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Challenges of using blockchain technology in the international markets

Hamzeh Aghababayi

PhD candidate of Production and Operations Management Industrial Management Department, Semnan University, Semnan, Iran. E-mail: hamzehaghababayi@semnan.ac.ir

Mohsen Shafiei Nikabadi *

*Corresponding Author, Associate Professor of Industrial Management Department Economics and Management Faculty Semnan University, Semnan, Iran. E-mail: shafiei@semnan.ac.ir

Saman Babaie Kafaki

Professor of Department of Mathematics, Faculty of Mathematics, Statistics and Computer Science, Semnan University, Semnan, Iran. E-mail: sbk@semnan.ac.ir

Mohammad Rahmanimanesh

Assistant Professor of Department of Computer Software Engineering, Faculty of Electrical & Computer Engineering, Semnan University, Semnan, Iran. E-mail: rahmanimanesh@semnan.ac.ir

Abstract

Despite all blockchain's advantages, it has experienced some challenges and disadvantages. Identifying these challenges and minimizing them are important steps in advancing the goals of this technology. The purpose of this study is to investigate and identify the challenges of using blockchain technology in international markets with regard to the risks of such newfound technologies. This is an applied research in terms of purpose and a mixed research in terms of methodology. The effective factors in using blockchain technology have been discovered by the meta-synthesis method at first; then the ranking of these factors has been done by the fuzzy pairwise comparison. A systematic search was performed in the database of Science Direct, Emerald, and Google Scholar. Also, the seven-step method of Sandlowski and Barroso (2007) was applied. All the related articles and the challenges of using blockchain in international markets were identified and coded. The comparison method between the two coders was used to adjust the reliability and the kappa coefficient was used to calculate the correlation coefficient between the two codes. The findings of the extracted sources were finally proposed and 41 challenges were classified into 6 categories of technical, educational, structural, market, infrastructure and legal which divided in both internal and external areas.

Keywords: Blockchain, International markets, Meta-synthesis method, Challenges.

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Introduction

Today, many factors form the trade flows in international markets, including whispers of the end of the oil age, inclination toward renewable energy, policies, sanctions on developing countries, economic diplomacy, inflation, unemployment, changes in nature, disruption in supply and demand, the breakdown of global supply chains and differences in labor costs, and even centralization, monopoly and hacking of business information. Meanwhile, what has recently affected international markets more and more, is undoubtedly the Covid 19 pandemic from the end of 2019 and its continuation to 2020 and 2021. Coronavirus is the first pandemic in the digital age (Duffin et al,2020), worldwide efforts are being made to restrain what has become a profoundly destructive pandemic (World Economic Forum,2020). But its consequences have penetrated in the depths of relations, social, cultural, political, and economic layers to the depths of relationships in international markets and have changed them.

Although the decrease in global market indexes due to the Covid 19 pandemic can be considered as a sign of entering the global economy into a period of recession in the financial markets, energy, goods, tourism, investment, production, exports, and imports. It should be noted that the Corona pandemic has changed people's lives in many areas. Also, the world has rapidly shifted to newfound technologies of the digital age (Ting et al,2020). Data from the Mackenzie International Institute shows that e-commerce will increase trade in manufactured goods and also enhance services based on new platforms in international markets by 2030 with a 6 to 10 percent (McKinsey, 2020). The most important advantage of these platforms is the ability to connect the goods and services of small companies into the international markets.

Blockchain technology has attracted a lot of attention among these emerging technologies. Blockchain is a digital head office with transparent, visible, and tamper-resistant exchanges that has a decentralized data center and distribution around the world (Bamakan et al., 2021). Transactions in blockchain are done without the presence of a third party (such as banks, governments, or companies), between the seller and the buyer (Pilkington, 2016). While the trading system is usually centralized and all data and information are controlled and managed by a third party organization, not the two main people involved in the transaction.

These intermediaries also control data security and data privacy completely (Pilkington,2016). Blockchain technology was created to solve this problem with the aim of creating a decentralized environment where no third party is in control of transactions and data (Koteska et al, 2017). A notable feature of blockchain is that public passwords are never associated with a real identity and are activated without disclosing the identities of individuals although transactions can be tracked if necessary. This is a major difference from Fiat currency transactions in which individuals usually have legal personalities (Pilkington, 2016). The business logic that blockchain works with, is defined in terms of smart contracts. Smart contracts specify all the conditions that must be met before making a transaction (Koteska, et al, 2017). The first and most common digital currency based on blockchain was Bitcoin (Coinmarketcap, 2016. Blockchain technology is the basis of modern cryptocurrencies due to the widespread use of cryptocurrency functions (Yaga et al, 2016). A cryptocurrency economic system is an economic system independent of geographical location, political structure, or legal system that is based on reliable cryptography (Babbitt,2014). Currency encryption technology was originally designed for information security systems but has been developed in a variety of fields over time (Saper,2012).

Blockchain can revolutionize many areas of finance, banking, business, security, and smart contracts. Proponents of blockchain argue that expanding exchange opportunities and cooperation will lead to this development by reducing reliance on intermediaries and related frictions (Prager, 2021).

Despite the great potential of this technology blockchain is not at the optimal level of maturity yet, and studies on the ambiguity in the dimensions, benefits, and broad economic effects of this technology should be sufficiently feasible before implementation (Clavin et al,2020). In general, not many studies have been conducted on the challenges and limitations such as waste of resources and usability, and a lot of research has been done on the challenges and limitations of security and privacy (Yli-Huumo et al, 2016). Multi-level authentication (Butun et al, 2016) and efficient energy resource management for distributed systems can be cited among the studies conducted in this field (Cordeschi et al, 2015; Shojafa et al, 2016) which accelerates the possibility of overcoming the current challenges and limitations of blockchain technology. Another limitation is the power of the blockchain network (Swan, 2015). The problem with the current bitcoin network is that it processes 3 to 20 transactions per second (tps) (Xu et al, 2016) while the VISA transaction network can process 2000 tps and The Twitter network can process 5000 tps. Delayed processing of requests in a network is an obstacle to the international acceptance of that technology (Beck et al, 2016). An important issue is a need for more blockchain transactions (Swan, 2015). One of the most challenging problems in implementing blockchain is scalability. It must have a large number of nodes in order to be secured. The solution to the problem of scalability is to have many blockchains for different purposes (Beck et al, 2016).

Therefore, the present article, considering the globalization of the smart economy and the elimination of physical boundaries, tries to take the economic benefits of this technology into account before any implementation, policy, and legislation in this field. Also, this article identifies the challenges facing its application by reviewing research, thematic, and research trends and it makes a small effort to find the response to this question; what are the challenges for researchers in this field in international markets?

The following of this paper is dedicated to stating the theoretical foundations as background, and the research method. Then, the "data analysis" and the "discussion, conclusions, and suggestions" are presented in sections 4 and 5, respectively.

Research background and literature review

According to a Bank of England report in February 2015, more research is needed on designing a system that can use general ledger technology without compromising the central bank's ability to control its currency and system security against systematic attack. Studies show that issues related to the use of blockchain in international markets include technical issues and the highly important ones: political, and regulatory issues. Many cryptocurrency users have expressed concerns about government regulations. While it is almost impossible to prevent the growing cryptocurrency, the government could theoretically ban ownership or participation in the cryptocurrency network (Nwabuike et al,2020). International markets are at the level of academic scientific research. The results show that the acceptance of blockchain in e-government-based applications is still very limited. The most important of all is that the governments themselves have the greatest share of ambiguity and non-transparency these days, and in addition, today's governments do not understand the true value of the blockchain and underestimate its enormous potential. The implementation of blockchain systems is opposed in states where corruption and lack of transparency are among the pillars of government (Ahmad et al,2021)

What is important is to understand the blockchain's ability to remove various trade barriers (Bogart ,2020). The inefficiency of international market ecosystems is one of the issues that should be considered. The speed of information dissemination, transparency, monitoring of transactions and political interventions affect the efficiency and inefficiency of markets. Blockchain can provide a delay-free framework for sharing information between manufacturers, suppliers, distributors, as well as products. It will also eliminate third parties, improve the management of intellectual property rights, and reduce business costs due to increased transparency. Blockchain is expected to facilitate and improve government procurement processes while combating fraud in the management of public contracts.

Therefore, considering the purpose and question of the research, study and research in related articles show that it is important that most research has paid special attention to the benefits of blockchain technology, especially in the fields of finance, banking, insurance, and security. The challenges have been re-examined after going through the technological

developments of the last decade, so significant shortcomings were felt in this regard, since no similar study was found to examine the challenges of using blockchain technology in international markets in Persian. Therefore, it was necessary to review and evaluate the research deficiencies in this field. The present study, under the supervision and advice of experts, is presented in table 1.

Table 1. Summary of some of the most important research in this field

Source code	Researchers	Findings
P1	Lee et al. (2021)	Privacy and security risks, information hazards, integration with new technologies, capital
P2	Jaradat et al. (2021)	Technology, Organization, Approval, Operational, Environmental Issues, Sustainability
P3	Nguyen et al. (2021)	Security issues, communication issues, economic issues, robbery issues, system delays
P4	Majeed et al. (2021)	Sustainability, Scalability, Delay Problems, Commuting Memory and High Performance Computational Storage, Empty Secure Economic Model, Privacy and Identity Problems, Problem Conventional Intelligent Contracts, Applied Factors
P5	Derindag et al. (2020)	Disruption in the International Industry, International Obstacles (Legal Issues, Regulatory, Policies), Evolution of National and International Laws, Distinction of Blockchain for Global Actors, Collaboration problems with users, undesirable performance, network and market
P6	Monrat et al. (2019)	Performance and scalability, privacy, energy consumption, cooperation, current setting problems, justice and security and regulatory issues, insights
P7	Aghayi, moslem. (2019)	Electronic data storage capacity, Blockchain invalidity, risks of electronic tools, Virtual currency validation, Digital Token Validation
P8	Tanwar et al. (2019)	Blockchain Challenges in the Future: Being Properly, Improving Infrastructure, More attention to privacy, lack of memory for storage, implementation, security, quantum resistance (using Quantum's illustration to enhance performance and security)
P9	Zheng et al. (2019)	Concerned about performance, concerns about security, performance issues, issues of mutual transactions, energy
P10	Gupta et al. (2019)	Scalability and poor performance in the use of large data, reducing delay, use a professional architecture and specialized design, infrastructure
P11	Liyanage et al. (2018)	Technology (privacy, security, correctness), legalization (usability, acceptance), exchanges
P12	Puthal et al. (2018)	Sustainability, high latency, energy consumption, fake block production, developers related problems
P13	Zheng et al. (2018)	Scalability (Blockchain storage optimization), privacy disclosure (mixing, lack of identification), personal and selfish use, communication
P14	Batubara et al. (2018)	Technology (privacy, scalability, ability to use, cooperation, assurance, flexibility, effectiveness, performance, general software platform, non-maturity, organizational (organizational readiness, acceptance, business model, trade rules, accordance, attention, attention consequently, the dangers of complexity), environmental (accessibility, support laws and regulations, support infrastructure)
P15	Savelyev. (2018)	Storage and digital content, Blockchain replacement, legal issues, network issues
P16	Ramachandran et al. (2018), G. S., & Krishnamachari, B	Limit resources, security, cost of transactions, changes in businesses, transaction volumes, physical interface weaknesses, software issues
P17	Khan & Salah. (2018)	Resource constraints, cooperation, security issues, software vulnerabilities and hardware, reliable updates and management issues, currency code issues

Source code	Researchers	Findings
P18	Deshpande et al. (2017)	The lack of clarity of terms and non-maturity of technology, disruption in existing practices, lack of transparency in the management of the technology, uncertainty about regulations, non-compliance implementation, security and privacy, ensure the integrity of data and strong encryption, the nature of the technology or high energy, lack of clarity in intelligent contracts, energy consumption
P19	Lin & Liao. (2017)	Majority attack, scalability, Blockchain data scheduling, current regulation problems, integrated cost problems, standards
P20	Asgari et al. (2018)	Newness and non-maturity of technology, the possibility of interacting with existing traditional systems and other similar systems, lack of awareness of people and activists, security and privacy, issues and problems in the field of laws, infrastructure and scalability, architecture and software development management, Protocols, applicability, potential value

Materials and Methods

This research has been done by mixed method. The qualitative part of the present study is an applied research in terms of purpose and an exploratory approach has been utilized in terms of data collection. Also, the method of Sandlowski and Barroso (2007) has been utilized to identify and examine the challenges of using blockchain technology in international markets. Hypertext research method is a method based on systematic review of library in order to gain a deep understanding of the phenomenon under study and it is a qualitative research method. With the growth of research in various fields of science and the scientific community facing an explosion of information, thinkers have come to the conclusion in practice that knowing and mastering all aspects of a field and being up-to-date in this field are not possible to a large extent. Combined research, which puts the essence of research on this particular subject in a systematic and scientific way for researchers, has become increasingly widespread. In fact, meta-synthesis is a qualitative study that uses information from findings of other studies on the subject. Therefore, meta-synthesis can be considered as a systematic study of previous researches and a kind of research about other researches (Sandelowski,2003). In the meta-synthesis method, the researcher combines the secondary data of the results of other studies to respond to the results of his study and obtains new results. In this study, the seven-step model of Sandlowski and Barroso (2007) is used to achieve the research goal. In the quantitative part of this research, the factors extracted from the qualitative stage of the research are ranked by pairwise comparison of the fuzzy analytical hierarchy method. In this step of the research, a pairwise comparison questionnaire was prepared for weighing each of the criteria and distributed among 12 related experts; then it was analyzed using analytical hierarchy research method and the weight of each criterion was obtained. One of the strengths of the analytical hierarchy process is the use of compatibility rates to evaluate the degree of reliability of pairwise comparison matrices. The compatibility rate is measured using the mathematical logic of special vectors. Obviously, since the decision maker makes pairwise comparisons of these factors, his comparisons may not be consistent at all. Therefore, the presence or absence

of compatibility is determined in comparisons by calculating the compatibility rate. In the compatibility criterion analysis, if this value is less than 0.1, the comparison table has acceptable compatibility; otherwise comparisons should be revised. Calculating the compatibility rate of group decision is done in steps (calculating the total weight vector, calculating the compatibility vector, calculating the specific value and calculating the compatibility index). The results of the analytical hierarchy research method can be seen in table 5. The mismatch rate in all pairwise comparison tables was obtained between 0 and 1, which indicates the reliability of the pairwise comparison matrices. Since no article on the specific subject and purpose of the research has been found in Persian so far, reviewing the articles published in the relevant reputable foreign scientific databases was the criterion.

Analysis of research data

The method in this study, namely the meta-synthesis method, was first proposed by Margaret Sandlowski and Julie Barso and includes research questions, systematic review of texts, search and selection of appropriate sources, extraction of source information, analysis, composition, quality control, and presenting the findings. Figure 1 shows these steps in order.

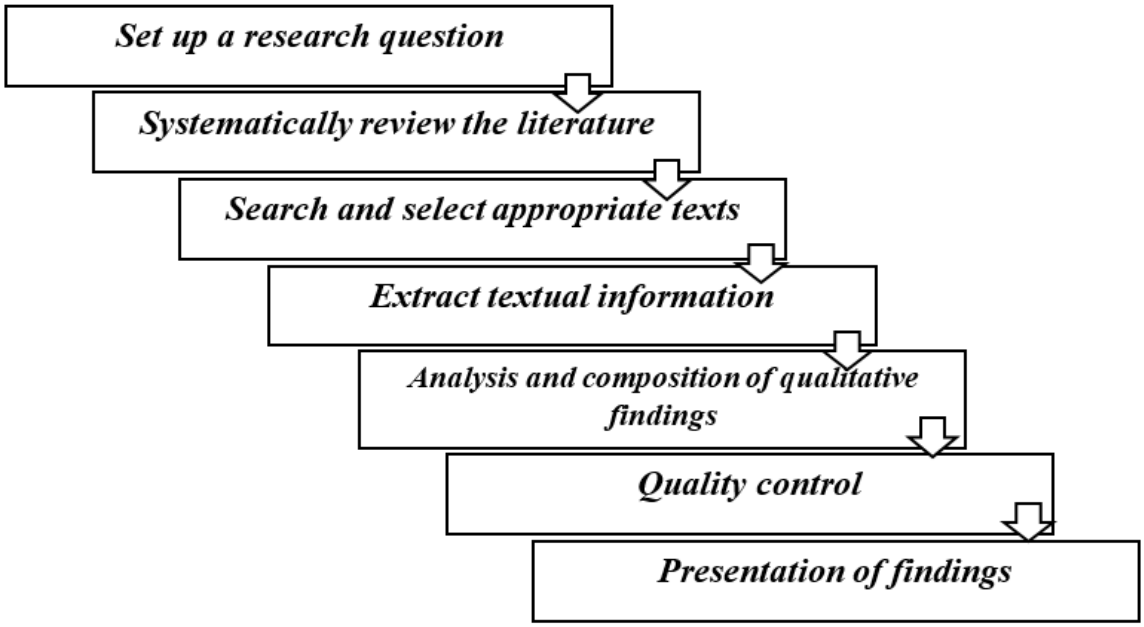

Figure 1. The seven stages of Meta-synthesis (Sandelowski, & Barroso, 2007)

Step 1: Setting up a research question

The most basic step in transcendence is setting up research questions. To set the research question, various parameters such as the study population, time limit and the way of using method. Considering the conditions prevailing in international markets, the question of the present study is: What are the challenges of using new technologies such as blockchain technology in international markets?

Step 2: Systematic literature

In this stage, the researcher systematically searches for articles published in valid foreign and domestic articles with the aim of determining valid, credible, and relevant documents in a timely manner. The present study is based on searching and reviewing valid scientific databases using the desired keywords, title, abstract and content in Persian sources during the period (2016-1400) and in Latin sources during the period (2017-2021). It was tried to use new and up-to-date resources.

Step 3: Searching and selecting appropriate articles

In this stage, different parameters such as title, abstract, content and details of the article are considered in each review by the researcher and articles that are not appropriate to the research question and purpose are removed. In the present study, the review process is summarized in figure 2.

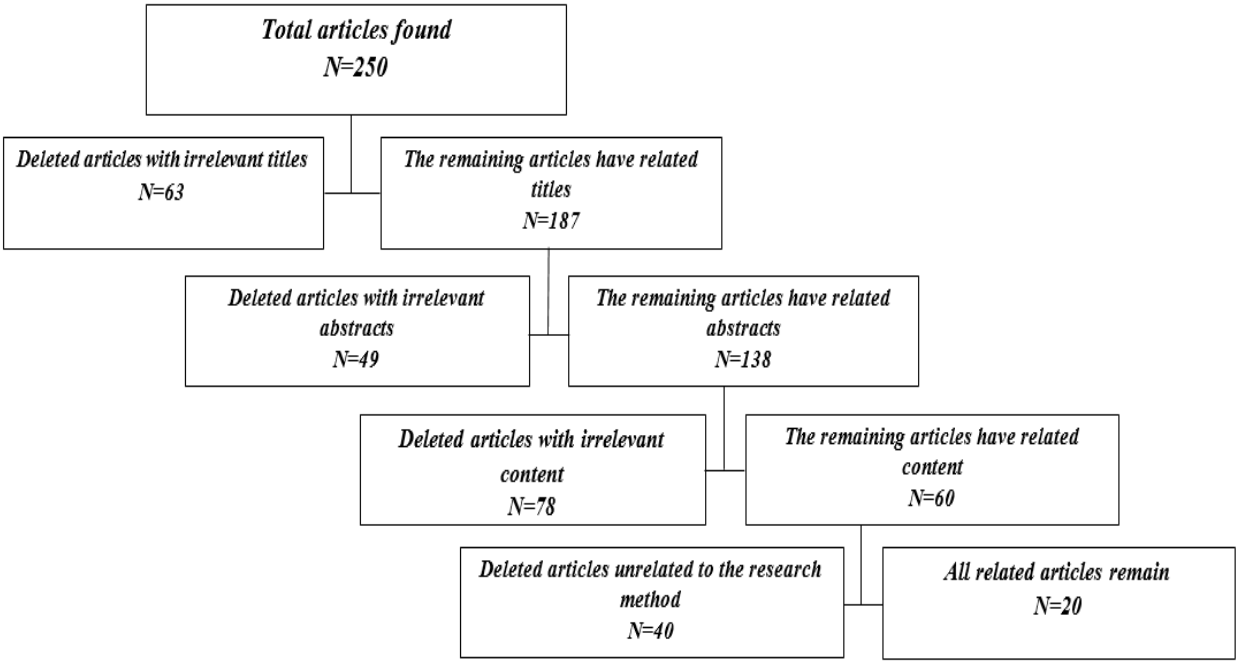

Figure 2. Index for selecting appropriate research articles

In this research, 250 internal and external articles which were related in title, abstract and content were extracted by the researcher. According to the studies, 63 articles were screened in terms of titles. After that, 49 articles were screened in terms of abstracts and 78 articles in terms of content, and 40 articles were screened and deleted due to not being relevant to the research method. Finally, the researcher obtained 20 general articles related to the present study.

Step 4: Extraction of Results

The researcher continuously studies the content of the articles and the basic indicators are extracted in order to meet the challenges of using blockchain technology in international markets. In the present study, important articles are given in table 1. This table summarizes the results of related screened articles. For better organization, each article was given a code called p1, p2. Each extracted indicator was used to refer to the source in the next meta-synthesis steps.

Step 5: Analyzing and integrating qualitative findings

In this stage, the researcher is looking for codes derived from the meta-synthesis process. For this reason, a code is considered for all factors extracted from problem-related sources, and then these codes are classified according to the sources from which they are extracted, as well as their frequency. This is a crucial step in the Sandlowski and Rousseau method. In this study, after extracting texts from selected articles, due to the synonymy of the words, the necessary overlap was made; so that 127 codes were identified and finally 41 codes or concepts were extracted.

Step 6: Quality control

To control the extracted concepts, the researcher's comparison with an expert is used. When two rankers rank the codes, the Kappa Cohen index is used to evaluate the degree of agreement between the two rankers. In this study, according to the calculations, the value of kappa index is equal to 0.723, which according to Cohen's table in the status of kappa index, this value is recognized in the valid category and as a result, the reliability of the model is confirmed. In the last step, the findings from the previous steps are presented. They were classified in a similar concept according to the study of the meanings of the codes. The obtained concepts were then aggregated and placed in more general categories. It should be noted that the researcher has used the relevant experts who were among the experienced activists in the field of blockchain to categorize the indicators, components, and areas.

Step 7: Presentation

In this study, 41 challenges are divided into 2 dimensions including internal and external field, 6 components including technical, educational, structural, market, legal and infrastructural challenges. Related experts have been used for these categories. The results can be seen in table 2.

Table 2. Grouping and classification of extracted indicators (Source: Research Findings)

The main dimension	Sub-dimension	Challenges	Reference
Internal area	Technical challenges	Privacy, security, latency problems, lack of comprehensive software, developer limitations, lack of standards, incomplete tools, exchanges with external databases, integration with new technologies, development of protocols	P1,P4,P3,P9 ,P8,P20,P16,P12 P19,P11,P14,P20,P11
	Educational Challenges	Energy Consumption Problems, Environmental Issues, Sustainability, Limited Executive Insight, Network Trust, Low Applicability, Improper Actions, Lack of Potential Value Information, Communication with Users, Perceived Immaturity, Applicability	P18,P12,P6,P20 P13,P5,P4,P6,P2 P9
	Structural challenge	Ecosystem development infrastructure, scalability, interactivity, complexity risks, change management	P10,P19,P13,P14, P20
Outer area	Market Challenges	Storage and transfer of assets, market fluctuations, high investment risk, cost issues, business change	P19,P16,P15,P5,P1 P8
	Infrastructure Challenge	Security and speed of electronic payments, number of users, lack of skilled developers, vulnerability of tokens and currency cryptocurrencies	P17,P8,P7,P9,P14 P20
	Legal Challenges	Ambiguous regulations, government interventions, hype, taxation and complaints, restrictive requirements, data rights	P18,P20,P19,P14 P15,P5,

According to the researcher, two areas are influential in creating challenges for the application of blockchain technology in international markets. Internal area that includes components such as technical challenges, educational challenges and structural challenges. Blockchain technology, which is a new type of internet network, is expected to provide a transparent and non-manipulative environment for storing data. The researcher's research shows that the high potential of blockchain technology for recording and distributing information and protecting digital traffic is undeniable, but this technology also faces many technical challenges, which are mentioned in table 2. The use of blockchain in international markets also experiences educational challenges, the lack of a full understanding of the basic capabilities of blockchain confuses people in examining the values of blockchain. Studies also show that the use of this technology in large organizations requires desirable structural changes.

Another influential area in the application of blockchain technology in international markets is the external area. Blockchain must be able to connect with thousands and possibly millions of users through related software and increase risk-taking for financing, manufacturing, and software innovation. There are also challenges in the legal field that need to be addressed and people associated with this technology will be confused and uncertain as long as there is no clear law. The deployment of blockchain technology also requires its own technology infrastructure as well as a dynamic ecosystem and several primary members for support.

What can be deduced from the extracted indicators is that all external and internal domains are involved and effective in the application of blockchain technology within the

ecosystems of international markets, but the degree of impact of each will be different, the importance of each will be determined in the following. However, it should be noted that not all of them alone can have a positive impact on the advancement of the intended goals. Accordingly, with the solution of technical, educational, structural, legal, market and infrastructure challenges, its impact on the knowledge and application of blockchain technology and ultimately on the comprehensive trade-economic growth of world markets will be evident and inevitable. Therefore, in the next step, the priority of each dimension, component and index are determined using pairwise comparisons of fuzzy analytical hierarchy method.

After finding the challenges affecting the application of blockchain technology in international markets by meta-synthesis method and the cooperation of related experienced experts, the researcher seeks to find the priorities of each index. As mentioned, at this stage, these challenges were ranked through fuzzy pairwise comparisons. In the first stage, the researcher obtained the results through the Fuzzy AHP questionnaire with the participation of 10 relevant experts, university professors, blockchain and cryptocurrency activists (table 3) and then the weight of each challenge was obtained in the latest version of the Expert Choice software environment. The following is a detailed description of pairwise comparisons.

Table 3. List of interviewees

Interviewee	Experience Years	Sex	Education
University professor	years۲۰	Man	P.H.D
University professor	years۱۵	Female	P.H.D
University Assistant Professor	years۱۰	Female	P.H.D
Active blockchain domain	years۱۰	Female	MA
Active blockchain domain	years۱۰	Man	MA
Active blockchain domain	years۱۵	Man	P.H.D
IT expert	years۲۰	Man	Masters
IT expert	years۲۰	Female	MA
software expert	years۲۰	Man	Masters
software expert	years۱۵	Man	MA

Ranking by fuzzy analytical hierarchy method

In the next step, the researcher prepared a pairwise comparison questionnaire to weigh each of the dimensions, components and indicators according to the participation of university

professors and blockchain activists in determining the indicators and it was distributed among 10 related experts. Then it was analyzed using analytical hierarchy process and the weight of each of the dimensions, components, and indicators was obtained. One of the strengths of the analytical hierarchy research method is the use of incompatibility rates to evaluate the degree of reliability of pairwise comparison matrices. The rate of incompatibility is measured using the mathematical logic of special vectors. Obviously, since the decision maker compares the pair of factors, his comparisons may not be consistent at all, so the presence or absence of consistency in the comparisons is determined by calculating the adjustment rate. In the compatibility criterion analysis, if this value is less than 0.1, the comparison table has acceptable compatibility, otherwise the comparisons should be revised.

Incompatibility rate

One of the most important features of the analytical hierarchy process is the possibility of examining the rate of decision consistency. By checking the consistency rate of the decision, the reliability of the answer obtained from the model is increased in order to ensure that the calculated weight is acceptable. The adjustment rate (C.R) is obtained from the ratio of the adjustment index (I.C) to the random incompatibility index (R.I) and is calculated through equations 1 and 2 (Song et al., 2014).

$$\boldsymbol{C}.R = \frac{C.I}{R.I} \qquad (۱)$$

$$\mathbf{C}.\mathbf{I} = \frac{\boldsymbol{\lambda}\mathbf{max}-\boldsymbol{n}}{\boldsymbol{n}-\mathbf{1}} \qquad (۲)$$

In this regard, □max□ is the largest eigenvalue of the matrix and n is the dimension of the matrix. The value of the Stochastic Incompatibility Index (RI) has been calculated by Song et al. (2014) for square matrices. To confirm the validity of the proposed survey, the compatibility rate (CR) must be less than 0.1 (Song et al., 2014: 83). In this study, the incompatibility rate of each index has been calculated. The calculated inconsistency rate was less than 0.1, which indicates the accuracy of the research.

Equation 3 is also used for ranking in the analytical hierarchy method, which is obtained based on absolute weight:

$$R_i = \sum_{j=1}^{N} t_{ij} w_j \qquad (3)$$

In this relation Ri is the absolute weight of strategy i, tij is the relative weight of strategy i relative to criterion i and Wj is the relative weight of criterion j. The results of the present study are shown in table 5. In this table, as can be seen, the final weight of components and indicators is calculated through Equation 3.

Table 5. Ranking and final weight of components and indicators

Final weight	Relative weight	Indicator	Final weight	Reltive weight	Component	The final weight of dimensions	Dimensions
۰,۰۱۹۸	۰,۱۲۳	Privacy	۰,۰۱۶۱	۰,۳۳۴	Technical challenges	۰,۴۸۵	Internal area
۰,۰۱۹۶	۰,۱۲۲	Security					
۰,۰۱۹۴	۰,۱۲۱	Delay problems					
۰,۰۱۱۲	۰,۰۷۰	Lack of comprehensive software					
۰,۰۱۳۰	۰,۰۸۱	Developer restrictions					
۰,۰۱۴۴	۰,۰۹۰	Lack of standards					
۰,۰۱۷۷	۰,۱۱۰	Among the imperfect tools					
۰,۰۱۶۵	۰,۱۰۳	Exchanges with external databases					
۰,۰۱۲۸	۰,۰۸۰	Integration with new technologies					
۰,۰۱۶۱	۰,۱۰۰	Development of protocols					
۰,۰۳۳۵	۰,۲۰۷	Ecosystem development infrastructure	۰,۱۶۲	۰,۳۳۶	Structural challenge		
۰,۰۳۴۰	۰,۲۱۰	Scalability					
۰,۰۳۲۰	۰,۱۹۸	Interoperability					
۰,۰۳۱۷	۰,۱۹۶	Risks of complexity					
۰,۰۳۰۶	۰,۱۸۹	Change management					
۰,۰۱۵۶	۰,۰۹۸	Energy consumption problems	۰,۱۶۰	۰,۳۳۰	Educational Challenges		
۰,۰۱۵۵	۰,۰۹۷	environmental issues					
۰,۰۱۵۸	۰,۰۹۹	Stability					
۰,۰۱۳۲	۰,۰۸۳	Limited executive insights					
۰,۰۱۳۶	۰,۰۸۵	Trust the network					
۰,۰۱۳۱	۰,۰۸۲	Low functional factor					
۰,۰۱۳۹	۰,۰۸۷	Improper actions					
۰,۰۱۴۰	۰,۰۸۸	Lack of knowledge of potential value					
۰,۰۱۴۴	۰,۰۹۰	Communication with users					
۰,۰۱۵۳	۰,۰۹۶	Perceived immaturity					
۰,۰۱۵۲	۰,۰۹۵	Applicability					
۰,۰۳۳۱	۰,۱۹۶	Storage and transfer of assets	۰,۱۶۹	۰,۳۳۰	Market Challenges	۰,۵۱۵	Outer area
۰,۰۳۵۶	۰,۲۱۱	Market fluctuations					
۰,۰۳۴۶	۰,۲۰۵	High investment risk					
۰,۰۳۱۹	۰,۱۸۹	Changes in businesses					
۰,۰۳۳۶	۰,۱۹۹	Cost issues					
۰,۰۵۰۸	۰,۲۹۲	Security and speed of electronic payments	۰,۱۷۴	۰,۳۳۹	Infrastructure Challenge		
۰,۰۳۷۴	۰,۲۱۵	number of users					
۰,۰۴۸۵	۰,۲۷۹	Lack of skilled developers					
۰,۰۳۷۲	۰,۲۱۴	Vulnerability of tokens and cryptocurrencies					
۰,۰۳۰	۰,۱۷۹	Ambiguous rules	۰,۱۷۰	۰,۳۳۱	Legal Challenges		
۰,۰۳۱	۰,۱۸۵	Government interventions					
۰,۰۲۶	۰,۱۵۷	Hype					
۰,۰۲۳	۰,۱۳۹	Taxation and complaints					
۰,۰۲۹	۰,۱۷۲	Restrictive requirements					
۰,۰۲۸	۰,۱۶۵	Data rights					

Results

As mentioned, the degree of importance of the criteria was determined using the fuzzy analytical hierarchy research method, which is based on pairwise comparison of criteria. Based on the results obtained in this stage of the research, the outer sphere dimension was recognized as the most important dimension among the dimensions. Among the components of the external sphere, the components of infrastructure challenges, legal challenges and market challenges have the highest priority, respectively, among the components of the internal sphere, the component of structural challenges, technical challenges and educational challenges have the highest priority, respectively. Also, among the indicators of the external field, the security and electronic payment speed index has the highest rank. It seems that in order to meet this challenge, governments and organizations need to improve the infrastructure related to the security and speed of electronic payments in international markets in order to provide a suitable and favorable platform for such payments and the use of blockchain technology. In the field of intra-organizational, the scalability index has the highest rank. To solve this challenge, developers must always help develop with new designs aimed at solving the problem of scalability.

Discussion and conclusion

The achievements of macro-manufacturing, the creation of inter-industry metadata, as well as the elimination of fraud, are stunning benefits which are possible by the unprecedented synergy owed to blockchain technology and its platforms. Brought Blockchain, like a new Silk Road, will potentially accelerate the development of international markets globally. However, one should not ignore the possible obstacles and challenges of using it. The key obstacle for using blockchain is their compatibility and dependence on traditional systems in the markets. Blockchain technology requires to be agile and changeable. The challenge of using this technology will become even more complex as markets begin to change the way they use blockchain. Due to this, it was necessary to conduct this research. This study examines the main challenges and procedures related to the use of blockchain technology for digital innovation in international markets from the perspective of researchers in this field. The present research in terms of research method and in terms of the scope of application of the subject with other recent research in this field can be considered as one of its advantages.

Research results of many researchers in recent years, including Majid et al. (2021), Lee et al. (2020), Monrat et al. (2019), Tenor et al. (2019), Lianage et al. (2018), Batobara et al. 2018) and Lin and Liao (2017) confirm the findings of this study in identifying the most important challenges of using blockchain technology with the current achievements of digital technology, however, identifying the most important indicators of blockchain technology in the field of financial and commercial activity in worldwide are among the differences between the present study and other studies. Legal challenges, for example, have been cited in most

research as the most serious challenge in order to implement blockchain technology in financial markets. Another important point is that from the perspective of experts, considering the hardware resources, technical and educational challenges as a challenge equal to other challenges and risks observed, taking into account the fluctuations and variables affecting international markets should be considered.

According to the results, a range of challenges places in the development of blockchain technology and the other parts place in the acceptance of the application and the popularity of its application community, although many challenges may still be unknown due to the newfound of this technology. Five criteria of privacy, security, scalability, sustainability and ability to integrate with other technologies can be mentioned among the most important challenges facing the development of blockchain technology in international markets. The highest level of privacy can be provided by investigating cryptographic algorithms, using end-to-end encryption protocols, asymmetric key systems and hash functions. Blockchain could also be a potential alternative to centralized, cloud-based storage. The key mechanism for achieving this capability is called sharding, which means splitting something into pieces. For example, information (documents, contracts, reports, etc.) stored in the Sharder Network is encrypted and shared. In other words, it is divided into several small sections. This information is then distributed to various storage nodes around the world. In addition to storing information, the blockchain has the ability to verify information and identify changes made to it. Blockchain technology uses digital fingerprint or hash of a file to authenticate it. In this way, the information owner can maintain full access and ownership of the information, and no one can access to the information without permission. This feature will provide a high level of security in the network. Blockchain capabilities to enhance data storage security, as well as its validity and immutability, create countless business opportunities for almost all industries and businesses.

Another challenge facing the development and application of this technology is scalability. Scalability in blockchain can be considered as the ability of a network to respond to demand. Scalability includes parameters such as the number of transactions per second (TPS), the volume required to store the blockchain network, and the speed of transmission of network information. Nowadays, the challenge of scalability has been reduced to some extent by using Lightening Network, increasing the volume of blocks, increasing extraction rewards, and using other methods of decentralized consensus such as stock proof (PoS) or Block Lattice technology.

Another challenge is the ability of blockchain to integrate business advantages in international markets with other technologies such as artificial intelligence, the Internet of Things, big data, cloud computing, virtual reality, robotics and nanotechnology. The development and evolution of tools and standards, the use of secure and hacked quantum internet on the basis of Li-Fi (Light Fidelity) communication network can be effective in the convergence of these technologies and create value in the economic chain.

The economic justification of producing blocks using clean or renewable energy is likely to increase the demand for renewable power plant equipment, and finally reduce energy costs by the scale and increasing investment in equipment production. It will reduce challenging in energy consumption the dangers in environmental issues.

One of the challenges of the blockchain and cryptocurrency companies is the lack of specialized personnel. In fact, one of the most difficult tasks in the blockchain industry and the currency code is attracting skilled technical personnel. Implementing joint research projects between universities and scientific centers and such companies can certainly be very efficient.

The challenges of accepting employment, which have a significant impact on financial and commercial markets, high investment risk, vague regulations, and government intervention can be mentioned. There is a need for risk-taking to finance, generate and accelerate innovations in blockchain application software. Among these, the role of financial and economic experts in reducing the risks of market fluctuations, using financial instruments in this field, recognizing investment opportunities and supporting and financing small and medium-sized businesses are especially important. On the other hand, any regulations that impede the effectiveness of information flow jeopardize an important part of the information, operational and allocation efficiency of the market. Elimination of redundant regulations and international agreements are mandatory in this regard. Within the body of governments, there are many obstacles in the way of compatibility with the blockchain. It should be noted that data security, privacy and lack of regulations are the most prominent focal points of governments. At the same time, the current high level of suspicion and uncertainty is another reason that slows down their adaptation, but the focus on regulation, security, and public resistance has shifted from the past. Despite all the obstacles and challenges that each uniquely stand in the way of this technology, we continue to see our industries challenging themselves to innovate. Blockchain has the potential to transform international markets, both explicit and implicit, as well as invisible.

Future research directions

Considering Bitcoin as a derivative of blockchain technology, it has the largest market share and more people are trading and buying bitcoins on a daily basis. It is very likely that Bitcoin will be one of the future research topics in industry and university that encourage further commercial and technical research. However, future research is likely to focus not only on Bitcoin and other cryptocurrencies, but also on other active applications based on Black China. Most current blockchain technology research focuses on security and privacy issues. For widespread use of blockchain technology, scalability issues such as performance and opacity must be considered. Blockchain-based applications must be developed beyond Bitcoin and other cryptographic systems. Current research focuses on the bitcoin system,

while blockchain technology can be used for other solutions such as smart contracts, asset licensing, voting, and more. The effectiveness of the proposed solutions to solve the blockchain challenges should be evaluated with objective evaluation criteria. Few studies have done this so far (Yli-Huumo,2016).

In order to use blockchain technology in international markets, it is suggested that the government of each country develops the infrastructure for the use of this technology by each company and organization because resistance to change is a failure.

The first step in applying blockchain technology in international markets is to improve and modernize the infrastructure. Therefore, to use this technology, it is suggested that organizations and companies take the first step in the best possible way to eliminate the infrastructure problems and clear the way forward to grow and develop their organization.

International business development is a very important decision for countries, especially third world countries, which has become more important than ever with the advancement of technology. One of the major changes in today's societies is the expansion of the use of blockchain technology. It is suggested that managers recognize the opportunities available in international markets and use access to these markets as a tool for greater competitiveness and development of their international business in international markets.

In this research, the challenges of the external field are known as more important ones, but it is suggested to the relevant organizations and companies not to ignore the challenges of the internal field because eliminating the technical challenges that form the basis of communication promotes more desirable goals in this field and in international markets. Also, to make better use of blockchain technology, every organization or company must learn how to implement this technology properly. Due to this issue, it is suggested that trainings should be created through managers and companies for managers and employees to provide a new opportunity for people to take advantage of the use of this technology in international markets.

In order to further analyze about the challenges facing the use of blockchain technology in international markets, it is suggested that this research should be implemented in other financial and commercial ecosystems to compare the results and exploring the feasibility and discovering other challenges in these ecosystems should be analyzed too.

Therefore, considering the challenges identified in the application of this emerging technology and the growing trend of its application in various industries, there are extensive fields and study opportunities for those interested in this field, and the achievements of these studies can play an important role in facilitating effective application and management. Some of these fields of study include: examining the role of blockchain in the field of international payments in emerging markets, the role of blockchain in the global economy and e-commerce, threats and opportunities for the use and development of this technology, studying the impact of blockchain on decentralization economics, providing legal solutions for the use

of blockchain technology, assessing the level of maturity of blockchain technology in international markets and examining the consequences of using cryptocurrencies in financial markets.

Research Limitations

Since doing any research work is associated with several limitations, so this research is no exception and there have been direct and indirect limitations in the research process. On the one hand, the present study has been conducted in the current technological conditions, so the generalization of its results to other times should be done with caution. On the other hand, the lack of relevant domestic research in this field caused the researcher to seek for the benefit from foreign research and its maximum use. Due to the novelty of the blockchain debate, there is a diffusion bias even in existing studies. This means that in a limited number of studies and in new subjects, the probability of publishing positive results is higher than negative results. To solve this problem, several well-known scientific databases were uses in the search protocol to find articles. This somewhat increased the likelihood of finding articles with negative results. On the other hand, according to the conditions of our country the generalizability of the results of foreign studies is not clear.

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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