P. (2018). Blockchain Implementation Assessment Framework, Case Study of IoT LPWA Licensing in Indonesia. *Proceeding - 2018 International Conference on ICT for Smart Society: Innovation Toward Smart Society and Society 5.0, ICISS 2018*, 1–5. https://doi.org/10.1109/ICTSS.2018.8549940

Yang, L. (2019). The blockchain: State-of-the-art and research challenges. *Journal of Industrial Information Integration*, *April*. https://doi.org/10.1016/j.jii.2019.04.002

Zhang, D. (2019). Application of blockchain technology in incentivizing efficient use of rural wastes: A case study on Yitong System. *Energy Procedia*, *158*, 6707–6714. https://doi.org/10.1016/j.egypro.2019.01.018

Zhao, G., Liu, S., Lopez, C., Lu, H., Elgueta, S., Chen, H., & Boshkoska, B. M. (2019). Blockchain technology in agri-food value chain management: A synthesis of applications, challenges and future research directions. *Computers in Industry*, *109*, 83–99. https://doi.org/10.1016/j.compind.2019.04.002

Zhao, G., Liu, S., Lopez, C., Lu, H., Elgueta, S., Chen, H., & Mileva, B. (2019). Computers in Industry Blockchain technology in agri-food value chain management : A synthesis of applications , challenges and future research directions. *Computers in Industry*, *109*, 83–99. https://doi.org/10.1016/j.compind.2019.04.002

Zimmer, L. (2006). Methodological Issues In Nursing Research Qualitative meta-synthesis: a question of dialoguing with texts. *Journal of Advanced Nursing*, *53*(3), 311–318. http://search.ebscohost.com/login.aspx?direct=true&db=eoah&AN=8360815&site=ehost-live

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