The Journal of Muamalat and Islamic Finance Research
ISSN: 1823-075X e-ISSN: 2948-5266
Vol. 21, No. 1, June 2024, Pp. 101-126
DOI: https://doi.org/10.33102/jmifr.576

UNIVERSITI SAINS ISLAM MALAYSIA
جَامِعَة العُلُوم الإسْلَامِيَة المَالِيزِيَة
ISLAMIC SCIENCE UNIVERSITY OF MALAYSIA

Article

Mapping Blockchain Adoption Challenges: A Bibliometric Analysis

Naharudin Saadan*[1], Khairil Faizal Khairi[2], Azuan Ahmad[3], Agoos Munalis Tahir[2]

[1]Accountant General's Department of Malaysia (AGD), Level 1-8, Ministry of Finance Complex, No. 1, Persiaran Perdana, Precinct 2, 62594 Putrajaya.
[2]Faculty of Economics and Muamalat, Universiti Sains Islam Malaysia, 71800 Nilai, Negeri Sembilan, Malaysia.
[3]Faculty of Science and Technology, Universiti Sains Islam Malaysia, 71800 Nilai, Negeri Sembilan, Malaysia.

ABSTRACT - The evolution of the Internet has shifted from centralised to decentralised systems, particularly after the financial crisis in 2008. The Internet disrupts traditional financial systems and the consequent shift towards Blockchain Technology (BCT) for more transparent and accountable business practices. It outlines BCT's origins and transformative potential in various domains. Thus, this study aims to investigate challenges in BCT adoption in various domains. This study adopted a bibliometric analysis based on the data obtained from the Scopus database. Based on the keywords used, which are related to BCT adoption in the article title, the study obtains 229 documents for further analysis. Various tools have been employed, such as Microsoft Excel to conduct the frequency analysis and VOSviewer for data visualisation analysis. This study reports the results using standard bibliometric indicators such as publication year, document type, source type, source title, languages, subject area, keywords analysis, geographical distribution, authorship, active institutions, and citation analysis. The analysis reveals that studies on BCT integration with the Internet of Things (IoT) suggest the highest cites followed by BCT adoption challenges. Since 2021, there has been a rapid accumulation of citations, highlighting the ongoing relevance and interest in BCT across diverse fields. Indonesia leads in academic contributions to BCT, while the United States excels in citation impact. Notably, China, Australia, Jordan, and Malaysia are interested in adopting BCT in Asia. In Europe, the United Kingdom stands out alongside Romania and Belgium for their commitment to the study as well. Prominent authors and keywords highlight BCT's integration with IoT and supply chain. Findings underscore global academic engagement with BCT challenges and applications, offering a foundation for future research on practical hurdles, regulations, and technological intersections. Blockchain is just one of many IR4.0 technologies that will enhance governance when coupled with Artificial Intelligence (AI) and Big Data Analytics. Future research should focus deeper on practical challenges, regulations, and intersections of BCT with other technologies, building upon the findings of this analysis.

ARTICLE HISTORY

Received: 26th Mar 2024
Revised: 01st Apr 2024
Accepted: 05th Apr 2024
Published: 01st June 2024

KEYWORDS

Blockchain Technology (BCT), Decentralised Systems, Bibliometric Analysis, BCT Adoption Challenges, Scopus Database

INTRODUCTION

The Internet has altered how individuals in society interact with each other (Bonsón & Bednárová, 2019). It is anticipated to evolve continuously alongside the new technologies that potentially cause disruptions to current business practices (Parker, 2019). Previously, financial transactions from

*CORRESPONDING AUTHOR | Naharudin Saadan | nahar.saadan@anm.gov.my

banking or financial institutions, such as the transfer of money, required third-party or central authority involvement (Şeyma Alkan et al., 2021). Note that a central authority is vital in validating and verifying transactions and becoming a source of truth (Şeyma Alkan et al., 2021). Nevertheless, this approach has risks, as it renders the system susceptible to hacking, phishing, and corruption when a centralised database becomes the target of online attacks (e.g., cyber-attacks) or offline manipulation (e.g., centralised manipulation) (Bonsón & Bednárová, 2019; Tan & Low, 2019).

The financial market crash in 2008 indicated weaknesses in the centralised monetary system (Mia, 2021). People began questioning whether the government or central authority had lost control over financial market regulation, leading to concerns about uncontrolled money printing without proper oversight (Mia, 2021). The author further noted that the centralised financial system had granted banks or other financial institutions excessive power to determine and manipulate economic activity (Mia, 2021). Thus, the lack of trust in centralised models has demanded a shift towards a decentralised financial model through Blockchain Technology (BCT) (Mia, 2021). Recently, BCT capabilities become apparent and offer a potential avenue for addressing prevalent concerns, encompassing aspects such as transparency, the integrity of data, and establishing accountability (Sicilia & Visvizi, 2019).

The core concept of blockchain

Initially, BCT was designed to facilitate Bitcoin operations. However, witnessing its successful stories in Bitcoin, scholars and professionals now acknowledge the potential of employing BCT across diverse domains. BCT is one of the emerging technologies experiencing exponential growth and gaining widespread recognition globally (Parker, 2019). In the white paper titled "Bitcoin: A Peer-to-Peer Electronic Cash System," BCT was introduced as a mechanism to facilitate the implementation of the Bitcoin cryptocurrency (Kitsantas & Chytis, 2022). Moreover, BCT was used to validate the ownership of the virtual currency without third-party involvement (Mounia & Nadjat, 2022; Şeyma Alkan et al., 2021; Tan & Low, 2019; Yermack, 2017). Antova et al. (2020) contended that the decentralised model within BCT had unlocked fresh possibilities for businesses to perform transactions and formalise digital agreements.

BCT is built upon a set of concepts that instil uniqueness and capabilities. These concepts have revolutionised traditional business practices, particularly regarding record-keeping and transaction verification, introducing elevated levels of security, transparency, and decentralisation. Other than that, it appreciates its attributes of transparency, immutability, and cryptography, as well as its compatibility with emerging technologies such as the Internet of Things (IoT), Artificial Intelligence (AI), and BCT. These hold potential benefits for Chief Financial Officers (CFOs) and align with the demands of Industry 4.0 (Sandner et al., 2020). According to Abu Afifa et al. (2023) and Bonsón and Bednárová (2019), with its features of decentralisation and transparency, BCT undoubtedly possesses the capacity to enhance information and accounting quality.

Despite the commendable attributes encompassed by BCT, such as its security, resiliency, and transparency, Sarwar et al. (2021) argued that BCT cannot be regarded as an explicit panacea for tackling multifaceted challenges like fraud, risks, and criminal issues. Substantive and further investigation remains imperative within these domains. From an applications standpoint, BCT's traits – decentralisation, non-tampering, trace retention, traceability, collective upkeep, openness, and transparency – establish its platform's credibility and trustworthiness (Xiaoguang et al., 2021). According to Abu Afifa et al. (2023), the rise of emerging technologies is predicted to usher in more intricate transactions. Moreover, cross-border transactions necessitate concerted endeavours from involved parties to establish trust, transparency, and information sharing. BCT presents a probable solution to address these challenges.

Nevertheless, regarding the trustworthiness of transactional decisions, trust remains a pivotal element within a BCT environment (Gaggioli et al., 2019). BCT enables trust-less transactions through peer-to-peer networks and cryptography. Note that the adoption of BCT could eliminate the need for third-party intermediaries. Through consensus-based algorithms, data

can be stored and exchanged peer-to-peer (Bonyuet, 2020; Samaduzzaman, 2020). At the same time, Şeyma Alkan et al. (2021) mentioned that granting multiple parties simultaneous access to the same ledger enhances transparency and trust. Han et al. (2023) suggested that integrating BCT with AI, IoT, and cloud computing enhances trust and resilience.

Alternatively, Efanov and Roschin (2018) contended that BCT's peer-to-peer network and online cryptography offer solutions for transparency and trust issues in centralised authorisation. As an abuse-resistant, shared ledger, BCT secures entries via community consensus, fostering trust by eliminating compromise requirements (Şeyma Alkan et al., 2021). However, in promoting BCT adoption among stakeholders, Gaggioli et al. (2019) discovered that trust emerges as a primary concern, giving rise to psychological challenges alongside technological benefits. This results from BCT replacing the trust mechanism formerly held by central authorities with a decentralised network.

The blockchain application

Service providers and manufacturers assert that BCT is a future technology that could benefit businesses (Mathivathanan et al., 2021). The success story of Bitcoin has positioned BCT as a promising technology with the potential to disrupt many sectors (Kosmarski, 2020). However, Eyassu (2019) argued that the effectiveness of BCT can only be observed when it is adopted alongside other technologies. The author added that since 2017, BCT adoption has expanded beyond crypto-based platforms. Sectors such as banking, retail, Supply Chain Management (SCM), healthcare, and public administration have accelerated the incorporation of BCT into their processes (Eyassu, 2019).

The World Economic Trajectory forecasts that trade from BCT is expected to surpass 1 trillion USD in the next ten years (Ganne, 2018). According to Gartner (2019), BCT was identified as one of the 10 Strategic Technology Trends in 2019 and has the potential to transform society. Nevertheless, despite the hype surrounding BCT's potential, its implementation is still low, at around ten per cent (Caldarelli et al. 2021). For instance, shipping and transportation are critical sectors prone to inefficiency due to the complexity of their processes (Tan & Sundarakani, 2021). Therefore, BCT adoption could be a solution. Nevertheless, Balci and Surucu-Balci (2021) observed a scarcity of BCT adoption in global shipping industries, even though the prospects and potential of BCT in this domain have been positively highlighted.

In other views, Mathivathanan et al. (2021) expressed doubts about the effectiveness of BCT adoption in transforming supply chain activities. Meanwhile, individuals are still attempting to grasp the concept of BCT and explore its adoption in various domains (Mathivathanan et al., 2021). Yadlapalli et al. (2022) discovered that BCT could replace existing systems in certain use cases. Nonetheless, a significant portion of BCT adoption still builds upon these existing structures. For example, in the case of Enterprise Resources Planning (ERP) systems, BCT adoption requires the legacy system (Tan & Sundarakani, 2021). This underscores the point that dependency on existing systems can result in additional integration costs when adopting BCT (Tan & Sundarakani, 2021). In the construction industry, BCT can enhance the supply chain by improving traceability and facilitating information sharing in precast-construction supply chains (Singh et al., 2023). However, due to its limited adoption in this sector, the business value derived from BCT is relatively minor compared to other supply chains (Singh et al., 2023).

Based on previous studies, there needs to be more real-world use cases for BCT adoption (Ietto et al., 2023). This study aims to identify the challenges and barriers businesses face that hinder their adoption, presenting the trend of the previous study on BCT adoption challenges and mapping it with the development trend of the field. In contrast, most previous literature focuses on BCT adoption challenges in the specific domain. Nevertheless, this study contributes to a more systematic and updated analysis to better understand the landscape of BCT adoption challenges, which is not restricted to the specific domain. Therefore, this study will try to address the following research question:

RQ1: What is the latest trend of research publications on Blockchain Technology (BCT) adoption challenges?
RQ2: Which countries contribute significant studies on Blockchain Technology (BCT) adoption challenges?
RQ3: Who are the authors actively studying Blockchain Technology (BCT) adoption challenges?
RQ4: What are the most influential publications on Blockchain Technology (BCT) adoption challenges?
RQ5: What are the main keywords of scientific research on Blockchain Technology (BCT) adoption challenges?

The remainder of this paper is organised as follows. First, this study offers a literature review that provides an overview of bibliometric analysis, the overview of BCT, encompassing its definition, evolution, potential, and the typical challenges encountered by entities during its adoption. Next, this study delves into a bibliometric analysis, examining prior studies on BCT adoption challenges. Subsequently, an explanation of the methodologies employed in this research will be provided. The ensuing 'Analysis and Findings' section presents results from documents from the Scopus database. The paper concludes with a summary of our findings, the study's limitations, and recommendations for future research.

LITERATURE REVIEW

Bibliometrics is a quantitative approach designed to evaluate scientific research based on publications (Ahmi et al., 2020). They further elaborate that the underlying assumption of a bibliometric study rests on the premise that scientific discoveries and research findings are eventually published internationally, making them accessible to be read and cited by others. Conversely, Al-Ashmori et al. (2022) regarded bibliometrics as an innovative approach to research. The analysis seamlessly integrates mathematical and graphical methods and other visualisation techniques to depict a discipline's foundational structure, historical development, key focus areas, and overall knowledge framework. This is achieved through techniques such as citation analyses and co-occurrence analysis, to name a few.

Alternatively, Rejeb et al. (2021) noted that the research gaps can be explored using bibliometric analysis. For instance, the power of text mining can provide insights into the current state of research on a specific topic. Bibliometric analysis is distinct from conventional and systematic reviews in that it can address the limited coverage often discovered in literature reviews. In their review of bibliometric analysis, Ahmi et al. (2020) categorised the indicator into three distinct groups: quantity, quality, and structural. Quantity indicators refer to the productivity in the publication of a specific researcher. Meanwhile, the quality indicators refer to the performance of a researcher based on their output. Lastly, structural indicators highlight the relationship between authors, publications, and research areas.

Ahmi et al. (2020) further elaborated, stating that through bibliometric analysis, the performance of a publication can also be assessed using metrics such as the citation number received per year, total h-index or g-index, cite scoring, and other various matrices. Notably, various tools are available for bibliometric analysis for a more streamlined analysis process. These include Ms Excel, Vosviewer, Biblioshiny, 'Publish or Perish,' and others.

Previous studies

Bibliometric analysis studies on BCT adoption have gained attention in the academic landscape. Musigmann et al. (2020) and Rejeb et al. (2021) undertook wide-ranging analyses in the realm of logistics, supply chain, and transport. Their studies employed various databases like Scopus, Web

of Science, Google Scholar, and many others. Their studies evaluated the influential papers, research clusters, and trends of BCT research in logistics and SCM. On a specialised domain, Darabseh and Martins (2020) focused on the intersection of BCT and construction. They utilised databases like Scopus and Web of Science to enrich the existing body of literature and assess research trends. In the broader management area, Tandon et al. (2021) explored the applications of BCT, exploring research contexts and highlighting potential future themes.

In the healthcare domain, the intersection studies with BCT were assessed by Rejeb et al. (2021). The study emphasised advancing BCT research and identifying new pathways in the healthcare sector. Similarly, Zhou and Liu (2022) concentrated on the dynamic field of cross-border e-commerce and SCM, striving for the progress trend of BCT in this area. At the same time, Al-Ashmori et al. (2022) conducted a multifaceted approach by examining technological, organisational, and environmental factors of BCT adoption. Their studies scrutinised several elements like publication maps, associated countries, organisations, and authors, aiming for a holistic view. On the other hand, Shoaib et al. (2023) further investigated another dimension. Their study focused on supply chain aspects, analysing research hotspots, influential entities, dominant themes, and methodologies in the literature. Finally, the niche study on marketing was conducted by Wasiq et al. (2023). Their studies explored the relationship between BCT and marketing. Their research provided insights into the current state of BCT application in marketing, emerging trends, and potential avenues for future investigation.

Table 1: Summary of previous studies

Authors	Searching Strategy	Data Source & Database	TDE	Bibliometric Attributes Examined
Musigmann et al. (2020)	1. supply chain OR logistics OR transport AND blockchain; 2. supply chain OR logistics OR transport AND block chain; 3. supply chain OR logistics OR transport AND distributed ledger technology.	1. Scopus 2. Google Scholar 3. Web of Science 4. Springer 5. IEEE Xplore 6. Science Direct 7. SSRN 8. Taylor & Francis 9. EBSCO 10. Emerald Insight	613	1. Influential papers in terms of popularity and prestige in the field of BCT in LSCM 2. Existing clusters of current research within BCT in LSCM
Darabseh and Martins (2020)	Blockchain AND construction	1. Scopus 2. Web of knowledge	40	1. To contribute to the available body of literature 2. To assess the existing literature and research trends using bibliometrics
Tandon et al. (2021)	"blockchain or ethereum" OR "blockchain or distributed ledger technology" OR "blockchain or smart contracts"	Scopus	586	1. The present status of the research on blockchain applications in the management sector and its related sectors 2. Research contexts and themes in this domain have been explored in the existing literature 3. Avenues or themes can be addressed in future research

Authors	Searching Strategy	Data Source & Database	TDE	Bibliometric Attributes Examined
Treiblmaier et al. (2021)	ABS ((blockchain AND (health* OR medic* OR biomedic* OR clinic* OR doctor* OR pharmaceutical* OR illness* OR nursing OR physician* OR hospital* OR biotechnology OR diagnos* OR insurance* OR wellness OR patient* OR therapy OR disease* OR disabilit* OR treatment OR "life expectancy" OR prescription* OR surger*))	Web of Science	626	The undertaking of the present study can advance BC research, promote further ap- plications, and illuminate new directions for future BC knowledge dissemination in the healthcare sector
Rejeb et al. (2021)	("blockchain*") AND ("supply chain*" OR "logistic*")	1. Scopus 2. Web of Science	628	1. Blockchain research within logistics and SCM has progressed since its emergence 2. Countries/regions contribute most to the formation of a geographic atlas of blockchain research in logistics and SCM 3. Scholars and studies are most impactful in the blockchain logistics and SCM field 4. The thematic trends of blockchain research in logistics and SCM 5. The key research discussions and hotspots in the literature
Saif et al. (2022)	ALL (blockchain AND implementation AND challenges AND in AND developing AND country) AND PUBYEAR>2015 AND PUBYEAR<2022	1. Scopus 2. Web of Science 3. IEEE Xplore 4. ScienceDirect	1,298	Topic: the authors reviewed the existing literature related to the topic to find out the challenges in a broader context
Zhou and Liu, (2022)	"blockchain," "cross-border e-commerce," and "supply chain management"	Web of Science	19,062	To disclose the development trend of BCT and its application in cross-border e-commerce SCM

Authors	Searching Strategy	Data Source & Database	TDE	Bibliometric Attributes Examined
AL-Ashmori et al. (2023)	TECHNOLOGICAL FACTOR ("BLOCKCHAIN ADOPTION" OR (TAM OR UTAUT OR DOI OR TR OR TBP OR TOE OR "TECHNOLOGICAL FACTORS")) ORGANISATIONAL FACTORS ("BLOCKCHAIN ADOPTION" OR (TAM OR UTAUT OR DOI OR TR OR TBP OR TOE OR "TECHNOLOGICAL FACTORS" OR "ORGANI?ATIONAL FACTORS")) ENVIRONMENTAL FACTORS ("BLOCKCHAIN ADOPTION" OR (TAM OR UTAUT OR DOI OR TR OR TBP OR TOE OR "TECHNOLOGICAL FACTORS" OR "ORGANISATIONAL FACTORS" OR "ENVIRONMENTAL FACTORS")) BLOCKCHAIN ("BLOCKCHAIN ADOPTION" OR (BLOCKCHAIN AND (TAM OR UTAUT OR DOI OR TR OR TBP OR TOE OR "TECHNOLOGICAL FACTORS" OR "ORGANI?ATIONAL FACTORS" OR "ENVIRONMENTAL FACTORS")))	Web of Science	107	1. The number of publications per year on Blockchain adoption 2. The publication map theme of Blockchain adoption 3. Countries most frequently associated with Blockchain adoption 4. Organisations most frequently associated with Blockchain adoption 5. Individual authors are most frequently associated with Blockchain adoption 6. Articles most frequently cited in Blockchain adoption publications 7. Summaries of related Blockchain adoption studies with relation to countries, industries, theories, methods, respondent sample sizes, and the number of factors included in each study 8. Identification of the top 18 most used adoption factors that appeared at least in five studies

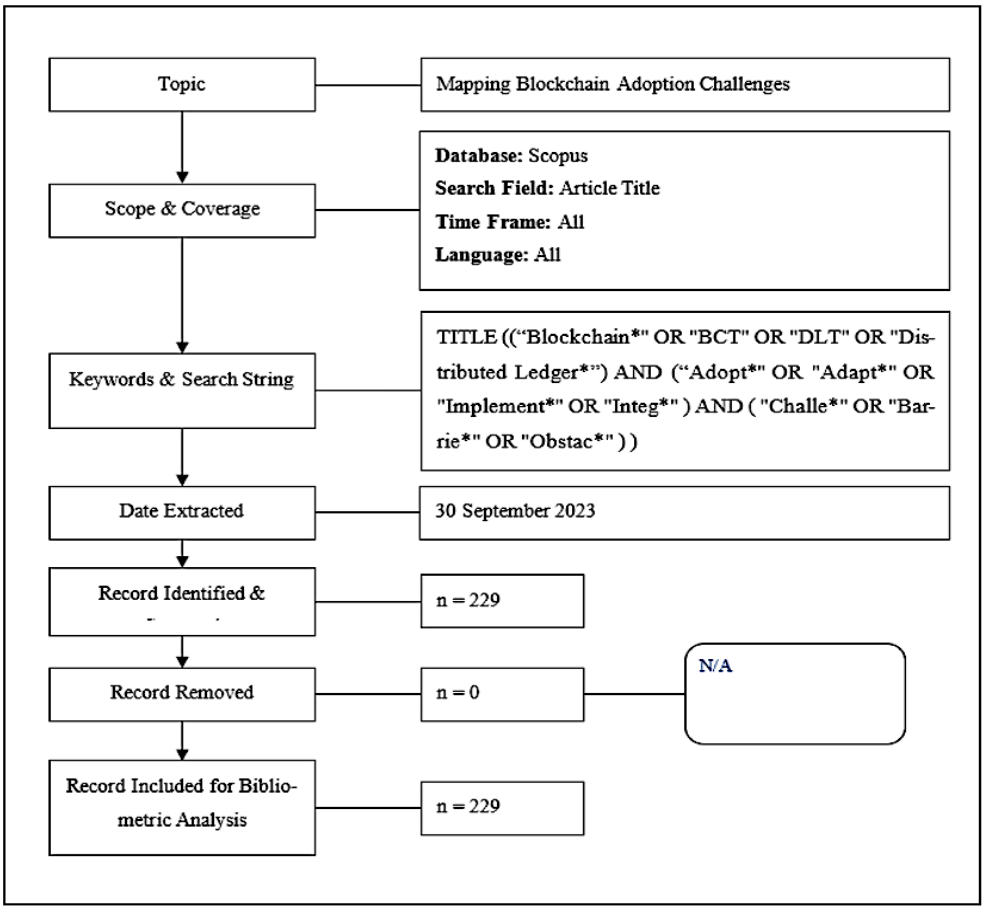
Authors	Searching Strategy	Data Source & Database	TDE	Bibliometric Attributes Examined
Shoaib et al. (2023)	("blockchain" OR "Ethereum" OR "Hyperledger Fabric") AND ("Supply chain" OR "transport" OR "logistics" OR "cross-border trade")	1. Scopus 2. Web of Science	431	1. The research hotspots in the existing literature on blockchain-based supply chains 2. The most influential countries, articles, authors, and journals related to the blockchain-based supply chain 3. The dominant themes and trends on the site of blockchain-based supply chain research 4. Critical methodologies and dynamic industries were discussed in blockchain-based supply chain literature 5. The research gaps and future agendas in light of the blockchain-based supply chain
Wasiq et al. (2023)	TIT-ABS-KEY (("Blockchain" AND "Marketing") OR ("Blockchain" AND "Digital Marketing") OR ("Blockchain Technology" AND "Marketing") OR ("Distributed Ledger" AND "Marketing") OR ("Digital Ledger" AND "Marketing") OR ("Public Transaction Ledger" AND "Marketing") OR ("Public Transaction Ledger" AND "Retail Marketing") OR ("Cryptographic Ledger" AND "Marketing") OR ("Ledger" AND "Digital Marketing")	Scopus	161	1. The current state of research in the application of BCT in marketing 2. Intellectual structure, i.e., emerging trends in the adoption and application of blockchain in marketing 3. The probable areas of future research in this field

TDE=Total documents examined

These bibliometric studies present a multifaceted view of how BCT adoption has been approached, studied, and evaluated across diverse domains. The previous study indicates a notable gap in the realm of bibliometric studies focusing on BCT adoption challenges. Note that various studies have been conducted on specific domains. However, a comprehensive mapping, especially on the Scopus database, which addresses BCT adoption challenges across a broader spectrum, remains to be seen. This observed deficiency in the literature underscores the importance of addressing this area and provides a compelling motivation for the present study. Hence, the endeavour to fill this gap will contribute significantly to a holistic view of the challenges associated with BCT adoption.

METHODOLOGY

This bibliometric study scrutinised the publications sourced from the Scopus database, in contrast to earlier bibliometric studies that predominantly utilised Scopus for examining scientific journals, books, and conference proceedings (e.g., Abdul Shukor et al., 2023; Tandon et al., 2021; Wasiq et al., 2023). Scopus offers functionalities like Search, Discover, and Analyse to extract data from 229 research publications, encompassing fields like source title, abstract, author keywords, publication year, research area, affiliation, and document type. Furthermore, Scopus is often recognised as one of the most extensive and meticulously curated databases (Ishak et al., 2023). Thus, Scopus is valuable for gaining a holistic perspective on global scientific research contributions (Khan et al., 2023; Kumar et al., 2023; Pal et al., 2021).



Source: Zakaria et al. (2021)

Figure 1: Flow diagram of the search strategy.

Search strategy

This study sourced data from the Scopus database, retrieved as of 30 September 2023. The research utilised specific keywords and synonyms to scour for articles pertinent to the adoption of BCT, emphasising the challenges associated with this adoption. The keyword search restricted the appearance of these terms in the article titles. According to Ahmi et al. (2020), the title serves as the initial point of contact for readers. Therefore, the article needs to feature details that can captivate and hold the attention of its audience. In order to enhance and enrich our search results, we incorporated synonyms and considered both singular and plural forms of the terms. The search string employed for this study was: "TITLE (("Blockchain*" OR "BCT" OR "DLT" OR "Distributed Ledger*") AND ("Adopt*" OR "Adapt*" OR "Implement*" OR "Integ*") AND ("Challe*" OR "Barrie*" OR "Obstac*"))."

Based on the strings above, this means that articles were selected based on their titles containing keywords related to BCT, such as "Blockchain," "Blockchains," "BCT," "DLT," "Distributed Ledger," or "Distributed Ledgers." Concurrently, these articles also needed to include terms indicating the adoption or integration process, like "Adopt," "Adopts," "Adoption," "Adoptions," "Adapt," "Adapts," "Implement," "Implements," "Implementation," "Implementations," "Integrate," "Integrates," "Integration" or "Integrations." Lastly, to zero in on the challenges, barriers, or obstacles associated with the adoption, words like "Challenge," "Challenges," "Barrier," "Barriers," "Obstacle," or "Obstacles" were included in the search criteria.

Data analysis

Based on the query, 229 documents were obtained for the bibliometric analysis. We employ all documents discovered from the string search without excluding them with specific criteria for the analysis. However, we made some replacements to ensure consistency in the terminology used. For example, terms like "blockchains," "blockchain," "blockchain technology," and "decentralised ledger" were replaced with "blockchain." Similarly, the word "challenges" was replaced with "challenge." Several tools were employed to dissect the data when conducting the bibliometric analysis. In this study, we utilised (1) Microsoft Excel for tallying publication frequencies and crafting pertinent charts and graphs; (2) VOSviewer from www.vosviewer.com for building and visualising bibliometric networks; and (3) WordSift.org to display commonly used words from author keywords in a word cloud format.

RESULTS

In this section, we detail our analysis of the state of publications concerning BCT adoption challenges discovered in the Scopus database.

Document type

The foundational step in our bibliometric study on BCT adoption challenges began with exploring document profiles sourced from the Scopus database. As depicted in Table 2, out of the cumulative 229 publications, journal articles emerged as the predominant document type. They accounted for a notable 51% with a total of 117 publications. This pronounced inclination towards journal articles underscores the extensive academic involvement in investigating BCT adoption challenges. Here, the emphasis on journal articles indicates the academic community's profound interest in the challenges of BCT adoption. It underscores academia's commitment to conducting and disseminating rigorous research findings in this domain. Meanwhile, conference papers constitute 25% of the dataset, with 57 publications. Conferences serve as platforms where academicians and practitioners unveil their preliminary findings on BCT adoption challenges. The noteworthy representation of conference papers emphasises the relentless research endeavors in this field. Furthermore, it underscores the topic's sustained pertinence, resonating within academic circles and industry-focused conventions.

Book chapters, accounting for 13% (29 publications) of the dataset, serve as an optimal medium for delving into the intricacies of BCT adoption challenges. These chapters, possibly within interdisciplinary texts, emphasise the multifaceted nuances of the subject. Concurrently, the 11% (25 publications) representation of reviews underscores the academic community's concerted efforts to distil and synthesise the extant body of knowledge on the topic, facilitating structured comprehension for seasoned researchers and newcomers. Additionally, the presence of a solitary letter, although negligible in proportion, signifies the inclusion of concise communications in the discourse, possibly offering responses or critiques to prevailing narratives on BCT adoption challenges.

Table 2: Document Type

Document Type	Total Publications (TP)	Percentage (%)
Article	117	51%
Conference Paper	57	25%
Book Chapter	29	13%
Review	25	11%
Letter	1	0%
Total	**229**	**100%**

Source type

Journal publications are intrinsically linked with a robust process of scrutiny and validation. Their prominence in the dataset in Table 3, representing 62% of total publications, underscores a marked preference among researchers. This preference can be associated with the rigorous peer-review process journals usually entail, as well as the desire of researchers to engage in thorough, in-depth explorations of their subjects. The prevalence of journal articles in this area suggests a commitment to the depth of study and the validation of findings in the realm of BCT adoption challenges. Meanwhile, conference proceedings, making up 17% (39 publications) of the dataset, highlight the field's vibrant and ongoing dialogue, often marked by prompt dissemination of emergent insights. Concurrently, the data reveals a combined 21% contribution from book series (12% or 27 publications) and standalone books (9% or 21 publications). This emphasis on both series and standalone books indicates depth and context in discussions on BCT adoption challenges, aiming to offer readers a comprehensive grasp of the topic.

Table 3: Source Type

Source Type	Total Publications (TP)	Percentage (%)
Journal	142	62%
Conference Proceeding	39	17%
Book Series	27	12%
Book	21	9%
Total	**229**	**100%**

Languages

Based on Table 4, the English language predominates the distribution of publications on BCT adoption challenges, encompassing a commanding 99.6% (or 228 publications) of the total. In contrast, Russian and Spanish have a minimal representation, each contributing a mere 0.4%, equating to a single publication for each language. This trend aligns with broader academic practices, as English is often the central medium for global conversations, with most academic writings anchored in English.

Table 4: Languages

Language	Total Publications (TP)*	Percentage (%)
English	228	99.6%
Russian	1	0.4%
Spanish	1	0.4%
Total	**230**	**100.4%**

*one document has been prepared in dual languages

Subject Area

Based on Table 5, the distribution of publications on BCT adoption challenges derived from multiple subject areas. The various publications on the subject area reflect the topic's interdisciplinary nature. Predominantly, publications on Computer Science led at 58.1%, followed by Engineering and Business, Management, and Accounting with 41.0% and 32.3%, respectively. Meanwhile, Decision and Social Sciences contribute 21.0% and 15.3%, respectively, demonstrating broader societal implications. Other fields like Energy, Medicine, and Materials Science also engage in the discourse, albeit with lesser representation, ranging from 6.6% to 4.4%. The remaining subjects account for under 4% each, highlighting the focus on technological and business aspects.

Table 5: Subject Area

Subject Area	Total Publications (TP)	Percentage (%)
Computer Science	133	58.1%
Engineering	94	41.0%
Business, Management and Accounting	74	32.3%
Decision Sciences	48	21.0%
Social Sciences	35	15.3%
Economics, Econometrics and Finance	22	9.6%
Environmental Science	19	8.3%
Mathematics	18	7.9%
Energy	15	6.6%
Medicine	11	4.8%
Materials Science	10	4.4%
Agricultural and Biological Sciences	7	3.1%
Physics and Astronomy	6	2.6%
Biochemistry, Genetics and Molecular Biology	3	1.3%
Chemical Engineering	3	1.3%
Chemistry	1	0.4%
Earth and Planetary Sciences	1	0.4%
Health Professions	1	0.4%
Immunology and Microbiology	1	0.4%
Psychology	1	0.4%

Publication Trends

Table 6: Year of Publication

Year	TP	NCP	TC	C/P	C/CP	*h*	*g*
2017	1	1	11	11.0	11.0	1	1
2018	6	6	1377	229.5	229.5	6	6
2019	19	19	1883	99.1	99.1	8	19
2020	16	14	1020	63.8	72.9	12	16
2021	55	45	1757	31.9	39.0	23	41
2022	72	47	450	6.3	9.6	12	18
2023	60	29	188	3.1	6.5	8	12
Total	**229**						

Notes: TP=total number of publications; NCP=number of cited publications; TC=total citations; C/P=average citations per publication; C/CP=average citations per cited publication; h=h-index; and g=g-index.

Based on Table 6, the data illustrates the progression of publications on BCT adoption challenges over seven years (2017-2023). The journey began modestly in 2017 with a single publication, notably the pioneering article by Koteska et al. (2017) in the Scopus database. A marked surge occurred in 2018, witnessing a sixfold increase and accumulating a significant Total Citation (TC) count of 1,377. In 2019, the momentum persisted with 19 publications and an impressive TC of 1,883. The ensuing years saw an expansion in Total Publications (TP), culminating in a peak of 72 in 2022. Interestingly, despite the upward trend in TP, the citation per publication (C/CP) exhibited a decline, reducing from a peak of 229.5 in 2018 to 6.5 by 2023. Note that such a trend might suggest a shifting focus in the community or potential saturation of specific themes. Hence, we anticipate that publications will continue to grow for the next year, especially as new publication data for 2023 remains open until 31 December.

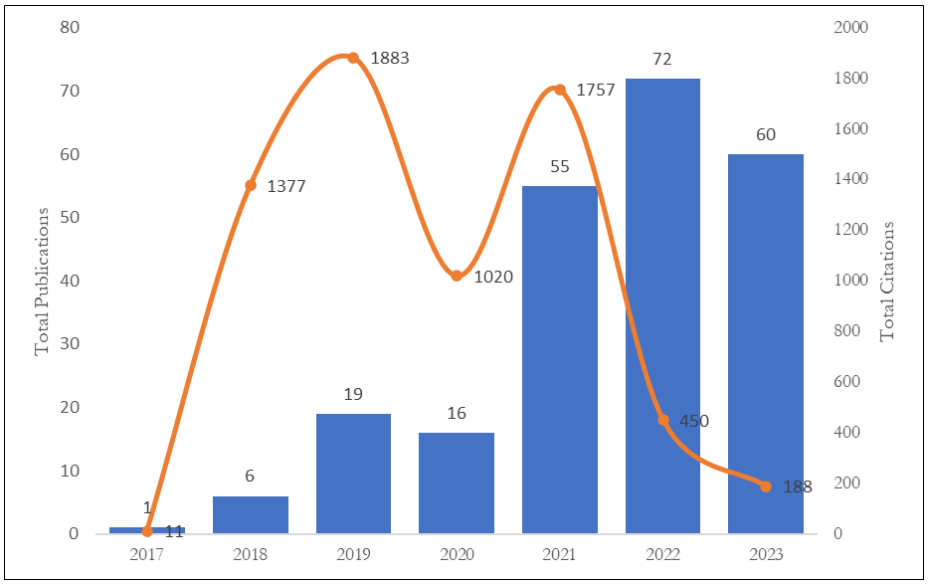


Figure 2: Total Publications and Citations by Year

Publications by Institutions

The data from Table 7 highlights varied institutional contributions toward publications on BCT adoption challenges.

Table 7: Most productive institutions with a minimum of two publications

Institutions	TP	NCP	TC	C/P	C/CP	*h*	*g*
Jadara University	8	5	82	10.25	16.40	4	1
Bina Nusantara University	7	1	19	2.71	19.00	1	2
Universitas Padjadjaran	5	1	2	0.40	2.00	1	2
Universiti Malaysia Terengganu	3	3	64	21.33	21.33	3	0
Universiti Kebangsaan Malaysia	3	3	15	5.00	5.00	2	1
University of Antwerp	3	3	5	1.67	1.67	1	1
Universiti Sains Malaysia	2	1	4	2.00	4.00	1	1
Irbid National University	2	1	4	2.00	4.00	1	1
Amman Arab University	2	1	9	4.50	9.00	1	1
Dar Alhekma University	2	1	5	2.50	5.00	1	1
Macquarie University	2	2	3	1.50	1.50	1	1
University of Muhammadiyah Tangerang	2	0	0	0.00	0.00	0	1
Victoria University of Wellington	2	1	2	1.00	2.00	1	1
Universitas Sumatera Utara	2	1	3	1.50	3.00	1	1

Notes: TP=total number of publications; NCP=number of cited publications; TC=total citations; C/P=average citations per publication; C/CP=average citations per cited publication; h=h-index; and g=g-index.

Jadara University stands out with eight publications and a notable average C/P of 10.25. However, Bina Nusantara University and Universitas Padjadjaran trail has seven and five publications, although with different citation impacts. Despite having only three publications, Universiti Malaysia Terengganu shines with a high C/P of 21.33. Universiti Kebangsaan Malaysia and the University of Antwerp have contributed significantly, with three publications each. Meanwhile, institutions like Macquarie University and Victoria University of Wellington, each with two publications, underscore the broad academic interest in the subject.

Publications by Countries

Table 8: Top 20 Countries contributed to the publications

Country	TP	NCP	TC	C/P	C/CP	*h*	*g*
Indonesia	74	41	267	3.61	6.51	10	8
United States	33	26	467	14.15	17.96	14	4
China	23	16	43	1.87	2.69	4	4
Australia	19	13	131	6.89	10.08	6	3
Jordan	17	9	102	6.00	11.33	5	3
Malaysia	16	13	114	7.13	8.77	5	2
United Kingdom	12	12	261	21.75	21.75	8	1
Romania	10	6	60	6.00	10.00	4	2
Saudi Arabia	10	8	45	4.50	5.63	5	2
Turkey	8	3	14	1.75	4.67	2	2
Italy	8	6	23	2.88	3.83	3	2
New Zealand	5	1	2	0.40	2.00	1	2
Belgium	5	5	21	4.20	4.20	3	1
Portugal	4	2	29	7.25	14.50	2	1
United Arab Emirates	4	3	14	3.50	4.67	2	1
South Korea	4	4	174	43.50	43.50	3	0
Pakistan	3	3	21	7.00	7.00	3	0
Latvia	3	2	26	8.67	13.00	2	1
Russian Federation	3	3	4	1.33	1.33	1	1
Spain	3	3	19	6.33	6.33	3	0

Notes: TP=total number of publications; NCP=number of cited publications; TC=total citations; C/P=average citations per publication; C/CP=average citations per cited publication; h=h-index; and g=g-index.

Table 8 highlights the top 20 countries contributing to publications on BCT adoption challenges. Indonesia leads the chart with 74 publications and a C/P of 3.61, reflecting its active role in this research domain. The United States, with 33 publications, outshines others in terms of citation impact, boasting a C/P of 14.15. Though their total publications vary, China, Australia, and Jordan further bolster the global discourse with respective contributions of 23, 19, and 17 publications. Malaysia's input is also noteworthy, with 16 publications emphasising the Asian concentration in this field.

The United Kingdom stands out in Europe with 12 publications and a significant C/P of 21.75. Romania and Saudi Arabia, each contributing ten publications, signify their academic commitment. Despite having fewer publications, countries like Italy, Turkey, and New Zealand enrich the global dialogue on the subject. Belgium, Portugal, and the United Arab Emirates, with

their contributions, further attest to the widespread international interest in BCT adoption challenges.

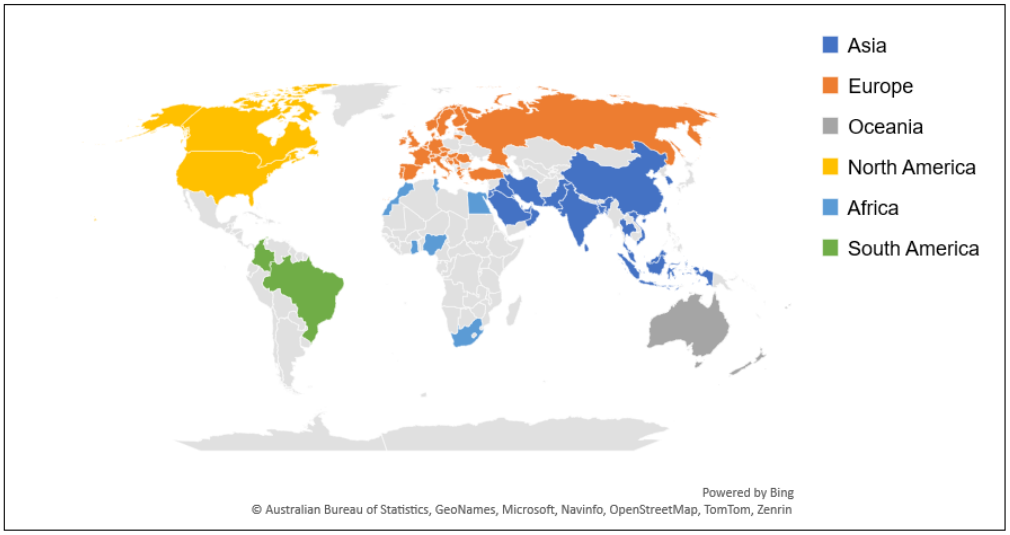


Figure 3: Worldwide scientific production indexed by Scopus on BCT Adoption Challenges

Highly Cited Documents

From the data presented in Table 9, Reyna et al.'s (2018) work on integrating BCT with IoT is the most cited, accumulating an impressive 1,142 citations and a yearly citation average of 190.33. It was followed by Queiroz M.M. Fosso Wamba S.'s (2019) investigation on BCT adoption challenges in supply chains, receiving 548 citations and an average of 109.60 annually. Notably, works from 2021, such as by Kouhizadeh M., Saberi S., and Sarkis J. (2021), have rapidly amassed citations, pointing to the topic's contemporary relevance.

Further, down the list, articles like Tanwar S., Bhatia Q., Patel P., Kumari A., Singh P.K., Hong W.-C.'s (2020) piece on machine learning's adoption in BCT applications, and Yadav V.S., Singh A.R.; Raut R.D.; Govindarajan U.H.'s (2020) examination of BCT barriers in India's agriculture supply chain highlight BCT's diverse applications and challenges across various sectors. Several studies also discuss the integration challenges of BCT with other technologies, reinforcing BCT research's evolving and interdisciplinary nature.

Table 9: Top 20 highly cited articles

No.	Authors	Title	Cites	Cites per Year
1	Reyna et al. (2018)	On blockchain and its integration with IoT. Challenges and opportunities	1,142	190.33
2	Queiroz and Fosso Wamba (2019)	Blockchain adoption challenges in supply chain: An empirical investigation of the main drivers in India and the USA	548	109.60
3	Kouhizadeh et al. (2021)	Blockchain technology and the sustainable supply chain: Theoretically exploring adoption barriers	468	156.00
4	Yang et al. (2019)	Integrated Blockchain and Edge Computing Systems: A Survey, Some Research Issues and Challenges	428	85.60
5	Hassan et al. (2019)	Privacy preservation in blockchain based IoT systems: Integration issues, prospects, challenges, and future research directions	345	69.00

No.	Authors	Title	Cites	Cites per Year
6	Makhdoom et al. (2019)	Blockchain's adoption in IoT: The challenges, and a way forward	298	59.60
7	Tanwar et al. (2020)	Machine Learning Adoption in Blockchain-Based Smart Applications: The Challenges, and a Way Forward	194	48.50
8	Yadav et al. (2020)	Blockchain technology adoption barriers in the Indian agricultural supply chain: an integrated approach	175	43.75
9	Torky and Hassanein (2020)	Integrating blockchain and the Internet of things in precision agriculture: Analysis, opportunities, and challenges	156	39.00
10	Biswas and Gupta (2019)	Analysis of barriers to implement blockchain in industry and service sectors	147	29.40
11	Batubara et al. (2018)	Challenges of blockchain technology adoption for e-government: A systematic literature review	126	21.00
12	Uddin et al. (2021)	A survey on the adoption of blockchain in IoT: challenges and solutions	123	41.00
13	Sanka et al. (2021)	A survey of breakthrough in blockchain technology: Adoptions, applications, challenges and future research	107	35.67
14	Toufaily et al. (2021)	A framework of blockchain technology adoption: An investigation of challenges and expected value	103	34.33
15	Nguyen et al. (2020)	Integration of Blockchain and Cloud of Things: Architecture, Applications and Challenges	98	24.50
16	Mathivathanan et al. (2021)	Barriers to the adoption of blockchain technology in business supply chains: a total interpretive structural modelling (TISM) approach	97	32.33
17	Sahebi et al. (2020)	Expert oriented approach for analysing the blockchain adoption barriers in humanitarian supply chain	71	17.75
18	Pandey and Litoriya (2020)	Implementing healthcare services on a large scale: Challenges and remedies based on blockchain technology	67	16.75
19	Zhou et al. (2020)	The key challenges and critical success factors of blockchain implementation: Policy implications for Singapore's maritime industry	64	16.00
20	Sadawi et al. (2021)	A Survey on the Integration of Blockchain with IoT to Enhance Performance and Eliminate Challenges	63	21.00

Top Keywords

Table 10: Top author's keywords

Author Keywords	Total Publications (TP)	Percentage (%)
blockchain	185	41.5%
security	21	4.7%
barriers	20	4.5%
internet of things	20	4.5%
supply chain	15	3.4%
challenges	14	3.1%
internet of things (iot)	19	2.9%
dematel	11	2.5%
sustainability	11	2.5%
circular economy	8	1.8%

Author Keywords	Total Publications (TP)	Percentage (%)
smart contracts	8	1.8%
adoption	7	1.6%
blockchain adoption	7	1.6%
cloud computing	7	1.6%
distributed ledger technology	7	1.6%
ism	7	1.6%
privacy	7	1.6%
supply chain management	7	1.6%
technology adoption	7	1.6%
artificial intelligence	6	1.3%
bitcoin	6	1.3%
traceability	6	1.3%
adoption barriers	5	1.1%
barrier analysis	5	1.1%
consensus	5	1.1%
fintech	5	1.1%
food supply chain	5	1.1%
healthcare	5	1.1%
interpretive structural modeling	5	1.1%
smart contract	5	1.1%

Based on Table 10, the keyword "blockchain" markedly dominates the author's keywords, featured in 185 publications, accounting for a significant 41.5% of the total. It indicates the core theme underpinning most of the studies. Following it, albeit distantly, are terms like "security," "barriers," "internet of things," and "supply chain," which are mentioned in 4.7%, 4.5%, 4.5%, and 3.4% of the papers, respectively. These terms reflect the prominent challenges and application areas associated with BCT.

Further analysis showcases other pivotal keywords such as "challenges," "IoT," and "dematel," each capturing specific aspects or methodologies of BCT research. Additionally, terms like "sustainability," "circular economy," and "smart contracts" highlight the diverse sectors and applications where BCT finds its relevance. Several keywords like "cloud computing," "privacy," and "technology adoption" underscore the intersection of BCT with other technological and security paradigms.

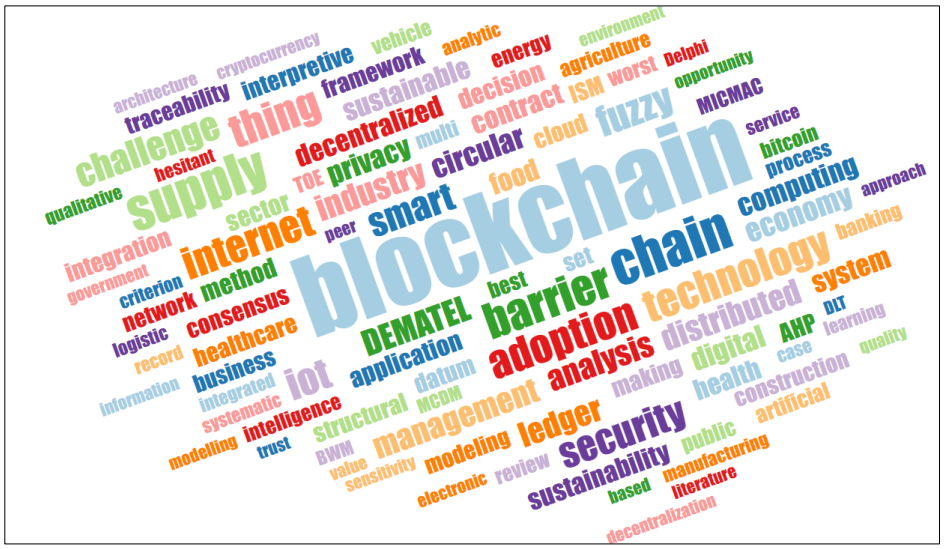


Figure 4: Word cloud of the author keywords

Co-authorship by countries

Based on Figure 5, VOSviewer's co-authorship analysis based on countries provides intriguing insights into global collaborations on BCT research. India emerges as a central node with the highest number of documents at 94 and a total link strength of 43, indicating robust collaborative networks. While China and the United Kingdom follow with 23 and 25 documents, respectively, their link strengths differ considerably, hinting at varied collaboration intensities. Despite having only five documents, Spain boasts 1,158 citations, underscoring impactful research. The United States, Australia, and Canada also play pivotal roles with notable numbers of documents and citations. Meanwhile, countries like Malaysia, Saudi Arabia, and Taiwan indicate active collaboration, evidenced by their substantial total link strengths relative to their document counts.

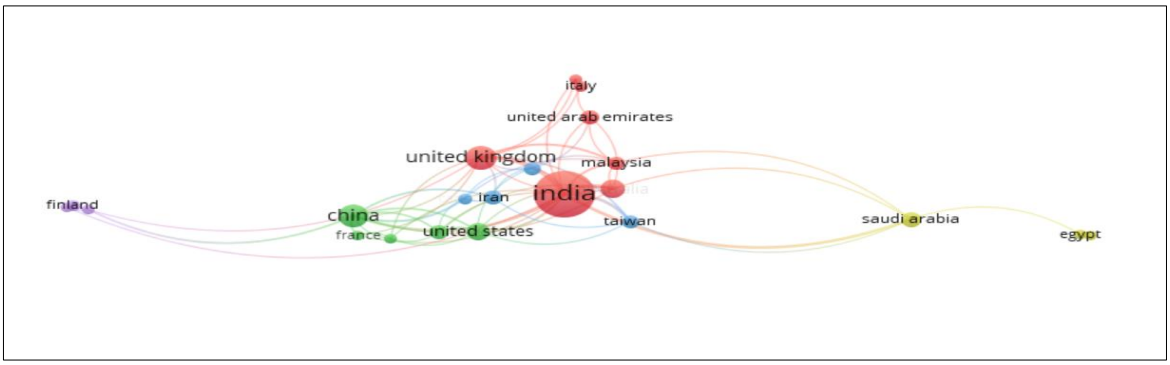


Figure 5: Network visualisation map of the co-authorship by countries

Co-occurrence analysis of author's keywords

According to the analysis by Vosviewer displayed in Figure 6, when examining co-authorship by country and focusing on author keywords, it is clear that "blockchain" is the most dominant keyword, appearing in 41.5% of all publications. Other vital keywords include "security," "barriers," and "internet of things," each appearing in more than 4% of the articles. The study also demonstrates how BCT intersects with the "supply chain" and its management, as well as the ongoing discussion around "sustainability" and the "circular economy." Furthermore, the data reveals emerging trends such as the use of "artificial intelligence" and "cloud computing" in conjunction with BCT, as well as concerns about "privacy" in its implementation, highlighting the multifaceted nature of BCT discourse.

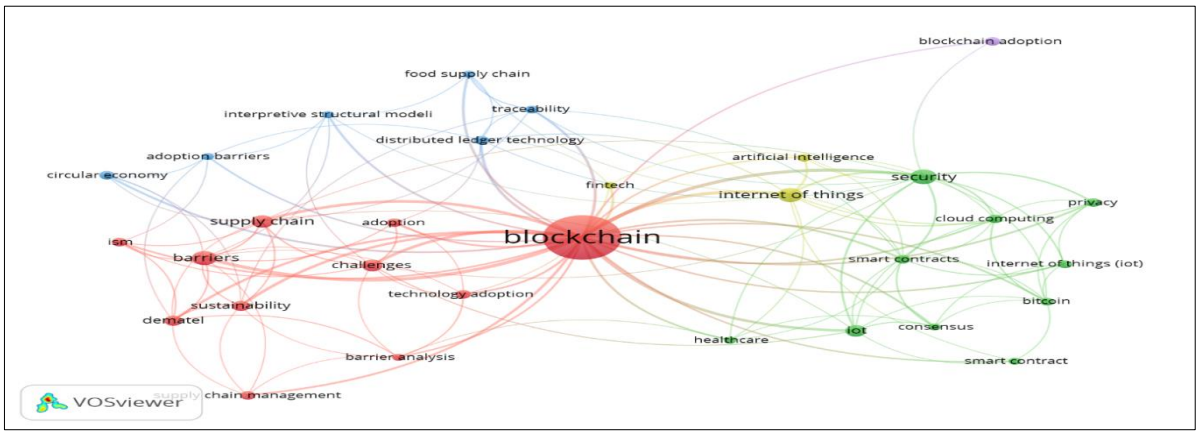


Figure 6: Network visualisation of the author's keywords

Co-occurrence analysis of terms based on title and abstract

According to the data presented in Figure 7, a VOSviewer analysis of keywords obtained from titles and abstracts has revealed that "blockchain" is the most frequently used term, appearing 208 times with a link strength of 629. The analysis has also highlighted the strong connections between BCT, the "Internet of things," and "supply chain management" through their frequent use and link strengths. Additionally, keywords like "adoption barriers," "security," and "sustainability" indicate that there are ongoing discussions around the challenges and implications of BCT. Other terms such as "artificial intelligence," "circular economy," and "technology adoption" emphasise the diverse and evolving discussions surrounding BCT's integration and potential in various sectors.

From the visual, we also discovered that the cluster exists in the network, and several thematic clusters become apparent. The central cluster revolves around the core concept of "blockchain," closely tied to terms like "distributed ledger" and "cryptocurrency." There is an evident technological cluster with terms like "internet of things," "cloud computing," and "5g mobile communication systems." Another distinct cluster can be associated with challenges and barriers, including "adoption barriers," "security," "data privacy," and "challenge." The "supply chain" theme forms its cluster, interlinked with "traceability," "supply chain management," and "food supply chain." Moreover, a sustainability and management-focused cluster surfaces with "circular economy," "sustainability," "sustainable development," and "decision making." The presence of these clusters highlights the multifaceted nature of BCT discussions, ranging from its technical applications to its implications in broader societal and economic contexts.

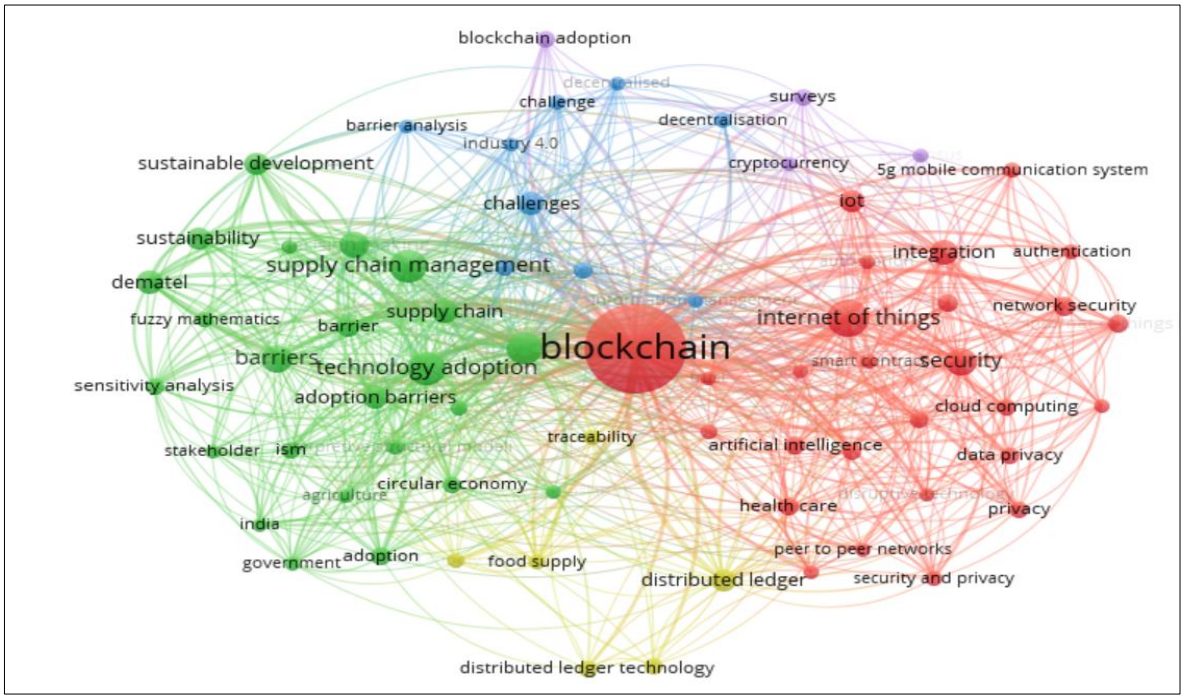


Figure 7: Network visualisation of a term co-occurrence network based on title and abstract field

DISCUSSION ON BLOCKCHAIN ADOPTION CHALLENGES

The uniqueness of BCT can revolutionise traditional business practices. By holding decentralised, immutable, and transparent features, BCT implementation can enhance security and transparency in record-keeping and transaction verification (Balasubramanian et al., 2021). According to Sandner et al. (2020), the compatibility of BCT with other emerging technologies, like the IoT and AI, makes it beneficial for CFOs towards better decision-making. Similarly, studies from Abu Afifa

et al. (2023) and Bonsón and Bednárová (2019) argued that BCT can potentially enhance the quality of information. This enhancement can be attributed to BCT's decentralised nature and transparent characteristics. Moreover, BCT presents a promising solution to meet this requirement (Suominen, 2022; Victor Chukwunweike et al., 2023).

Even though the adoption of BCT could benefit the organisation, its adoption is still in the early stages (Laili et al., 2023). Many industries are still waiting to see how BCT can genuinely benefit them (Dyball & Seethamraju, 2022). The adoption of BCT presents multifaceted challenges and considerations. Previous studies broadly classified technology, organisation, regulations, and security as its adoption challenges. In the context of technology, Hassan et al. (2019) discussed the challenges in privacy issues in integrating BCT and other applications like the IoT. They specifically focused on how these issues affect daily operations and privacy protection techniques such as anonymisation, encryption, and differential privacy. Consequently, they further emphasised the importance of future research to improve the strategies for IoT systems operating in the BCT environment. In the meantime, Yang et al. (2019) mentioned the need for scalability, self-organisation, and security advancements before these technologies can be widely implemented.

In terms of organisational factors, Pandey and Litoriya (2020) discussed scalability challenges in the healthcare context. They emphasised the trade-offs between system throughput, time-to-commit, and fault tolerance and concluded that BCT could enable an efficient nationwide health insurance programme resistant to corruption. Biswas and Gupta (2019), Mathivathanan et al. (2021), and Zhou et al. (2020) also identified scalability and market-based risks as significant barriers to adoption. Additionally, they mentioned a lack of business awareness and familiarity with BCT's potential for supply chains. At the same time, the studies conducted by Batubara et al. (2018), Sahebi et al. (2020), and Yadav et al. (2020) mentioned the challenges posed by regulatory uncertainty, the lack of established governance models, and the absence of knowledge or employee training. Furthermore, they emphasised the significance of managerial implications and urged governments and relevant agencies to address these obstacles.

Finally, Makhdoom et al. (2019) conducted a study on mapping the security and performance of BCTs and identifying discrepancies in meeting IoT requirements. They discovered practical issues integrating IoT devices with BCT, indicating a gap between the current technology and the desired performance standards. The researchers' findings suggested that while BCT has the potential to transform the IoT and other sectors, its adoption is hindered by a complex interplay of technological challenges, organisational resistance, and regulatory gaps. These studies highlighted the critical need for a multidimensional approach to overcome these barriers. This approach should include enhanced privacy protection strategies, scalability solutions, comprehensive training and knowledge dissemination, and the development of supportive regulatory frameworks to foster trust and acceptance among stakeholders.

FINDINGS

Over the past several years, the burgeoning interest in BCT and its challenges in adoption has become a focal point for researchers, institutions, and countries alike. The analysis of 229 documents from the Scopus database reveals that this domain's expansive landscape elucidates critical insights and contributions, shaping our understanding of the subject. Starting from 2017, the research trajectory on BCT adoption challenges experienced a steady ascent. The modest initiation in 2017 witnessed a marked uptick in 2018, and this momentum was maintained in subsequent years. Although total publications experienced growth, a decline in citations per publication after 2018 was observed. The potential hints at evolving interests or thematic saturation, yet the publications are anticipated to sustain their upward trajectory soon, especially when the actual use case of BCT adoption occurs in the market.

The global academic arena exhibits varied contributions. Indonesia emerges as a dominant country that contributes the most to publications. Nevertheless, while the United States might not

match Indonesia in quantity, its citation impact is unparalleled. In the meantime, in the Asian region, countries like China, Australia, Jordan, and Malaysia also exhibit academic interest that focuses on BCT adoption. On the other hand, Europe perceives the United Kingdom as having a significant interest in this area, besides other nations like Romania and Belgium highlighting their commitment. Note that the analysis of institutions identified Jadara University as topping the list of publications, followed closely by Bina Nusantara University and Universitas Padjadjaran. In terms of authorship, although not explicitly mentioned in the initial analysis, the authors Reyna et al. (2018) have significantly impacted the discourse with their most cited work in 2018. A distinct publication by Reyna et al. (2018) on integrating BCT with IoT has garnered significant attention, accumulating a staggering number of citations. Close on its heels, Queiroz and Fosso Wamba's (2019) investigation shed light on BCT adoption challenges in supply chains, adding substantial weight to the body of literature.

Here, keywords serve as beacons, illuminating the major thrust areas of research. "Blockchain" stands out prominently, followed by themes around "security," "barriers," and "internet of things." Keywords also spotlight the expansive application potential of BCT, highlighting intersections with areas such as "supply chain," "sustainability," "cloud computing," and "privacy." This analysis significantly enhances our comprehension of the prevailing research trends on BCT adoption challenges. We have achieved an all-encompassing understanding of the discipline's progression by evaluating contributions from diverse countries, identifying prominent authors and institutions, underscoring pivotal publications, and highlighting prevalent keywords. This study is a crucial touchstone for academicians, decision-makers, and industry insiders, steering them toward pertinent resources and aiding future investigations. Furthermore, we acknowledge the study's limitations, from a singular focus on the Scopus database and the analysis of 229 publications. However, as BCT's significance surges across various sectors, there is a vast potential for more extensive research using other databases. Academicians can further investigate the tangible hurdles in BCT's real-world application, regulatory framework, and socio-economic repercussions. Additionally, the intersection of BCT with other emerging technologies, such as quantum computing and enhanced AI, opens up fresh domains for study.

CONCLUSION

The transformational influence of the Internet on societal interactions has paved the way for a revaluation of centralised systems, especially in the wake of the 2008 market crash. This has led to a burgeoning interest in BCT as a promising decentralised alternative. Despite the surge in attention, a comprehensive understanding of the challenges related to BCT adoption still needs to be improved in the literature. This bibliometric study delved into this domain, analysing 229 publications from the Scopus database, tracking its growth trajectory since 2017, and identifying critical contributions from various countries, institutions, and scholars. Our findings indicate a dominant academic contribution from Indonesia and significant impacts from authors like Reyna A. and Martín C. Notably, the research keywords spotlighted areas like "security," "barriers," and "internet of things," revealing the multifaceted application potential of BCT. This study is an invaluable guidepost for academia, industry, and policymaking stakeholders. Given that we recognise the constraints of our study, stemming mainly from the exclusive reliance on the Scopus database, the expanding relevance of BCT signals a rich avenue for future investigations. Accordingly, upcoming research can explore the practical challenges in BCT application, its regulatory dimensions, and the socio-economic outcomes. Moreover, the confluence of BCT with other emergent technologies offers many opportunities for academic and practical exploration.

ACKNOWLEDGEMENT
The authors wish to acknowledge the Public Service Department of Malaysia (JPA) for their generosity in providing study leave and financial aid under Hadiah Latihan Persekutuan (HLP).

REFERENCES

Abdul Shukor, S., Salikin, N., Ahmad Bustamam, U. S., Anwar, I. F., & Nordin, S. N. (2023). Crisis management: A bibliometric analysis. *The Journal of Muamalat and Islamic Finance Research*, *20*(1), 64–78. https://doi.org/10.33102/jmifr.500

Abu Afifa, M. M., Vo Van, H., & Le Hoang Van, T. (2023). Blockchain adoption in accounting by an extended UTAUT model: empirical evidence from an emerging economy. *Journal of Financial Reporting and Accounting*, *21*(1), 5–44. https://doi.org/10.1108/JFRA-12-2021-0434

Ahmi, A., Tapa, A., & Hamzah, A. H. (2020). Mapping of financial technology (FinTech) Research: A bibliometric analysis article in international journal of advanced science and technology. *International Journal of Advanced Science and Technology*, *29*(8), 379–392. https://www.researchgate.net/publication/351103949

Al-Ashmori, A., Basri, S., Dominic, P. D. D., Capretz, L. F., Muneer, A., Balogun, A. O., Gilal, A. R., & Ali, R. F. (2022). Classifications of sustainable factors in blockchain adoption: A literature review and bibliometric analysis. *Sustainability (Switzerland)*, *14*(9). https://doi.org/10.3390/su14095176

AL-Ashmori, A., Thangarasu, G., Dominic, P. D. D., & Al-Mekhlafi, A. B. A. (2023). A readiness model and factors influencing blockchain adoption in Malaysia's software sector: A survey study. *Sustainability (Switzerland)*, *15*(16). https://doi.org/10.3390/su151612139

Antova, I., & Tayachi, T. (2020). Blockchain and smart contracts: A risk management tool for Islamic finance. *Journal of Islamic Financial Studies*, *05*(01), 29–42. https://doi.org/10.12785/jifs/050103

Balasubramanian, S., Shukla, V., Sethi, J. S., Islam, N., & Saloum, R. (2021). A readiness assessment framework for Blockchain adoption: A healthcare case study. *Technological Forecasting and Social Change*, *165*(July 2020), 120536. https://doi.org/10.1016/j.techfore.2020.120536

Balci, G., & Surucu-Balci, E. (2021). Blockchain adoption in the maritime supply chain: Examining barriers and salient stakeholders in containerized international trade. *Transportation Research Part E: Logistics and Transportation Review*, *156*(November). https://doi.org/10.1016/j.tre.2021.102539

Batubara, F. R., Ubacht, J., & Janssen, M. (2018). Challenges of blockchain technology adoption for e-government: A systematic literature review. *ACM International Conference Proceeding Series*. https://doi.org/10.1145/3209281.3209317

Biswas, B., & Gupta, R. (2019). Analysis of barriers to implement blockchain in industry and service sectors. *Computers and Industrial Engineering*, *136*, 225 – 241. https://doi.org/10.1016/j.cie.2019.07.005

Bonsón, E., & Bednárová, M. (2019). Blockchain and its implications for accounting and auditing. *Meditari Accountancy Research*, *27*(5), 725–740. https://doi.org/10.1108/MEDAR-11-2018-0406

Bonyuet, D. (2020). Overview and impact of blockchain on auditing. *International Journal of Digital Accounting Research*, *20*(June 2019), 31–43. https://doi.org/10.4192/1577-8517-v20_2

Caldarelli, G., Zardini, A., & Rossignoli, C. (2021). Blockchain adoption in the fashion sustainable supply chain: Pragmatically addressing barriers. *Journal of Organizational Change Management*, *34*(2), 507–524. https://doi.org/10.1108/JOCM-09-2020-0299

Darabseh, M., & Martins, J. P. (2020). Risks and opportunities for reforming construction with blockchain: Bibliometric study. *Civil Engineering Journal (Iran)*, *6*(6), 1204–1217. https://doi.org/10.28991/cej-2020-03091541

Dyball, M. C., & Seethamraju, R. (2022). Client use of blockchain technology: exploring its (potential) impact on financial statement audits of Australian accounting firms. *Accounting, Auditing and Accountability Journal*, *35*(7), 1656–1684. https://doi.org/10.1108/AAAJ-07-2020-4681

Efanov, D., & Roschin, P. (2018). The all-pervasiveness of the blockchain technology. *Procedia Computer Science*, *123*, 116–121. https://doi.org/10.1016/j.procs.2018.01.019

Eyassu, S. E. (2019). Overview of blockchain legislation and adoption: Status and challenges. *Issues in Information Systems*, *20*(1), 12–21. https://doi.org/10.48009/1_iis_2019_12-21

Gaggioli, A., Eskandari, S., Cipresso, P., & Lozza, E. (2019). *The middleman is dead, long live the middleman: The "Trust Factor" and the Psycho-Social Implications of Blockchain*. *Frontiers in Blockchain, 2*(November), 1-8. https://doi.org/10.3389/fbloc.2019.00020

Ganne, E. (2018). *Can blockchain revolutionize international trade? World Trade Organization.* https://doi.org/10.30875/7c7e7202-en

Gartner. (2019). *Executive Guidance Get to Know Blockchain*.

Han, H., Shiwakoti, R. K., Jarvis, R., Mordi, C., & Botchie, D. (2023). Accounting and auditing with blockchain technology and artificial Intelligence: A literature review. *International Journal of Accounting Information Systems*, *48*(March 2021), 100598. https://doi.org/10.1016/j.accinf.2022.100598

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

Ietto, B., Rabe, J., Muth, R., & Pascucci, F. (2023). Blockchain for citizens' participation in urban planning: The case of the city of Berlin. A value sensitive design approach. *Cities*, *140*(May), 104382. https://doi.org/10.1016/j.cities.2023.104382

Ishak, M. S., Sarkowi, A., Ahmi, A., Abdulrauf-Salau, A., & Memon, S. (2023). Global research trends in school bullying: A bibliometric analysis. *Journal of Educational and Social Research*, *13*(1), 91–105. https://doi.org/10.36941/jesr-2023-0009

Khan, S., Haleem, A., Husain, Z., Samson, D., & Pathak, R. D. (2023). Barriers to blockchain technology adoption in supply chains: the case of India. *Operations Management Research*, *16*(2), 668–683. https://doi.org/10.1007/s12063-023-00358-z

Kitsantas, T., & Chytis, E. (2022). Blockchain technology as an ecosystem: Trends and perspectives in accounting and management. *Journal of Theoretical and Applied Electronic Commerce Research*, *17*(3), 1143–1161. https://doi.org/10.3390/jtaer17030058

Kosmarski, A. (2020). Blockchain adoption in academia: Promises and challenges. *Journal of Open Innovation: Technology, Market, and Complexity*, *6*(4), 1–15. https://doi.org/10.3390/joitmc6040117

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

Kouhizadeh, M., Saberi, S., & Sarkis, J. (2021). Blockchain technology and the sustainable supply chain: Theoretically exploring adoption barriers. *International Journal of Production Economics*, *231*. https://doi.org/10.1016/j.ijpe.2020.107831

Kumar, D., Singh, R. K., Mishra, R., & Daim, T. U. (2023). Roadmap for integrating blockchain with Internet of Things (IoT) for sustainable and secured operations in logistics and supply chains: Decision making framework with case illustration. *Technological Forecasting and Social Change*, *196*(January), 122837. https://doi.org/10.1016/j.techfore.2023.122837

Laili, N. H., Khairi, K. F., & Masruki, R. (2023). The role of blockchain technology in the management of waqf. *Lecture Notes in Networks and Systems*, *620 LNNS*(Piazza 2017), 72–81. https://doi.org/10.1007/978-3-031-26953-0_9

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

Mathivathanan, D., Mathiyazhagan, K., Rana, N. P., Khorana, S., & Dwivedi, Y. K. (2021). Barriers to the adoption of blockchain technology in business supply chains: A total interpretive structural modelling (TISM) approach. *International Journal of Production Research*, *59*(11), 3338–3359. https://doi.org/10.1080/00207543.2020.1868597

Mia, F. Z. (2021). *Decrypting blockchain transactions: A conceptual approach towards accounting for crypto tokens [Unpublished master thesis]*. University of Johannesburg. https://ujcontent.uj.ac.za/esploro/outputs/9915309907691#:~:text=https%3A//hdl.handle.net/10210/501430

Mounia, K., & Nadjat, K. (2022). Accounting in the era of blockchain technology what prospects? *Journal of Accounting, Auditing & Finance*, *4*(2), 48–58. https://www.asjp.cerist.dz/en/article/210592

Müßigmann, B., Von Der Gracht, H., & Hartmann, E. (2020). Blockchain technology in logistics and supply chain management - a bibliometric literature review from 2016 to January 2020. *IEEE Transactions on Engineering Management*, *67*(4), 988–1007. https://doi.org/10.1109/TEM.2020.2980733

Nguyen, D. C., Pathirana, P. N., Ding, M., & Seneviratne, A. (2020). Integration of blockchain and cloud of things: Architecture, applications and challenges. *IEEE Communications Surveys and Tutorials*, *22*(4), 2521 – 2549. https://doi.org/10.1109/COMST.2020.3020092

Pal, A., Tiwari, C. K., & Behl, A. (2021). Blockchain technology in financial services: a comprehensive review of the literature. *Journal of Global Operations and Strategic Sourcing*, *14*(1), 61–80. https://doi.org/10.1108/JGOSS-07-2020-0039

Pandey, P., & Litoriya, R. (2020). Implementing healthcare services on a large scale: Challenges and remedies based on blockchain technology. *Health Policy and Technology*, *9*(1), 69 – 78. https://doi.org/10.1016/j.hlpt.2020.01.004

Parker, L. (2019). *Blockchain technology: the disruption and impact to the accounting profession*. Gardner-Webb University. https://digitalcommons.gardner-webb.edu/undergrad-honors/33

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*, 70 – 82. https://doi.org/10.1016/j.ijinfomgt.2018.11.021

Rejeb, A., Treiblmaier, H., Rejeb, K., & Zailani, S. (2021). Blockchain research in healthcare: a bibliometric review and current research trends. *Journal of Data, Information and Management*, *3*(2), 109–124. https://doi.org/10.1007/s42488-021-00046-2

Reyna, A., Martín, C., Chen, J., Soler, E., & Díaz, M. (2018). On blockchain and its integration with IoT. Challenges and opportunities. *Future Generation Computer Systems*, *88*, 173 – 190. https://doi.org/10.1016/j.future.2018.05.046

Sadawi, A. Al, Hassan, M. S., & Ndiaye, M. (2021). A Survey on the Integration of Blockchain with IoT to Enhance Performance and Eliminate Challenges. *IEEE Access*, *9*, 54478 – 54497. https://doi.org/10.1109/ACCESS.2021.3070555

Sahebi, I. G., Masoomi, B., & Ghorbani, S. (2020b). Expert oriented approach for analysing the blockchain adoption barriers in humanitarian supply chain. *Technology in Society*, *63*(May). https://doi.org/10.1016/j.techsoc.2020.101427

Saif, A. N. M., Islam, K. M. A., Haque, A., Akhter, H., Rahman, S. M. M., Jafrin, N., Rupa, R. A., & Mostafa, R. (2022). Blockchain implementation challenges in developing countries: An evidence-based systematic review and bibliometric analysis. *Technology Innovation Management Review*, *12*(1–2). https://doi.org/10.22215/timreview/1479

Samaduzzaman, M. (2020). Blockchain: Future of accounting education. *Asian Journal of Finance & Accounting*, *12*(2), 14. https://doi.org/10.5296/ajfa.v12i2.17679

Sandner, P., Lange, A., & Schulden, P. (2020). The role of the CFO of an industrial company: An analysis of the impact of blockchain technology. *Future Internet*, *12*(8), 1–16. https://doi.org/10.3390/FI12080128

Sanka, A. I., Irfan, M., Huang, I., & Cheung, R. C. C. (2021). A survey of breakthrough in

blockchain technology: Adoptions, applications, challenges and future research. *Computer Communications*, *169*, 179 – 201. https://doi.org/10.1016/j.comcom.2020.12.028

Sarwar, M. I., Iqbal, M. W., Alyas, T., Namoun, A., Alrehaili, A., Tufail, A., & Tabassum, N. (2021). Data vaults for blockchain-empowered accounting information systems. *IEEE Access*, *9*, 117306–117324. https://doi.org/10.1109/ACCESS.2021.3107484

Şeyma Alkan, B., Bir, Y., Olarak, P., Zamanlı, G., Zinciri, B., & Sistemi, M. (2021). *Real-Time Blockchain Accounting System As A New Paradigm*. 41–58.

Singh, A. K., Kumar, V. R.; Dehdasht, G., Mohandes, S. R., Manu, P., & Rahimian, F. P. (2023). Investigating the barriers to the adoption of blockchain technology in sustainable construction projects. Journal of Cleaner Production, 403(March), 136840. https://doi.org/10.1016/j.jclepro.2023.136840

Shoaib, M., Zhang, S., & Ali, H. (2023). A bibliometric study on blockchain-based supply chain: a theme analysis, adopted methodologies, and future research agenda. *Environmental Science and Pollution Research*, *30*(6), 14029–14049). https://doi.org/10.1007/s11356-022-24844-2

Sicilia, M. A., & Visvizi, A. (2019). Blockchain and OECD data repositories: opportunities and policymaking implications. *Library Hi Tech*, *37*(1), 30–42. https://doi.org/10.1108/LHT-12-2017-0276

Suominen, K. (21 June 2022). *Making digital payments to power 21st century trade*. Hinrich Foundation. https://www.hinrichfoundation.com/research/wp/digital/digital-payments-21st-century-trade/

Tan, B. S., & Low, K. Y. (2019). Blockchain as the database engine in the accounting system. *Australian Accounting Review*, *29*(2), 312–318. https://doi.org/10.1111/auar.12278

Tan, W. K. A., & Sundarakani, B. (2021). Assessing blockchain technology application for freight booking business: a case study from technology acceptance model perspective. *Journal of Global Operations and Strategic Sourcing*, *14*(1), 202–223. https://doi.org/10.1108/JGOSS-04-2020-0018

Tandon, A., Kaur, P., Mäntymäki, M., & Dhir, A. (2021). Blockchain applications in management: A bibliometric analysis and literature review. *Technological Forecasting and Social Change*, *166*(February). https://doi.org/10.1016/j.techfore.2021.120649

Tanwar, S., Bhatia, Q., Patel, P., Kumari, A., Singh, P. K., & Hong, W.-C. (2020). Machine learning adoption in blockchain-based smart applications: The challenges, and a way forward. *IEEE Access*, *8*, 474 – 448. https://doi.org/10.1109/ACCESS.2019.2961372

Torky, M., & Hassanein, A. E. (2020). Integrating blockchain and the internet of things in precision agriculture: Analysis, opportunities, and challenges. *Computers and Electronics in Agriculture*, *178*. https://doi.org/10.1016/j.compag.2020.105476

Toufaily, E., Zalan, T., & Dhaou, S. Ben. (2021). A framework of blockchain technology adoption: An investigation of challenges and expected value. *Information and Management*, *58*(3). https://doi.org/10.1016/j.im.2021.103444

Treiblmaier, H., Rejeb, A., van Hoek, R., & Lacity, M. (2021). Intra- and interorganizational barriers to blockchain adoption: A general assessment and coping strategies in the agrifood industry. *Logistics*, *5*(4). https://doi.org/10.3390/logistics5040087

Uddin, M. A., Stranieri, A., Gondal, I., & Balasubramanian, V. (2021). A survey on the adoption of blockchain in IoT: challenges and solutions. *Blockchain: Research and Applications*, *2*(2), 100006. https://doi.org/10.1016/j.bcra.2021.100006

Victor Chukwunweike, E., Anastasia Chi-Chi, O., & Josephine Ofure, C. (2023). E-payment system (Eps) and efficiency of banks in Nigeria. *International Journal of Applied Research in Social Sciences*, *5*(1), 1–13. https://doi.org/10.51594/ijarss.v5i1.440

Wasiq, M., Bashar, A., Akmal, S., Rabbani, M. R., Saifi, M. A., Nawaz, N., & Nasef, Y. T. (2023). Adoption and applications of blockchain technology in marketing: A retrospective overview and bibliometric analysis. *Sustainability (Switzerland)*, *15*(4). https://doi.org/10.3390/su15043279

Xiaoguang, S., Yu, X., & Shaohua, L. (2021). Analysis on the impact of blockchain technology on the accounting profession. *Advances in Economics, Business and Management Research*, *212*, 63–72. https://doi.org/10.37945/cbr.2021.04.08

Yadav, V. S., Singh, A. R., Raut, R. D., & Govindarajan, U. H. (2020). Blockchain technology adoption barriers in the Indian agricultural supply chain: an integrated approach. *Resources, Conservation and Recycling*, *161*. https://doi.org/10.1016/j.resconrec.2020.104877

Yadlapalli, A., Rahman, S., & Gopal, P. (2022). Blockchain technology implementation challenges in supply chains – evidence from the case studies of multi-stakeholders. *International Journal of Logistics Management*, *33*(5), 278–305. https://doi.org/10.1108/IJLM-02-2021-0086

Yang, R., Yu, F. R., Si, P., Yang, Z., & Zhang, Y. (2019). Integrated Blockchain and Edge Computing Systems: A Survey, Some Research Issues and Challenges. *IEEE Communications Surveys and Tutorials*, *21*(2), 1508 – 1532. https://doi.org/10.1109/COMST.2019.2894727

Yermack, D. (2017). Corporate governance and blockchains. *Review of Finance*, *21*(1), 7–31. https://doi.org/10.1093/rof/rfw074

Zakaria, R., Ahmi, A., Ahmad, A. H., & Othman, Z. (2021). Worldwide melatonin research: a bibliometric analysis of the published literature between 2015 and 2019. *Chronobiology International*, *38*(1), 27–37. https://doi.org/10.1080/07420528.2020.1838534

Zhou, F., & Liu, Y. (2022). Blockchain-enabled cross-border e-commerce supply chain management: A bibliometric systematic review. *Sustainability (Switzerland)*, *14*(23). https://doi.org/10.3390/su142315918

Zhou, Y., Soh, Y. S., Loh, H. S., & Yuen, K. F. (2020). The key challenges and critical success factors of blockchain implementation: Policy implications for Singapore's maritime industry. *Marine Policy*, *122*. https://doi.org/10.1016/j.marpol.2020.104265