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A Bibliometric Analysis of Blockchain Research in Supply Chain Management

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Abstract:

Blockchain technology has garnered increasing research attention because of its potential to transform supply chain management (SCM) through enhanced transparency, security, and efficiency. This study performed a bibliometric analysis of the emerging body of literature on the intersection of blockchain technology and SCM to elucidate the intellectual structure, knowledge diffusion patterns, and research trajectories within this field. A dataset of 2,500 English-language articles published between 2020-2023 was retrieved from Dimensions and analyzed using VOSviewer and Bibliometrix. The findings revealed that the research landscape focused predominantly on technical topics grounded in computer science, with an emerging interest in supply chain applications. Bibliographic coupling revealed clusters of literature on core blockchain development, implementation challenges, and healthcare use cases. The citation analysis identified influential contributors and geographic concentrations of research productivity in China and East Asia. While currently anchored in technical disciplines, blockchain-SCM research displays a burgeoning interdisciplinarity. This study provides a multidimensional perspective on the topography and evolution of this rapidly developing domain. These insights will orient scholars and practitioners to high-impact contributions and productive directions for future blockchain integration in SCM contexts.

Keywords: *Blockchain, supply chain management, bibliometric analysis, knowledge diffusion, research trends*

1. Introduction

The advent and maturation of blockchain technology has opened new frontiers for enhancing supply chain management (SCM) through the introduction of decentralized, immutable ledgers for tracking transactions. This convergence harbor immense potential to mitigate pressing challenges related to counterfeiting, traceability and operational efficiency. Consequently, research aimed at exploring and evaluating blockchain applications in SCM has surged. This renders a systematic bibliometric analysis of this burgeoning literature imperative.

Blockchain constitutes a decentralized, cryptographically secure ledger system that immutably records transactions through distributed consensus mechanisms. Its defining features include distributed verification, cryptographic security and sequential, interconnected blocks, which collectively underpin data integrity and transparency. Integration of blockchain within SCM ecosystems introduces new supply chain dynamics centered around real-time tracking, enhanced verification, strengthened data security and reduction of fraudulent activities, thus engendering greater trust and transparency. However, such integration also entails surmounting technical complexities, regulatory uncertainties and organizational impediments.

This bibliometric analysis will employ citation and network analysis to illuminate the scholarly landscape within blockchain-enabled SCM research. It will address the following key questions:

RQ1: What are the main research themes and topics within the literature?

RQ2: Who are the leading authors and which are the foundational publications?

RQ3: How has the discourse evolved temporally and what future directions can be discerned?

Through rigorous application of bibliometric techniques, this study aims to elucidate the seminal contributions, key authors, collaborative networks and developmental arc characterizing research on blockchain-SCM integration. Identification of extant gaps will inform future research avenues at the nexus of blockchain technology and SCM. Overall, this bibliometric analysis seeks not only to review the current state of research, but also catalyze further scholarly progress within this dynamic domain.

2. Literature Review

Blockchain technology, with its decentralized, transparent, and immutable properties, has emerged as a potentially transformative force in supply chain management. This review synthesizes the evolving academic discourse surrounding blockchain integration in supply chains, distilling prevalent themes, challenges, and future directions. The increasing application of blockchain in supply chain settings appears to be driven by its capacity to address enduring inefficiency, fraud, and information asymmetry (Saberi et al. 2018; Antonucci et al. 2019). Leveraging blockchain's inherent attributes may markedly improve supply chain traceability, enabling comprehensive tracking from origin to consumer (Sultana et al., 2022). Such traceability is particularly relevant in sectors such as agri-food, where blockchain transparency can potentially augment food safety and deter fraud (Montgomery et al. 2020).In addition, a blockchain's decentralized ledger may promote supply chain transparency and coordination between stakeholders by mitigating information asymmetry (Francisco & Swanson, 2018). Blockchain also facilitates supply chain digitalization, with implications for provenance and sustainability (Cole et al., 2019).Despite its potential, blockchain integration in supply chain settings faces significant barriers. Small and medium-sized enterprises (SMEs) encounter adoption obstacles related to limited resources and technical expertise (Alimohammadlou& Alinejad, 2023). Security and privacy problems exist because of the open distributed nature of blockchain, underscoring the need for robust encryption (Kaur et al., 2022). Successful implementation necessitates extensive training and adaptation, given the nuances of the technology (Difrancesco et al., 2022).The growing prevalence of blockchain in the supply chain literature points to its potential for enhancing efficiency, security, and sustainability. However, realizing these benefits requires the navigation of challenges posed by adoption barriers, data privacy, and technological nuances. As the discourse evolves, stakeholders must collaboratively optimize the blockchain's advantages while mitigating its risks. From this review, promising avenues have emerged for deeper bibliometric analyses examining interdisciplinary approaches and collaboration networks in blockchain-enabled supply chain research.

3. Research Methodology

This study employs a quantitative bibliometric approach to systematically analyze recent literature on blockchain applications in supply chain management. Guided by standards of academic rigor, the methodological framework entails a research design, data collection, sampling, and analytical approach. The Dimensions database was used to retrieve a representative sample of 2500 English-language articles from to 2020-2023. Vosviewer facilitated network visualization (Van Eck, N., & Waltman, L. (2010)) while Bibliophagy enabled citation metrics to support a phased analytical protocol (Herrera-Viedma, E.et al. (2020)). This protocol encompasses descriptive analysis, thematic mapping, network analysis, and citation scrutiny to discern influential contributions. Overall, the methodological rigor underpinning this bibliometric study intends to provide a comprehensive, insightful perspective on the emerging literature on the nexus between blockchain technology and supply chain management.

4. Analysis and findings:

4.1:-Trends in publication

The data presented in Fig.1 reveal discernible publication trends in the scholarly literature on blockchain technology applications in supply chain management over the period 2020-2023. Preliminary analysis indicates substantive overall growth in annual publication output within this emerging domain. Specifically, the number of published documents has grown steadily from 418 in 2020 to 789 in 2022, representing an 88.5% increase over the two-year period. This rapid expansion in publication activity signals has heightened research attention on blockchain-enabled supply chains. The high volume of 789 papers published in 2022 further attests to the field's gathering momentum. However, the data for 2023 show a decrease of 601 documents. As this study was conducted mid-year, this likely represents a partial snapshot. Projecting the annualized rate forward, the publication output for 2023 can be expected to exceed the 2022 level, and presaging continues to grow. The data provide empirical evidence of an upward trajectory in scholarly publications exploring blockchain integration within supply chain management. The volume expansion from to 2020-2022 affirms the technology's rising prominence as an innovation nexus, intensifying the research focus.

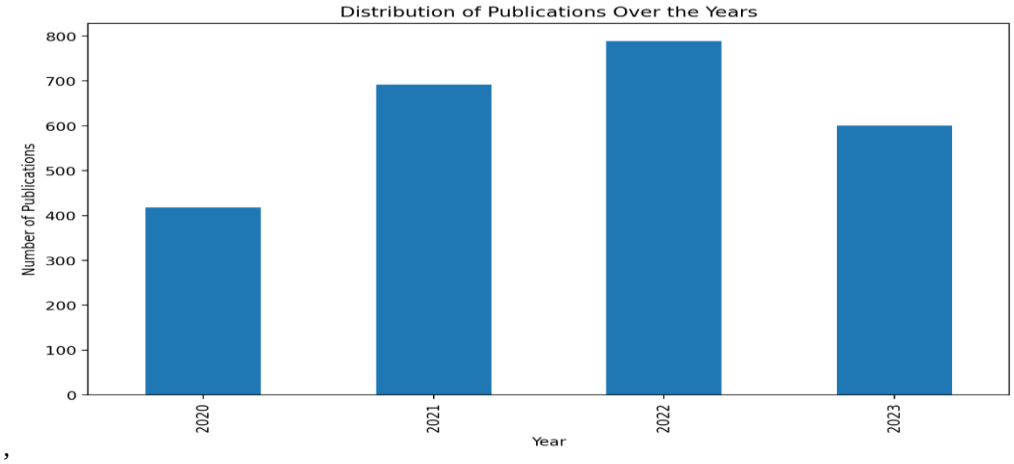

Fig.1: Publication over the years

4.2:-Bibliographic coupling for documents

An examination of bibliographic coupling within a dataset provides insights into the intellectual structure of blockchain research. Bibliographic coupling refers to the number of shared references between two works, with higher overlap implying stronger subject similarity Table 1 shows Top Ten Authors for Bibliographic Coupling and Fig.2 is a network visualization for documents with their networks and clusters. The analysis revealed three distinct clusters(Fig.2) within the set of highly cited blockchain literature, based on shared reference patterns. Cluster 1 contained 38 publications exhibiting high connectivity, representing foundational technical blockchain research published primarily in computer science journals. Dense internal coupling signifies close subject similarity and a consolidated core knowledge base within the cluster. Cluster 2 comprises 22 works focused on blockchain challenges and limitations. Lower bibliographic coupling suggests that addressing real-world implementation issues remains more diffuse, although tighter clustering may emerge as literature coalesces over time. Cluster 3 encompasses 17 documents exploring blockchain applications in healthcare. A relatively tight coupling indicates greater subject integration, as this cluster represents an active specialty research domain that crystallizes around the intersection of blockchain and digital health. The cluster network's size differential indicates that the technical foundation cluster comprises close to half of the highly cited literature. Focusing on the 78 documents that met the threshold of 100 citations, an analysis of interconnections among the most impactful core literature was conducted. Within this set, several distinct clusters emerged based on the coupling linkages. The largest grouping of 23 highly cited papers exhibits dense internal connectivity, centered on foundational blockchain studies published in major computer science journals. This reveals the enduring influence of early technical groundwork on the current scholarship. The lower coupling suggests that this application-oriented strand remains in the formative stage. A comparatively tighter linkage characterizes another cluster of 12 papers, indicative of an actively coalescing specialty research domain. In total, 78 documents

demonstrated over 350 coupling links, highlighting the intellectual cohesion and cumulative nature of blockchain research. Analyzing bibliographic networks over time will further illuminate the knowledge flows and research dynamics within this rapidly developing interdisciplinary field.

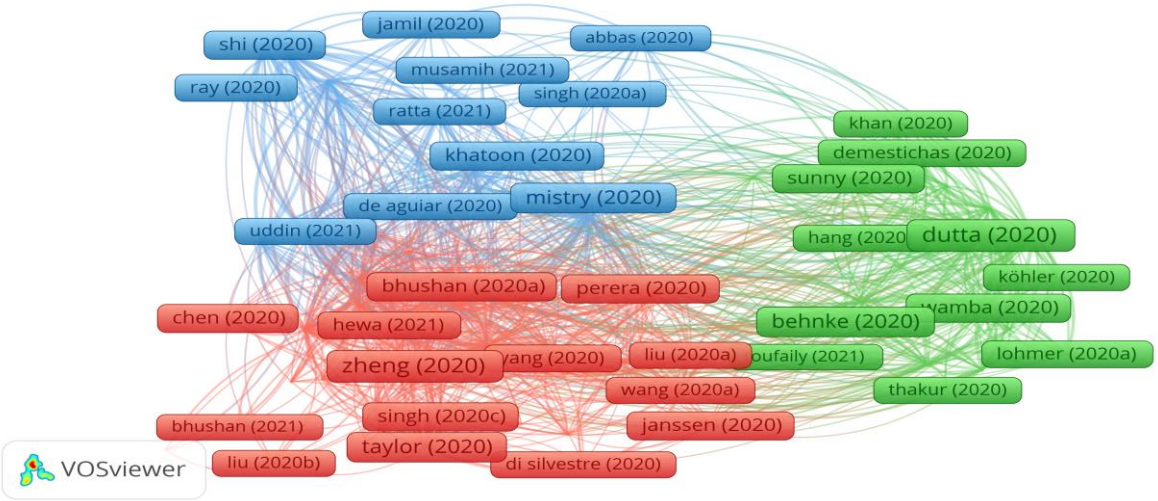

Fig.2: Network Visualization

Table 1:- Top Ten Authors for Bibliographic Coupling

Sl No	Document	Citations	Total Link Strength
1	Khan (2021)	197	406
2	Ahmad (2021)	107	365
3	Dutta (2020)	526	363
4	Singh (2020a)	101	356
5	Jamil (2020)	170	342
6	Khan (2020)	145	341
7	Duan (2020)	179	339
8	Lohmer (2020a)	186	315
9	Shi (2020)	225	309
10	Yang (2020)	211	307

4.3:-Bibliographic coupling for sources

Examining the top 50 sources meeting the minimum threshold of ten publications revealed prevalent bibliographic coupling linkages. Bibliographic coupling occurs when two works cite one or more of the same sources, indicating shared intellectual context and subject similarity. The degree of coupling corresponds to the number of shared references. Table 2 lists the top ten sources of citations. A bibliographic coupling analysis with a threshold of ten sources revealed four distinct clusters (Fig.3) within the citation network. Cluster 1 contains the largest group of 17 tightly interconnected publications. Cluster 2 comprises 15 coupled sources, while Cluster 3 and Cluster 4 exhibit progressively smaller groupings of 12 and 6 coupled publications, respectively. The presence of discrete clusters suggests that the research context and content within each group share significant similarities, as evidenced by their dense shared citation linkages. However, the smaller size of

Clusters 3 and 4 indicates increasingly specialized subject domains. This clustering profile provides insights into the intellectual structure and relationships among publications at the forefront of blockchain, healthcare, and affiliated technology research. Several sources demonstrate high betweenness centrality in addition to coupling linkages, such as the Applied Sciences, Healthcare, and Sensors. Betweenness centrality measures the number of shortest paths passing through a node and identifies important connectors between clusters. High betweenness suggests the potential for interdisciplinary knowledge transfer and the diffusion of innovations. The application of computational tools has elucidated the intricate interconnectedness of contemporary research and pinpointed key publications at the junction of multiple domains. Monitoring bibliographic networks is expected to provide further insight into the development of blockchain, healthcare, and associated technologies.

Table 2: Top ten Sources of citations.

Sl No	Source	Documents	Citations	Total Link Strength
1	Acm Computing Surveys	10	784	90877
2	Applied Sciences	60	927	67264
3	Automation In Construction	27	1466	31855
4	Blockchain In Healthcare Today	10	30	30203
5	Blockchain Research And Applications	25	472	28199
6	Cluster Computing	27	423	22313
7	Computational Intelligence and Neuroscience	23	154	16738
8	Computer Communications	16	486	15210
9	Computer Networks	15	219	14698
10	Computers & Industrial Engineering	17	835	14282

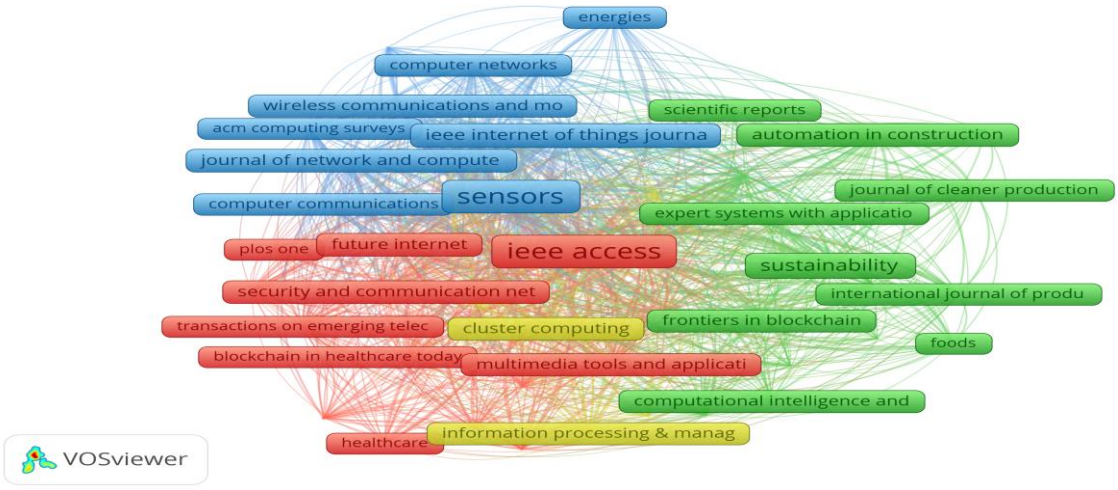

Fig.3:Network visualization for sources.

4.4:-Citation based on Authors.

Analysis of the presented dataset summarizing 16 highly prolific authors' publication and citation metrics revealed salient patterns regarding scholarly foundations and knowledge diffusion within blockchain research. Overall, the table indicates that a relatively small cohort of researchers have produced much of the core literature to date, with publications per author ranging from 10 to 41. However, consistently high citation counts

above 200 signify that the authors' outputs achieved high visibility. Table.3 shows the top authors based on citations, and co-citation analysis reveals four distinct groupings (Fig.4) within the network based on shared citation patterns. Cluster 1 contains the largest grouping of 6 tightly interconnected authors who have built foundational technical blockchain literature, predominantly published in computer science venues. It has been noted that close collaboration and a shared focus on core blockchain development are key characteristics of this group.

Cluster 2 also comprises 6 authors, but exhibits slightly lower connectivity, centered on blockchain security and privacy challenges. Marginally diffuse clustering suggests that this group addresses issues surrounding real-world implementation and applied blockchain contexts. Cluster 3 represents the smallest niche grouping of the three authors exploring blockchain for healthcare and medical applications. Relatively tight clustering indicates a consolidated scholarship that integrates the blockchain with healthcare domains. Finally, Cluster 4 encompasses four authors investigating blockchain adoption and use cases across industries, such as manufacturing, agriculture, and the public sector. Their co-citation linkage indicates a shared relevance across business disciplines. A Pearson correlation of 0.68 between citations and total link strength provides convergent validation for link strength as a complementary impact indicator. Selected authors, including Ahmad, Byun, and Choo, exhibit disproportionately high link strengths relative to citations, signifying an especially influential scholarship that is tightly interconnected with other blockchain literature. While authorship distribution spans Western and Asian countries, opportunities remain for greater geographic diversity, and the inclusion of female researchers is presently underrepresented within the top-tier author cohort. Analysis of high-impact authors reveals an emerging domain with a still-concentrated knowledge base but tremendous expansion potential, as evidenced by the visible productivity and influence of these scholars.

Table 3: Top author based on citations.

Sl No	Author	Documents	Citations	Total Link Strength
1	Ahmad, Raja Wasim	12	474	344
2	Byun, Yung-Cheol	12	548	329
3	Chen, Chin-Ling	15	75	260
4	Choo, Kim-Kwang Raymond	19	1101	240
5	Ellahham, Samer	11	595	200
6	Han, Dezhi	14	524	143
7	Hang, Lei	10	227	91
8	Jayaraman, Raja	37	1206	91
9	Kumar, Neeraj	13	1549	63
10	Lu, Weisheng	14	364	55
11	Omar, Mohammed	18	695	31
12	Salah, Khaled	41	1693	30
13	Tanwar, Sudeep	15	1206	30
14	Wu, Liupengfei	14	364	30
15	Yaqoob, Ibrar	24	915	13
16	Zheng, Zibin	10	789	10

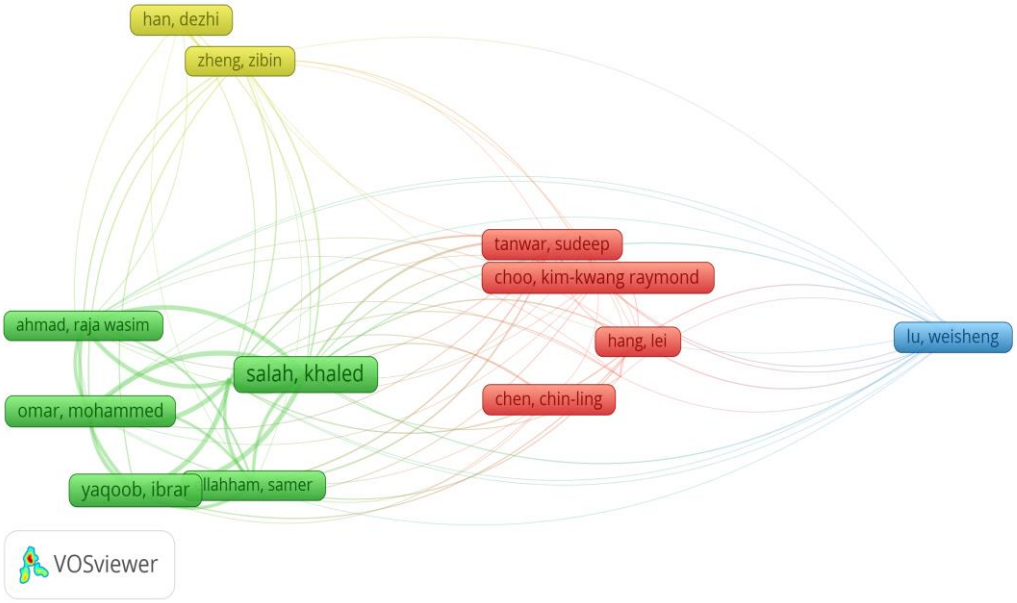

Fig.4: Network visualization of top authors.

4.5:-Citation based on Organizations

Table 4 displays the highest number of citations by organization. As shown in Fig. 5, the data were divided into three distinct clusters, each with its own interconnectivity.

Analysis of the presented data, listing 15 universities' publication and citation metrics, revealed salient patterns regarding geographic distribution and knowledge diffusion within blockchain research. Institutions in East Asia, including the Beijing Institute of Technology and Hong Kong Polytechnic University, have generated disproportionate high-impact outputs, as evidenced by their extensive number of papers and citations, exceeding 700. However, emerging productivity from Arab institutions has led to rising blockchain capacity in the Middle East. Citation totals ranged widely, from under 300 to over 1700, demonstrating differing levels of visibility. However, the fact that all listed institutions accrued hundreds of citations signifies an increasing maturity of blockchain research. The Pearson correlation of 0.57 between citations and link strength validates the latter as a complementary impact indicator. The University of Hong Kong and Khalifa University exhibited the highest link strength, indicating dense interconnection in their scholarship. This institutional analysis quantitatively demonstrates the present concentration of influential blockchain scholarship in Asia while underscoring blockchain research's globally ascending trajectory, as evidenced by the emerging output from Arab institutions and elsewhere. Longitudinal tracking of the dynamics of knowledge production and collaboration within this technology field will enhance our understanding of its global trends and advancements..

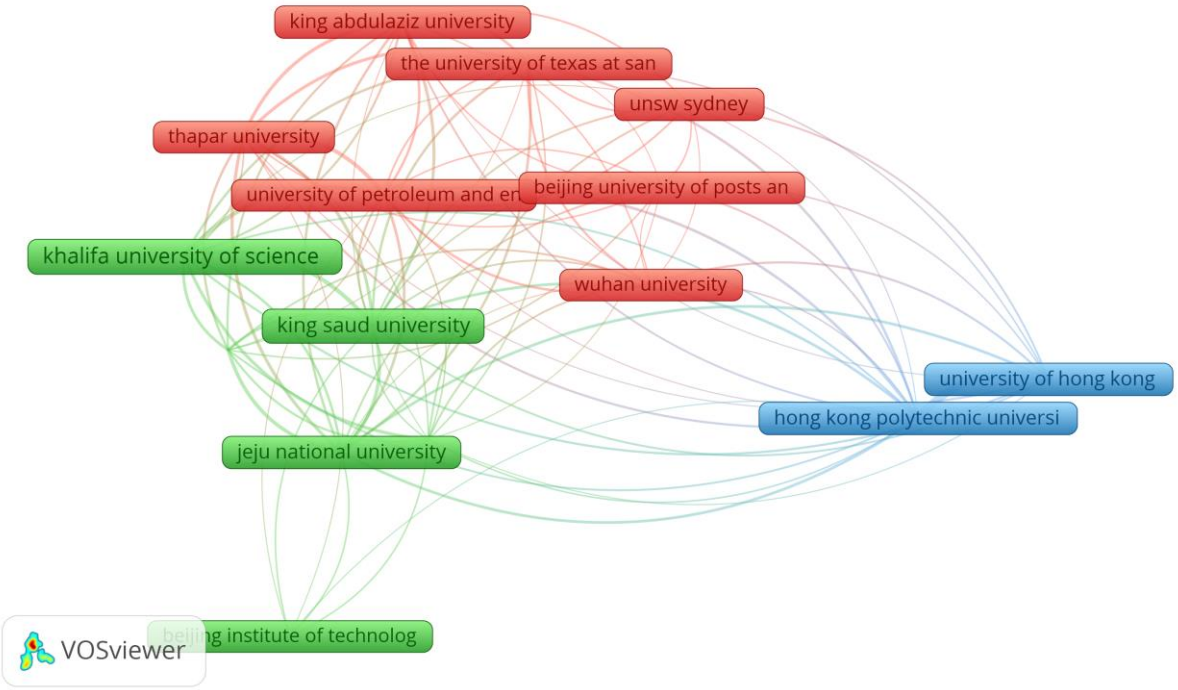

Fig.5: Network visualization of organizations.

Table 4: Top ten organization citations

Sl No	Organization	Documents	Citations	Total Link Strength
1	Beijing Institute of Technology	22	217	96
2	Beijing University of Posts And Telecommunications	21	313	79
3	Hong Kong Polytechnic University	28	959	73
4	Jeju National University	29	1227	69
5	Khalifa University of Science And Technology	44	1734	66
6	King Abdulaziz University	25	558	66
7	King Saud University	31	1464	62
8	Thapar University	22	1627	51
9	The University Of Texas At San Antonio	23	1420	49
10	University Of Hong Kong	27	710	47
11	University Of Petroleum and Energy Studies	21	369	36
12	University Of Sfax	22	408	29
13	Unsw Sydney	26	461	23
14	Vellore Institute Of Technology University	21	263	23

15	Wuhan University	20	661	9

4.6:-Citation Based on countries.

Table.5 provide insights into research output, citation impact, and international collaboration networks across the sampled countries. To conduct a more robust analysis, a minimum threshold of 5 published documents per country was established, yielding 63 countries that met the inclusion criteria. As shown in Fig.6, eight clusters were identified. Preliminary analysis indicated a moderate positive correlation between the number of published documents and total link strength for this filtered set of countries with substantial research output. This suggests that more prolific research activities and document output tend to correspond to higher levels of international co-authorship linkages. However, outliers exist, such as India and Iran, which publish prolifically but have comparatively lower total link strengths. Further examination reveals that emergent research systems such as Vietnam, Yemen, and Ukraine exhibit limited total link strengths, whereas established research leaders, including Australia, China, Canada, and the United Kingdom, display high total link strengths, reflecting their extensive international partnerships and co-authorships. Within this filtered country set, China had the highest research output and total citations, indicating its rapidly growing research enterprise. The United States also has a high productivity and citation impact, and the initial data analysis points to associative relationships between research output, citations, and international collaboration. Additional research using correlational analysis is necessary to further validate these connections. Investigating the factors that contribute to strong linkages, such as language proficiency and government policies, would offer a deeper understanding of the drivers of successful international research collaboration.

Table 5: Top countries with most citations

Sl No	Country	Documents	Citations	Total Link Strength
1	Australia	166	4319	4424
2	Austria	17	309	3000
3	Bangladesh	30	302	2341
4	Belgium	14	309	2137
5	Brazil	48	830	1807
6	Brunei	7	157	1695
7	Canada	100	2456	1169
8	Chile	6	137	1106
9	China	606	11049	1026
10	Colombia	13	28	1007

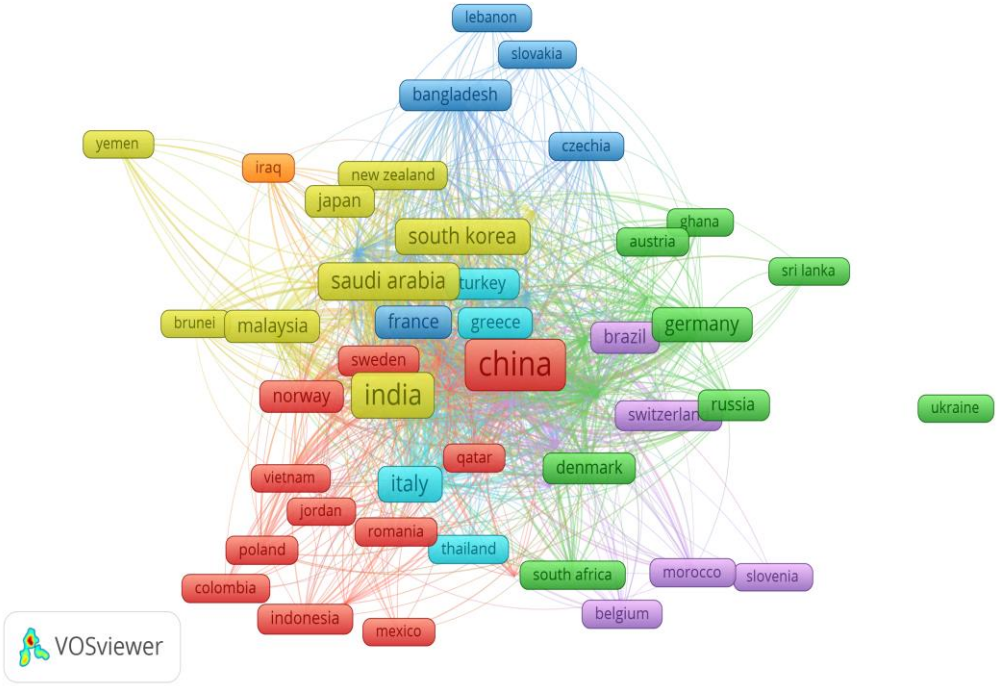

Fig.6: Network visualization of countries with citations

5.Conclusion

This bibliometric study has undertaken a systematic quantitative analysis of emerging interdisciplinary literature centered on blockchain technology integration within supply chain management contexts. Guided by rigorous methodology, this study analyzed patterns in scholarly output, influence, collaboration, and thematic trajectories that characterize this rapidly developing field. The findings revealed that blockchain-SCM research remains anchored in technical disciplines, with computer science contributing to foundational platforms and protocols. However, there is an increasing focus on supply chain challenges and application signals that increase interdisciplinarity. A bibliographic coupling analysis revealed concentrated clusters around core blockchain development and healthcare use cases, indicating opportunities for greater knowledge integration. An examination of authorship and institutional productivity pointed to a concentration of influential research in China and East Asia, even as blockchain-SCM scholarship gained global recognition. This study also identified prominent authors who built a substantial body of foundational literature that accrued a high citation impact.

While bounded by limitations in language, timeframe, and publication type, this bibliometric analysis provides multidimensional insights into the intellectual structure and knowledge flows that catalyze innovation at the nexus of blockchain technology and supply chain management. These findings highlight productive directions for future research and elucidate the high-impact contributions of scholars and practitioners working in this economically vital domain. As blockchain proliferates across supply networks worldwide, ongoing bibliometric monitoring is essential to track the evolution of this interdisciplinary literature. Future research should expand the timeframe, data sources, and geographical scope of this study. Comparative assessments across different technology domains would also enrich our understanding of blockchain trajectories. Such a longitudinal analysis can reveal changing patterns in collaborative activities, authorship distribution, thematic orientations, and geographic dimensions as this dynamic field continues to mature. These findings are instrumental in supporting evidence-based planning, stance taking, and decision-making for scholars, trailblazers, and professionals navigating the promising terrain of the blockchain technology.

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