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Evolutionary Mapping of the Research Landscape and Bibliometric Analysis of Blockchain Technology in Finance

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ABSTRACT

The study examines research on Blockchain technology in the global finance using trends analysis, bibliometric analysis, and literature review using the Elsevier Scopus database from 2016 to 2023. The findings showed that (Blockchain in Financial Management) BCFin research has generated 185 publications comprising 53.5% articles, 45.4% conference proceedings and 1.1% reviews. The subject area analysis revealed three major publications, groupings spanning Computer Science, Engineering, and Decision Sciences. In contrast, the source titles revealed ACM International Conference Proceeding Series, Sustainability Switzerland, and E3S Web of Conferences as the top mediums of publications for BCF in researchers. Stakeholders analysis showed that the top researchers and affiliations for BCFin are Jon M. Truby and Qatar University (Qatar), with 4 and % publications, respectively. The most productive nation on the topic is China, which is largely ascribed to active funding agencies such as the National Natural Science Foundation (NNSF) of China, which has funded 18 publications. Keywords Co-occurrence Analysis revealed that the top three keywords on BCFin are Blockchain, Finance, and Supply Chain Finance. Cluster analysis revealed three (3) clusters comprising 4-8 keywords, 132 links, and a TLS of 866. Based on the keywords, these clusters could be broadly categorised as the following terms: Integrated Business Solutions (Cluster 1), Digital Commerce Infrastructure (Cluster 2), and Decentralized Financial Network (Cluster 3). The findings indicate that BCFin is an active, multidisciplinary, and impactful research area. BCFin has transformed the global financial industry by overcoming trust issues, enhancing transaction security, and improving communication effectiveness, but it still faces challenges like interoperability, system integration, and sustainability.

Keywords: Bibliometric Mapping, Research Landscape, Finance, Blockchain Technology, Supply Chain Management
JEL Classification: G1

1. INTRODUCTION

The concept of blockchain, otherwise termed blockchain technology (BCT), was first introduced by Satoshi Nakamoto in 2008 (Kashyap et al., 2024). BCT is defined as a decentralized digital ledger system that keeps track of transactions between nodes, which guarantees safe and un-hackable storage of data (Kadir et al., 2024). Its main characteristics are immutability,

decentralization, transparency, and security via cryptography (Bhurgri et al., 2024). The author refers to the technique as a distributed public ledger that can be copied across multiple nodes inside a peer-to-peer (P2P) network. Blockchain consists of immutable blocks connected by hashes, nonce, transaction root, and network timestamps (Abu Al-Haija et al., 2023).

According to Jeyabharathi et al. (2020), BCT could be broadly classified into three (3) groups, namely, Public blockchains, Consortium blockchains, and Private blockchains. Public blockchains allow everyone to verify transactions and participate in consensus processes like Bitcoin and Ethereum. However, consortium blockchains allow nodes to choose their authority, with data open or private, whereas Private blockchains restrict participation and have strict authority management (Jeyabharathi et al., 2020). According to Zeba et al. (2023), there is a fourth category of blockchain termed hybrid blockchain, although the extent of association power determines the choice of each class.

At the outset, BCT was largely linked to the financial system, particularly with the advent of smart contracts and digital platforms such as Ethereum (Tiwari, 2023). Over the years, BCT has emerged as one of the world's most innovative and promising technologies (Ajibade et al., 2023; Viriyasitavat et al., 2019). It has also been reported that BCT has significantly transformed the exchange of media and information (Singh and Kim, 2019). Studies have shown that authorization and authentication can be facilitated by BCT independently of any reliable authority (Aggarwal and Kumar, 2021). The blockchain paradigm is gaining momentum because of its distinct benefits and uses. The blockchain paradigm is gaining momentum because of its distinct benefits and uses.

The dawn of blockchain technology (BCT) has greatly transformed various sectors, ranging from the Internet of Things (IoT) (Zubaydi et al., 2023), real estate (Ullah and Al-Turjman, 2023), healthcare (Adeghe et al., 2024) to finance (Wu et al., 2024), among others. The growing significance of blockchain in finance (BCFin) cannot be overemphasized. BCT has unleashed a surge of innovation that keeps reshaping the financial sector, from enabling Decentralized Finance (DeFi) and reinventing asset tokenization to areas that help to transform payment systems and improving transparency (Nguyen, 2023). The study by Chen and Bellavitis (2020) revealed that BCT can reduce transaction costs, generate trust, and empower decentralized platforms, potentially fostering decentralized models in business and finance. The authors also showed that BCT could benefit decentralized finance by transforming modern finance while promoting entrepreneurship and innovative technologies. Lahkani et al. (2020) reported that the integration of BCT into the global B2B supply chain had improved e-commerce profitability and competitiveness by simplifying transactions, providing consistent trade data, improving logistics efficiency, and enhancing digital documentation. The authors emphasize that BCT aids in the creation of secure, decentralized, and efficient databases that enhance the accuracy, reliability, and transparency of payments and transfers.

Schär (2021) explored decentralized finance (DeFi), a blockchain-based financial infrastructure built on Ethereum using smart contracts. The study found that DeFi ensures greater efficiency, transparency, accessibility, and composability, which could provide a more robust financial infrastructure. Kowalski et al. (2021) reported that BCT could boost transaction security, encourage kindness, improve communication effectiveness, and raise predictability in trade finance. Consequently, the trust relationships between trading partners in trade finance can be strengthened. Likewise, the study by Rijanto (2021) examined the use of BCT in supply chain finance and found that it enhances the trust, validity, and data in distributed ledger transactions.

Schulz and Feist (2021) reported that the use of distributed ledger-based systems (DLS) and BCT facilitated transparent transactions and efficient monitoring of climate finance under the Green Climate Fund initiative. However, the authors noted that BCT and DLS may not be able to resolve persistent resource allocation and governance issues. Similarly, the study by Zheng et al. (2022) highlighted challenges with the use of BCT, particularly with facilitating enterprise credit information sharing in supply chain finance. The authors revealed that the application of such BCT-based systems in the supply chain financial credit is prone to such problems as inaccurate information, security issues, and insufficient records. Therefore, they proposed the incorporation of A blockchain-based model consensus techniques for access control and privacy protection, which could, in turn, improve credit reporting efficiency.

The literature review reveals that numerous researchers across the globe have been actively engaged in studies to unearth the multilayered consequences of BCT in order to discover its capacity for tackling inefficiencies, risk mitigation, and liberalising admission to financial services. Despite the numerous publications on the topic, there is currently no publication that has critically explored the research landscape on the application of BCT in global finance. Therefore, this paper presents a comprehensive publications trends analysis, bibliometrics evaluation, and literature review of the research landscape on Blockchain Applications in Finance from 2016 to 2023. The years 2016–2023 represent the period of exponential expansion and mainstreaming of BCT in finance. There was an upsurge in academic production during this time as scholars examined its complexities, real-world applications, and effects on financial systems. In addition, the paper employs bibliometrics to explore the intricate dynamics of BCT applications, finding major themes, intellectual structures, and patterns. Lastly, it presents the ramifications, gaps in the literature, and directions for future research on the BCFin topic.

2. REVIEW OF LITERATURE

This section of the paper presents a review of the benchmark literature on the BCFin research topic. Bradford's Law of Scattering states that the most commonly referenced works in any given field of study or field offer important insights into the major themes, developments, and trends (Desai et al., 2018). Moreover, the law postulates that a tiny percentage of the most often referenced works, usually referred to as the "core articles," are indicative of the most important and influential studies conducted in a particular field (Borgohain et al., 2021). As such, it

is a useful tool for comprehending the dynamics and organization of scientific knowledge. Table 3 shows the benchmark or core publications on the BCFin based on the citation data recovered from the Scopus database.

3. METHODOLOGY

Figure 1 depicts the flowchart methodology adopted to examine the research landscape on blockchain applications in the global financial industry, or BCFin research for short. As observed, the methodology comprises four major stages, including the identification, screening, and analysis of published documents (hereafter termed publications) on the topic indexed in Elsevier's Scopus database. The database is regarded as the most comprehensive repository of scientific abstracts and citations on multiple subject areas worldwide. Stage I involved searching related publications on blockchain applications in global finance using keywords and Boolean operators.

The first search resulted in 237 document results based on the search terms: TITLE ("blockchain" AND "finance*") AND PUBYEAR >2015 AND PUBYEAR <2024 AND PUBYEAR >2015 AND PUBYEAR <2024. However, the results contained numerous unwanted results, such as non-English and non-conventional peer reviews, which necessitated screening to eliminate such items from the dataset. Consequently, screening was performed using the search terms: TITLE ("blockchain" AND "finance*") AND PUBYEAR >2015 AND PUBYEAR <2024 AND (LIMIT-TO [DOCTYPE, "ar"] OR LIMIT-TO [DOCTYPE, "cp"] OR LIMIT-TO [DOCTYPE, "re"]) AND (LIMIT-TO [LANGUAGE, "English"]). The screening process resulted in 185 publications containing only English-language publications comprising articles, conference papers, and reviews.

Lastly, the publications dataset of 185 documents was subjected to bibliometric analysis (BA) and literature review (LR). BA is a widely adopted procedure typically adopted to examine the publication trends and research landscape on any given topic based on published documents indexed in scientific databases. The concept utilises statistical tools to critically examine the metrics of published documents on any given area of research, topic, or subject area (Abuhussain et al., 2023; Zaidi et al., 2023).

Table 1: Top publication sources for blockchain in finance research

Source title	TP	%TP
ACM international conference proceeding series	8	4.32
Sustainability Switzerland	8	4.32
E3S Web of Conferences	5	2.70
Lecture Notes in Networks and Systems	5	2.70
International Journal of Production Economics	3	1.62
International Journal of Production Research	3	1.62
LNCS-B	3	1.62
Advances In Intelligent Systems and Computing	2	1.08
Communications In Computer and Information Science	2	1.08
Computer	2	1.08

LNCS-B: Lecture Notes In Computer Science Including Subseries Lecture Notes In Artificial Intelligence And Lecture Notes In Bioinformatics

The idea has been extensively adopted to explore and highlight the research landscape in multiple fields over the years. Notably, BA has been used to examine the concepts of business research, medical facilities (Kek et al., 2023), and food quality assessment (Lee et al., 2023). Other fields include computer science, waste management (Nyakuma et al., 2021), renewable energy (Adediran et al., 2024), climate change (Ajibade et al., 2023), and alternative energy sources (Nyakuma et al., 2023), among others. In this paper, BA was used to elucidate the stakeholders' productivity, research trends, and future directions for the BCFin research topic. Hence, the software VOSViewer (version 1.6.20) was used to examine the co-authorships, citations, and keyword co-occurrences on the subject.

4. RESULTS AND DISCUSSION

4.1. General Publication and Citation Trends

The total number of publications recovered from the Elsevier Scopus database for the topic was 185 publications. The distribution of document types consists of 99 articles, 84 conference papers, and 2 reviews, which represent 53.5%, 45.4% and 1.1% of the total publications (TP) on the topic.

As observed, the articles account for the highest number of publications/document types, followed by conference papers and reviews in decreasing order. The findings show a general preference for articles compared to the other document types, which may be due to the academic prestige or scholarly excellence associated with publishing in peer-reviewed, high-quality, and impactful mediums of publication. Figure 2 shows the general publications and citation trends for BCFin Research based on data recovered from Scopus.

Figure 1: Flowchart methodology for identification, screening, and analysis of publications on blockchain in finance research

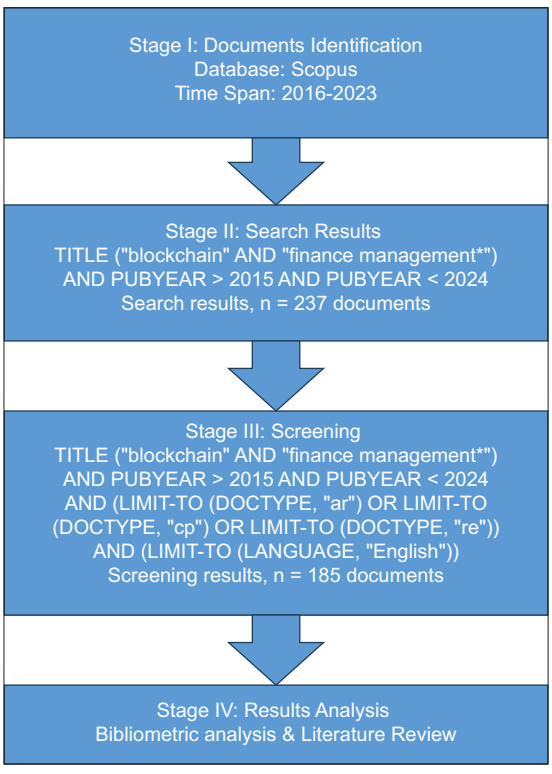


Figure 2: General publications and citations trends for blockchain in finance research

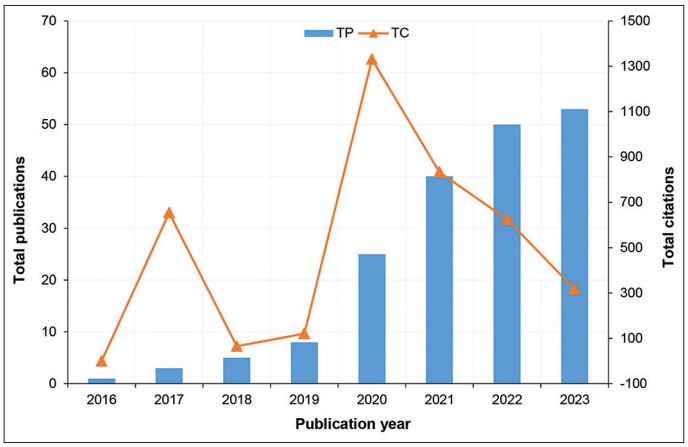
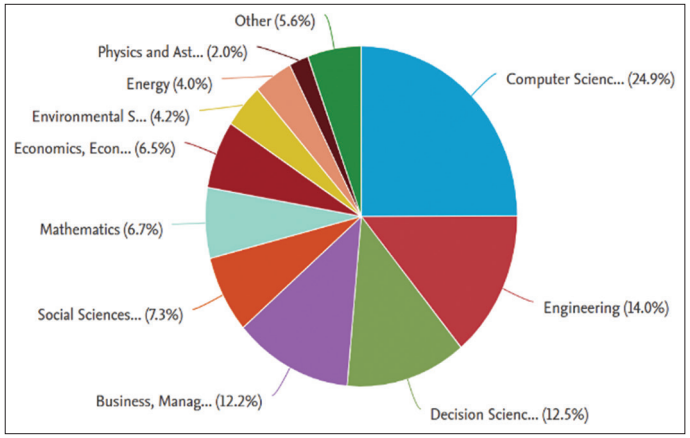


Figure 3: Subject area distribution of blockchain in finance publications



The number of publications on the topic showed an incremental pattern, increasing from 1 to 53 publications (23.125 on average per year). This pattern indicates not only an increase in publications but also interest in the research, development, and deployment of BCT (BCT) in the financial industry across the globe. The growth in publications on the topic has also resulted in a concomitant increase in the citations on the subject, as shown in Figure 2. As observed, the number of citations showed sharp increases between 2016 and 2018 as well as 2019 and 2023. The highest citations during these two peak citation periods were 654 and 1331, whereas the total citations (TC) on the topic is 3946 (or 493.25 citations on average per year). Overall, the analysis shows that BCFin research is characterised by high TP and TC metrics, which may suggest that it is a highly impactful area of research whose interest could further increase in the coming years.

The high TP and TC metrics may be ascribed to the source titles and subject areas of BCFin publications indexed in Scopus. Table 1 shows the top 10 source titles for publication in BCFin research over the years from 2016 to 2023, based on TP (total publications) and percentage TP (%TP). As observed, the top sources have published a total of 41 documents or 22.16% of TP or 4.10 documents or 2.22% on average over the years. Further analysis shows that the top source title is ACM International Conference Proceeding Series, followed by Sustainability (Switzerland) and E3S Web of Conferences. The data also shows that 2 out of the top 3 publications outlets on the topic are conference proceedings. This observation indicates authors in the field also prioritise the rapid dissemination of their findings through conference proceedings such as ACM and E3S.

As earlier surmised, the high TP and TC metrics could also be due to the subject area distributions of the publications on BCFin in Scopus. As observed in Figure 3, the top 3 subject areas on the topic (publications counts) are Computer Science (112), Engineering (63), and Decision Sciences (56). The high TP metrics indicate that computer scientists, engineers, and decision scientists have all been collaborating to design, develop, and implement safe and scalable blockchain-based computer systems for application in the global financial industry. These partnerships have helped to greatly enhance the efficiency, transparency, and security of financial transactions, which in turn fosters innovative ideas for the decentralization of finance.

The top subject areas account for 51.4% of the TP, which indicates these are the core areas of BCFin. Further analysis suggests that the application of blockchain technologies in finance primarily involves computer science, engineering, and decision sciences, which has generated a significant number of publications and citations on this topic. The strong focus on BCFin research has also resulted in numerous highly cited publications, as outlined in Table 2. The top 10 most highly cited publications on the topic have garnered a total of 1822 citations (or 182.2 on average per publication). The most cited publication on the subject is "BCT in Finance," published by Treleaven et al. (2017) in the journal "Computer" with 353 citations. In second place is "Blockchain disruption and decentralized finance: The rise of decentralized business models," published in the "Journal of Business Venturing Insights" by Chen and Bellavitis (2020), which has been cited 310 times. Another critical publication on the topic is "BCT: Transforming Libertarian Cryptocurrency Dreams to Finance and Banking Realities" by Eyal (2017), published in "Computer" with 238 citations. The high citation metrics indicate the high impact nature of the topic, as well as high interest by the various stakeholders who have contributed to the field of the overs.

The section will identify and highlight the nature, types, productivity, and impact of the various stakeholders on the topic.

4.2. Stakeholder Profile Characteristics

In this study, the stakeholders' analysis is based on the authors/researchers, affiliations, countries, and funding organisations related to the topic. This analysis provides critical insights into the nature, productivity, and impact of stakeholders actively engaged in the field over the years.

4.2.1. Authors

Figure 4 shows the top 5 authors/researchers actively engaged in BCFin research across the globe. The data shows that from 2016 to 2023, the top researcher on the topic is Jon M. Truby, with 4 publications. The second position is held by four others, namely Malcolm Campbell-Verduyn, Jing J Chen, Andrew M. Dahdal,

Table 2: Most cited publications on blockchain in finance research

References	Study title	Source title	Cited by
Treleaven et al. (2017)	BCT in Finance	Computer	353
Chen and Bellavitis (2020)	Blockchain disruption and decentralized finance: The rise of decentralized business models	Journal of Business Venturing Insights	310
Eyal (2017)	BCT: Transforming Libertarian Cryptocurrency Dreams to Finance and Banking Realities	Computer	238
Du et al. (2020)	Supply Chain Finance Innovation Using Blockchain	IEEE Transactions on Engineering Management	202
Schär (2021)	Decentralized finance: on blockchain-and smart contract-based financial markets	Federal Reserve Bank of St. Louis Review	176
Poongodi et al. (2020)	Prediction of the price of Ethereum blockchain cryptocurrency in an industrial finance system	Computers and Electrical Engineering	149
Zhang et al. (2020)	The challenges and countermeasures of blockchain in finance and economics	Systems Research and Behavioural Science	112
Lahkani et al. (2020)	Sustainable B2B E-commerce and blockchain-based supply chain finance	Sustainability (Switzerland)	103
Li et al. (2020)	Blockchain-enabled logistics finance execution platform for capital-constrained E-commerce retail	Robotics and Computer-Integrated Manufacturing	92
Chen et al. (2020)	A blockchain-driven supply chain finance application for the auto retail industry	Entropy	87

and Meriem Kherbouche, each with 3 publications to their name. The productivity of researchers is typically ascribed to numerous factors such as research interests, funding availability, and research affiliations, among others (Wong et al., 2021). The impact of the latter is examined in section b.

4.2.2. Affiliations

Figure 5 shows the top 5 affiliations or research institutions associated with BCFin research between 2016 and 2023 based on Scopus data. Research affiliations provide a research base for academics to conduct their research (Jayeola et al., 2022; Zaidi et al., 2023). In addition, these institutions also offer financial support, research facilities, and an enabling environment for the researchers. In the field of BCFin, the top beneficiaries of these support schemes and structures are Qatar University (Qatar), which has 5 publications, and Rijksuniversiteit Groningen (Netherlands), which has 4 publications. In third place are the Chinese universities Fudan University, Peking University, and Shanghai University, each with 3 publications. The data shows that these are the top 5 most prolific affiliations, with China dominating the list with 3 universities. The presence of the trio indicates that China is also a very active nation in the research landscape. The impact of China is further examined in the section c.

4.2.3. Countries

Figure 6 shows the data on the top 5 countries actively involved in BCFin research based on Scopus data from 2016 to 2023. As observed, the most prolific nation in the research landscape is China, which has 88 publications. India follows this lead with 30 publications, and lastly, the United States with 15 publications. Other notable contributors to the knowledge base of the research landscape include the United Kingdom and Germany, which have 12 and 8 publications, respectively. The findings indicate that China dominates the landscape in terms of productivity, which confirms the earlier submission of its dominance. China's productivity signals the nation's strategic intention and commitment to develop and deploy BCT to address the challenges in the nation's financial sector. According to various studies, China is actively involved in the industry to ensure it is strategically placed in that prime position

Figure 4: Top authors involved in blockchain in finance research (2016-2023)

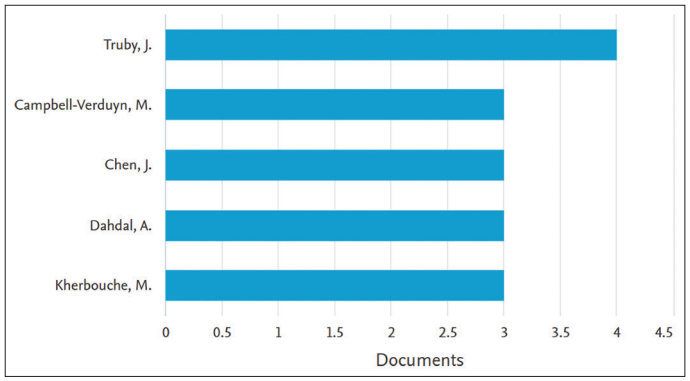
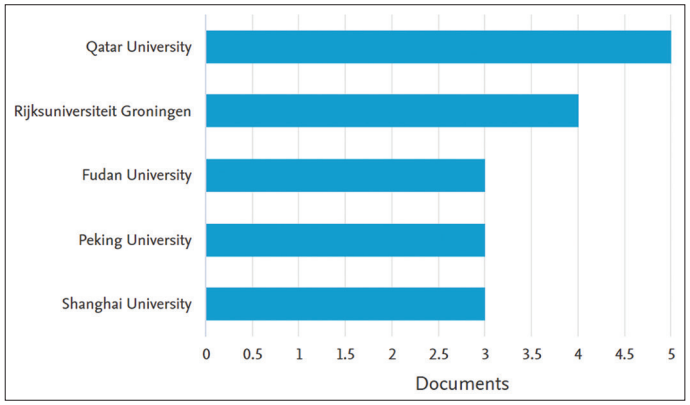


Figure 5: Top affiliations linked to blockchain in finance research (2016-2023)



in the field, as well as utilising the technology to not only address financial challenges but also protect the sector from cybersecurity and cyberwarfare (Lee and Kim, 2021; Liu, 2018; Wang et al., 2020).

4.2.4. Funding organisations

Figure 7 shows the top 5 funding organisations associated with BCFin research according to the data from Scopus between 2016 and 2023.

Figure 6: Top countries actively linked to blockchain in finance research (2016-2023)

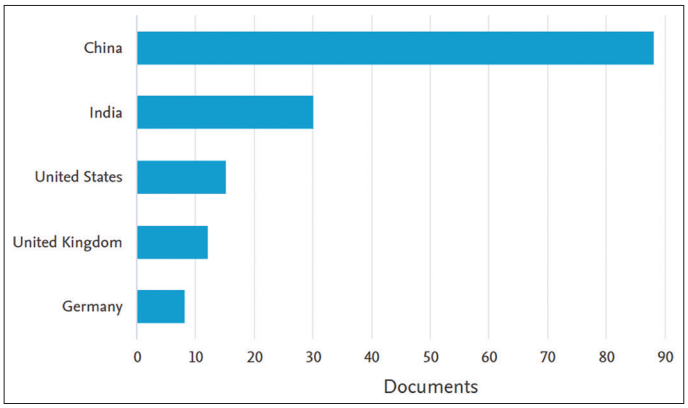
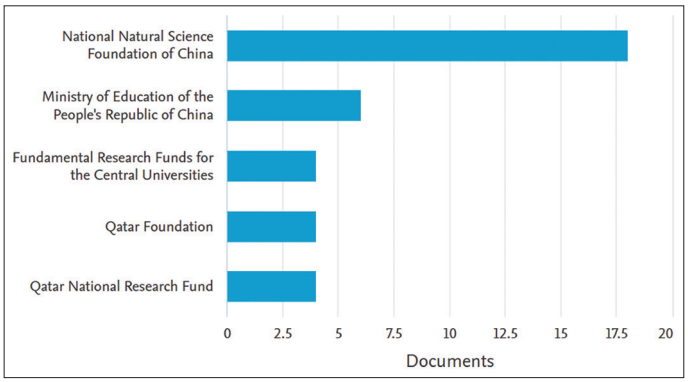


Figure 7: Top funding organisers linked to blockchain in finance research (2016-2023)



Funding organisations are a crucial part of the research landscape, as the funding they provide helps to support researchers and their affiliations (Otitolaiye et al., 2022; Wong et al., 2020). Funding agencies also provide non-monetary assistance in the form of research equipment, collaboration links, and scientific knowledge for researchers to grow and develop their research interests (Otitolaiye et al., 2024; Wong et al., 2022). As shown in Figure 7, the most active funder of BCFin research is the National Natural Science Foundation (NNSF) of China, with 18 publications. This lead is followed by the Ministry of Education of China with 6 publications, whereas the Fundamental Research Funds for the Central Universities, also based in China, has 4 publications. The data shows that the top 3 funders of research in this field are based in China, which further bolstered the point that the nation is a dominant leader. However, the Qatar Foundation and Qatar National Research Fund occupy 4th and 5th place on the leader board, with 4 publications. Overall, it can be surmised that China and Qatar dominate the funding landscape on BCFin research, which accounts for the high research activity of the nation's researchers in the landscape.

4.3. Social Network Patterns

The productivity of stakeholders in any research landscape can also be ascribed to collaborations, which could be in the form of co-authorships. As a result, the network of collaborators could be used as a measure of the level of their productivity. In this study, the analysis of co-authorship among researchers and nations was examined to elucidate the impact of collaborations/co-authorships.

4.3.1. Co-authorship analysis

Figure 8 shows the visualisation map (VM) for the author-based network that has co-authored or collaborated on 2 or more published documents. The results showed that 39 authors satisfied this threshold out of a total of 508 authors who have worked on the topic. However, further analysis shows that only 11 of the 39 (i.e., 28.21%) have published co-authored papers together in the network, which resulted in 4 clusters, each containing 2-3 items. Based on the VM, Chen J, Kherbouche M, and Molnar B. have the highest total link strength of 6, which indicates these are the most influential authors on the topic. Nonetheless, the results showed that productivity in the BCFin research landscape is not largely due to collaboration but other factors such as research interests, affiliation focus, and or the national research policy.

Figure 9 shows the visualisation map for the co-authorship network among participating countries in the BCFin research landscape. The VM shows that 8 out of a total of 51 countries have co-authored 3 or more publications, which resulted in 2 clusters comprising 3-5 countries along with 16 Links and a TLS of 28. The largest cluster consists of India, China, Italy, and Qatar, among others, whereas China, Hong Kong, and the US make up the smallest cluster. Based on the TLS criteria, China, the US, and India have the highest impact, with values of 13, 11, and 8, respectively.

The results indicate that the productivity of the most prolific nations, China, India, and the US, is largely due to co-authorships through various collaborations. The data shows that numerous researchers in China have co-authored papers with their peers, as evidenced by the thick link between the US and Hong Kong. Strong links can also be observed between the US and India, which indicates high collaboration between the nations.

4.3.2. Keywords co-occurrence

The KCO analysis is an important aspect of analysing the research landscape in any given field of study or research (Ajibade et al., 2023). It is also an important approach for identifying and examining the various research hotspots and or thematic areas in any field (Otitolaiye and Abd Aziz, 2023). As such, it can be used to gain insights into the current status and outlook on future studies (Tan et al., 2023). Moreover, it is considered an important approach for identifying and examining the various research hotspots and or thematic areas in any field. In this study, KCO analysis was performed using the VOSViewer software. Figure 10 provides the visualisation maps for the keywords co-occurrence on BCFin Research in the literature.

The VM shows that 21 keywords out of a total of 1156 have been cited a minimum of 10 times. Further analysis shows that the top 3 keywords (Total Occurrences/Total Link Strength) are Blockchain (162/520), Finance (72/309), and Supply Chain Finance (55/301). The KCO analysis shows that BCT has helped to transform the areas of finance and supply chains through the provision of computer-aided tools. For example, BCT provides enhanced security, lower costs, limited intermediaries, and decentralized ledgers for application in the financial industry. BCT has revolutionized financial operations by automating processes

Figure 8: Network visualisation map for co-authorship among blockchain in finance authors

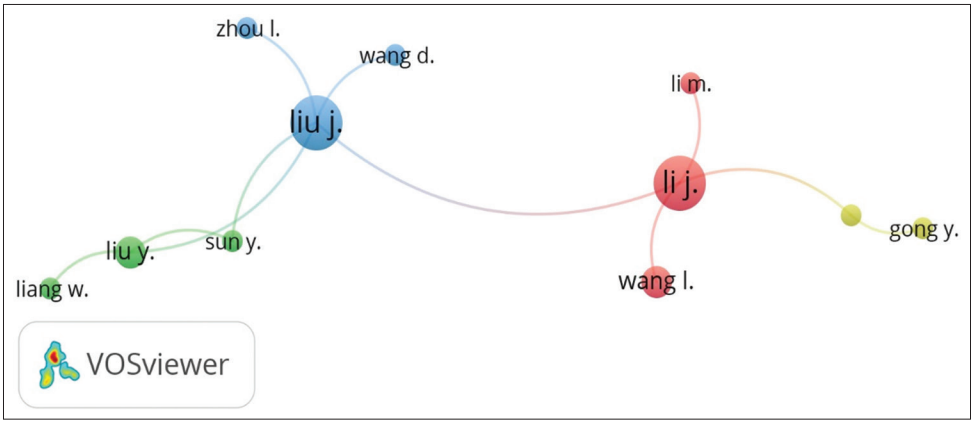
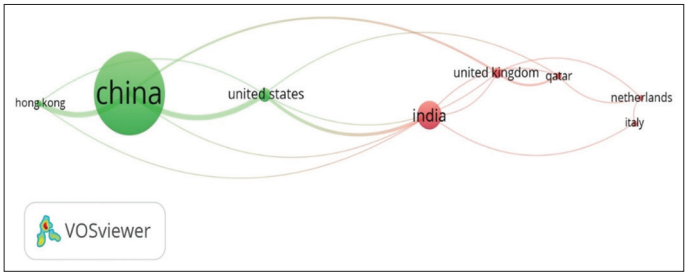


Figure 9: Network visualisation map for co-authorship among blockchain in finance participating countries



like smart contracts, which boost liquidity and trust, and altering traditional monetary systems.

Cluster analysis revealed three (3) clusters comprising 4-8 keywords, as well as 132 links, and a TLS of 866. Cluster 1 consists of the following keywords: Cryptography, finance, information asymmetry, risk management, small and medium-sized enterprises, supply chain finances, supply chain management, and supply chains. On the other hand, Cluster 2 consists of blockchain, commerce, fintech, smart contracts, trade finance, financial institutions, and distributed ledger. Lastly, Cluster 3 is made up of bitcoin, BCT, cryptocurrency, and financial services.

Based on the keywords, these clusters could be broadly categorised as the following terms:

- Integrated Business Solutions - Cluster 1
- Digital Commerce Infrastructure - Cluster 2
- Decentralized Financial Network - Cluster 3.

Based on the keywords "cryptography, finance, information asymmetry, risk management, small and medium-sized enterprise, supply chain finances, supply chain management, and supply chains" in Cluster 1, the terms could be broadly categorised as "Integrated Business Solutions" or IBS for short. IBS is a holistic approach that tackles issues with finance, supply chain management, risk management, and SMEs in corporate operations. It combines features and technology to optimize workflows, boost productivity, raise performance, and make decision-making and cooperation easier. On the other hand, the keywords in Cluster 2 can be broadly described as "Digital Commerce Infrastructure" or DCI. The term "Digital Commerce Infrastructure" refers to a network of technologies that streamlines trade finance, payment, distributed ledgers, smart contracts, and fintech solutions into commerce platforms. In digital commerce, it guarantees efficiency, security, and transparency while updating services and improving transaction security.

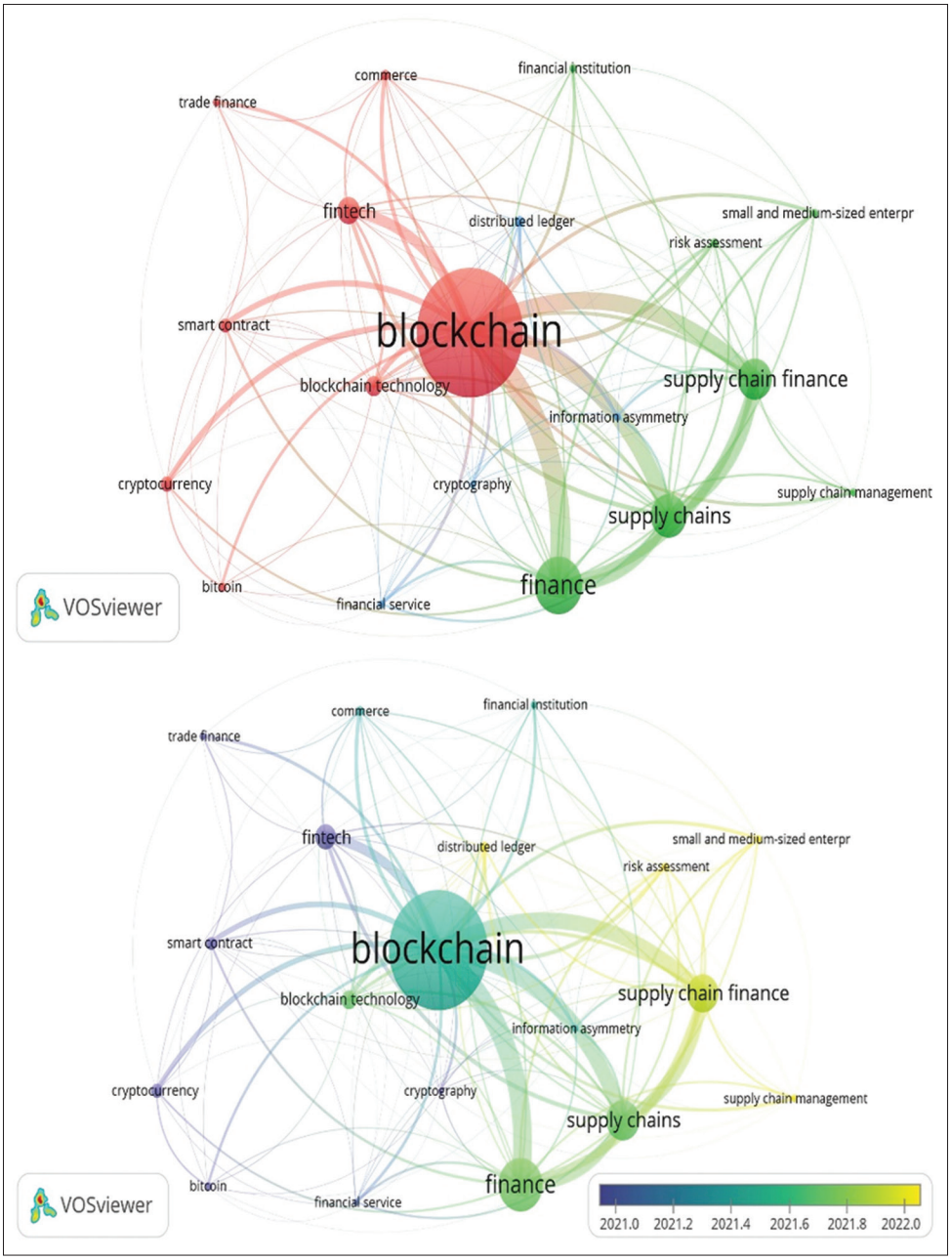
The keywords in cluster 3 describe the concept of "Decentralized Financial Network" or DFN. The phrase "Decentralized Financial Network" (DFN) describes a system in which financial transactions, services, and assets are managed independently of a central authority and are related to "Bitcoin, BCT, cryptocurrency, financial service." Peer-to-peer transactions and financial services can be facilitated by platforms and protocols based on BCT, such as Bitcoin and other cryptocurrencies, eliminating the need for middlemen like banks or financial institutions. Through this network, users can move money amongst one another, use lending and borrowing services, swap digital assets securely and openly, and carry out other financial transactions. In contrast to conventional centralized banking systems, this network's decentralized structure guarantees higher autonomy, privacy, and resilience.

Overall, the cluster/thematic analysis has shown that the scientific growth and technological development of the research landscape on BCFin has largely occurred in three broad categories, namely Integrated Business Solutions (IBS) Cluster 1; Digital Commerce Infrastructure (DCI) Cluster 2; and Decentralized Financial Network (DFN) Cluster 3. Blockchain applications in the financial sector, including Digital Commerce Infrastructure (DCI), Decentralized Financial Network (DFN), and Integrated Business Solutions (IBS), aim to improve efficiency, transparency, and security in internal business operations. DCI facilitates digital trade and transactions, while DFN enhances accessibility and anonymity, allowing peer-to-peer financial services and reducing middlemen.

4.4. Research Gap and Future Studies

BCT has the potential to transform the financial industry. However, there are still many unanswered questions. As such, issues like interoperability, system integration, financial inclusion, risk management, sustainability, long-term viability, and operational and technical problems need to be addressed. Hence, these challenges present research gaps that need to be addressed by

Figure 10: Visualisation maps for all keywords co-occurrence on blockchain in finance research



current and future stakeholders in the research landscape across the globe.

Scalability is a major challenge, particularly for high-frequency transactions or large-scale financial networks. Therefore, stakeholders need to explore and examine innovative approaches to address scalability. For example, sharding or layer-two protocols are methods that need to be tackled. Furthermore, since BCT functions in a complex supervisory environment, regulatory difficulties represent another crucial area. Security and privacy issues are equally important, especially with permissionless networks. In addition, research should concentrate on creating strong privacy-preserving methods in order to safeguard confidential financial data and utilise the transparency and audibility that is typically associated with BCT.

Another area that needs to be addressed is that of the interoperability of BCT with conventional financial systems across the globe. The main areas of research that could be addressed under this banner include cross-chain communication protocols, interoperable smart contracts, and interoperability standards. Other notable areas of research include user experience and adoption. Further studies are also required to improve trust and comprehend the viewpoints of users. Research is also needed in the area of integration with existing financial systems to address operational and technical problems. Hence, studies need to focus on cost, practical, and

Table 3: Review of Core/Benchmark Literature on blockchain in finance research

References	Study objectives	Findings
Treleaven et al. (2017)	The study examined the application of BCT in the financial sector	The findings showed that although there are still obstacles to overcome, the financial sector is embracing BCT. This submission is largely ascribed to BCT's promise, as an interview with international experts for a special edition noted. Overall, the study showed that the application of BCT and fintech has significantly transformed the banking industry
Eyal (2017)	The study explored the potential of BCT in transforming Libertarian cryptocurrency dreams into finance and banking realities	The author addresses the inadequacies in transaction throughput, security, and privacy in the FinTech industry by examining how blockchain research beyond Bitcoin addresses these issues
Till et al. (2017)	The study explores the potential of cryptocurrencies to finance universal health coverage, leveraging BCT for global health equity.	The study showed that BCT and cryptocurrencies have the potential to completely transform the funding of healthcare globally, advancing universal health coverage and health equity. This might entail open marketplaces for healthcare data, greater security, decreased fraud, and innovative international financing arrangements. It concludes by recommending that healthcare providers, governmental agencies, and aid organizations such as the World Bank Group, IMF, and WHO must adapt to these developments soon
Chen and Bellavitis (2020)	The study explores the impact of blockchain on decentralized finance and the rise of decentralized business models.	The study reported that BCT can reduce transaction costs, generate trust, and empower decentralized platforms, potentially fostering decentralized business models. It also showed the benefits of decentralized finance, identifies existing business models, and evaluates potential challenges. It concludes by suggesting that decentralized finance can reshape modern finance while fostering entrepreneurship and innovative technologies
Du et al. (2020)	The study explored the implementation of BCT in the supply chain finance sector.	The study showed that digital currencies like Bitcoin (based on BCT) offer decentralization, stability, security, anonymity, and nontampering. As such, it is increasingly used in supply chain finance, where core enterprises manage information flow, logistics, and capital flow. A novel supply chain financial platform based on BCT was also proposed to address non-trust, improve efficiency, reduce costs, and provide better financial services. The platform uses homomorphic encryption to protect user privacy in sensitive data scenarios
Poongodi et al. (2020)	The study analyzed the prediction of the Ethereum blockchain cryptocurrency price in an industrial finance system	The study showed that the popularity of cryptocurrency had prompted further research aimed at predicting its price using machine learning methods like linear regression and support vector machine. The study used a time series of daily ether cryptocurrency closing prices and different window lengths. The proposed model, which uses both methods, showed a higher accuracy (96.06%) than the linear regression method (85.46%)
Zhang et al. (2020)	The study analyzed the potential challenges and potential countermeasures of blockchain in finance and economics	The study revealed that BCT integrates financial resources, enhancing data analysis and processing. In addition, it develops novel financial formats and service models that improve efficiency and quality. It can identify customer credit conditions, restructure credit systems, and enhance cross-border payment efficiency. However, it also presents challenges for the development of financial industries. This paper analyzes blockchain's application in finance and economics
Lahkani et al. (2020)	The study explored the potential of sustainable B2B e-commerce and blockchain-based supply chain finance	The study revealed that BCT has been integrated into the global B2B supply chain. As a result, e-commerce profitability and competitiveness have improved. It simplifies transactions, provides consistent trade data, and improves logistics efficiency by 74% and digital documentation by 75%. Blockchain creates a secure, decentralized database, increases payment speed, and ensures data transfer reliability and transparency
Li et al. (2020)	The study aims to explore the use of blockchain-enabled logistics finance execution platforms in the e-commerce retail sector with limited capital	The study suggests a blockchain-enabled logistics finance execution platform (BcLFEP) to help SMEs meet financing requirements for logistics finance in e-commerce retail, using object-oriented methodology, a hybrid smart contract, and a multi-agent system

(Contd...)

Table 3: ***(Continued)***

References	Study objectives	Findings
Chen et al. (2020)	The study aims to explore a blockchain-driven supply chain finance application for the auto retail industry	BCautoSCF, a Blockchain-driven supply chain finance platform, offers a reliable, efficient system for the auto retail industry. It has over 600 active users and services across 21 Chinese provinces, demonstrating its feasibility in traditional finance
Chang et al. (2020)	The study explores the potential paradigm shift in using letters of credit through blockchain-enabled trade finance innovation	The study showed the potential of BCT in trade finance, arguing that centralized systems have limitations and vulnerabilities, and suggests future research on trade-related topics
Schär (2021)	The study aims to explore the concept of decentralized finance, specifically its application in blockchain- and smart contract-based financial markets	The paper showed that DeFi is a financial infrastructure built on Ethereum using smart contracts to replicate existing services. While it presents risks, it offers efficiency, transparency, accessibility, and composability. DeFi's building blocks include token standards, decentralized exchanges, decentralized debt markets, blockchain derivatives, and on-chain asset management protocols. It could contribute to a more robust financial infrastructure
Kowalski et al. (2021)	The study aims to investigate the relationship between BCT and trust dynamics in trade finance	The study found that by boosting transaction security, encouraging kindness, improving communication effectiveness, and raising predictability, BCT can strengthen trust relationships between trading partners in trade finance. This study emphasizes the consequences for industry practice and research
Osmani et al. (2021)	The study aims to analyze the potential of Blockchain in the banking and finance sector, focusing on its cost, benefit, risk, and opportunity aspects	This study demonstrated the use of BCT in the banking and financial industries, outlining its advantages, possibilities, expenses, dangers, and difficulties. Compared to other areas, the study shows that these sectors have made relatively little contribution to the use of blockchain. The results offer managers and decision-makers useful implications for comprehending the benefits and services offered by BCT, along with plans and initiatives for developing successful blockchain applications
Dong et al. (2021)	The study explores the implementation of centralization and blockchain in the operations strategy for supply chain finance with asset-backed securitization	The study explores SCF using blockchain and ABS for centralized operations. It emphasizes the importance of avoiding original channels for expensive goods and the impact of BCT on manufacturing prices
Rijanto (2021)	The study aims to analyze the implementation of BCT in supply chain finance	The article demonstrated the acceptance of BCT in SCF through an analysis of thirty actual application examples. Trust, validity, and distributed ledger transaction data are the primary factors driving blockchain adoption, according to the report. Blockchain technology is a useful tool for automating global supply chain SCF processes since smart contracts facilitate quick and simple transactions. The study emphasizes BCT's advantages for SCF
Caldarelli and Ellul (2021)	The study explores the blockchain oracle problem in decentralized finance using a multivocal approach	The study aims to identify the DeFi oracle problem and propose solutions, emphasizing the need for financial incentives and standardization to address the specific challenges of DeFi, a concept aiming to replace traditional financial products with transparent, trustless protocols
Schulz and Feist (2021)	The study aims to explore the use of BCT for innovative climate finance under the Green Climate Fund	The study suggests that distributed ledger-based systems and blockchain technology offer the potential for transparent transactions and efficient monitoring in climate finance but may face political and technological challenges and are not standalone solutions for resource allocation and governance
Jiang et al. (2022)	The study aims to analyze a trust transitivity model for small and medium-sized manufacturing enterprises using blockchain-based supply chain finance.	The study found that low trust and high demand present funding issues for small and medium- SMMEs. For SMMEs, SCF has emerged as a critical source of funding; yet, existing systems find it difficult to extend high credit to Tier 2 through Tier N suppliers. BCT has overcome trust difficulties and changed supply chain financing. Considering both direct and indirect trust, this paper suggests a trust transitivity model based on blockchain-issued electronic payment vouchers. By addressing financial challenges and confirming its rationality through numerical analysis, the model seeks to assess the trust of SMMEs
Zheng et al. (2022)	The study aims to explore the use of BCT to facilitate enterprise credit information sharing in supply chain finance	The research highlighted challenges in the supply chain financial credit system due to inaccurate information, security issues, and insufficient records. A blockchain-based model incorporating consensus techniques for access control and privacy protection can improve credit reporting efficiency

(Contd...)

Table 3: ***(Continued)***

References	Study objectives	Findings
Qin et al. (2023)	The study explores the role of the blockchain market and green finance in China's efforts towards carbon neutrality	The research emphasized the influence of green finance and the blockchain industry on China's carbon neutrality. It examines the relationships between these three sectors using a time-varying parameter-stochastic volatility-vector auto-regression model. The findings indicate that while green financing promotes carbon neutrality more tenaciously, the blockchain market stimulates it. The results imply that China can use these tactics to meet its carbon neutrality goal

BCT: Blockchain Technology, DeFi: Decentralized finance, SCF: Supply chain finance, ABS: Asset-backed securitization, SCF: Supply Chain Finance, SMME: Sized manufacturing firms

sustainable approaches to improve financial inclusion, as risk management in blockchain-based financial systems necessitates continuous work.

5. CONCLUSION

The paper examined the research landscape on BCT applications in the global financial sector. Hence, the study employed the three-pronged approach of publication trends analysis, bibliometric analysis, and literature review of the BCFin research over the years from 2016 to 2023. The search for publications in the Scopus database revealed 185 publications comprising articles, conference proceedings, and reviews. The subject area, source titles, and highly cited publications analyses revealed that BCFin is an active, multidisciplinary, and impactful research area. The publications were found to span Computer Science, Engineering, and Decision Sciences, which are published in high-impact journals such as Sustainability, International Journal of Production Economics, and International Journal of Production Research. The stakeholders profile analysis revealed that numerous authors, affiliations, and countries have been actively involved in BCFin research, which indicates that it is a research area with high impact.

The high publications and citation metrics observed for the stakeholders were largely ascribed to funding from large organisations based in China and Qatar. Another critical factor was adjudged to be due to collaborations, which was evident in the co-authorship analysis, particularly among authors and nations actively engaged in the field. Keywords co-occurrence analysis revealed that the top 3 keywords (based on Total Occurrences/Total Link Strength) on the topic are Blockchain (162/520), Finance (72/309), and Supply Chain Finance (55/301). The cluster analysis revealed three (3) clusters comprising 4-8 keywords, as well as 132 links, and a TLS of 866. Based on the keywords, the three clusters could be broadly categorised as the following terms: Integrated Business Solutions (Cluster 1), Digital Commerce Infrastructure (Cluster 2), and Decentralized Financial Network (Cluster 3).

The review of the literature suggests that BCT has transformed the global financial industry by overcoming trust issues and transforming supply chain financing. It has also helped to enhance transaction security, communication effectiveness, and predictability, thereby improving e-commerce profitability and competitiveness. BCT simplifies transactions, provides consistent trade data, and reduces costs. However, there are still many unanswered questions related to the topic. Therefore, it is necessary to address concerns like interoperability, system integration, financial inclusion, risk management, sustainability, long-term viability, and operational and technological issues. As a result, these issues create research gaps that future and existing global research landscape players must fill.

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