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Blockchain Technology in the Sports Industry: A Bibliometric Review

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ABSTRACT
The sports industry has become a field open to technology integration alongside digital transformation. Blockchain technology, with its features of decentralization, transparency, immutability, and security, holds the potential to offer solutions to some of the problems within the sports sector. This study aims to present a systematic review of the academic literature on blockchain applications in the sports industry between 2018 and 2025. A search conducted in the Web of Knowledge database using the keyword "blockchain and sports" yielded 100 academic works. Following the application of inclusion criteria (English articles published between 2018-2025 and index limitations), 76 articles were utilized in the study. Within the scope of the research, the trends in academic publications were visually mapped using keywords. According to the analysis results, the country receiving the most citations is China with 96 citations. The authors receiving the most citations were identified as Mansoor Ali, Ekrem Hossain, Georges Kaddoum, and Faisal Naeem (43 citations), followed by David Vidal-Tomas (28 citations). In the co-author analysis, Salil Bharany, Seada Hussen, Upinder Kaur, Visal Mehra, Ateeq Ur Rehman, Ravinder Singh Sawhney, and Prabhsimran Singh stood out with 6 connections each. In the keyword analysis, blockchain (19 occurrences), cryptocurrency (8 occurrences), blockchain technology (7 occurrences), sports (6 occurrences), smart contract (4 occurrences), and security (3 occurrences) were the most frequently used terms. In the co-citation analysis, the author receiving the most citations was identified as Ante, I. with 12 citations. In conclusion, this bibliometric analysis reveals that blockchain technology is an early-stage but rapidly developing research area in the sports industry, while highlighting the need for more interdisciplinary and application-focused studies on topics such as NFTs, fan tokens, smart contracts, and digital fan engagement. It is anticipated that this study will provide researchers with a comprehensive perspective and contribute to the field.

1. INTRODUCTION

Blockchain is defined as the distributed ledger technology underlying cryptocurrencies. Cryptocurrency generated through blockchain technology is fundamentally an abstract value with no real backing behind it [1]. The term blockchain was introduced in 2008 with the publication of Bitcoin's technical paper by Nakamoto (2008) and initially functioned as the technology behind cryptocurrencies [2].

Blockchain is a distributed record-keeping system with various potential uses. In addition to being usable for any type of data transfer, it is a system where data is distributed across various segments to enhance transparency, and is used for contracts, shipment tracking, fraud, misunderstandings, and financial payments [3]. Blockchain technology operates with a copy (or portion) of the database distributed to each party, and can then execute changes in the database according to generally accepted rules. Changes made by different parties are collected and stored in packages called 'blocks' at specific time intervals within the database. When new blocks are added to the original database, a blockchain or an updated database containing all changes is created [4].

Hundreds of cryptocurrencies developed based on blockchain exist, and these cryptocurrencies are divided into two main groups:

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'Coins' and 'Tokens'. A coin (also called "alternative currencies" or "altcoins") creates a new type of currency that offers an alternative to Bitcoin. A company creating a new virtual currency can develop altcoins, which typically build their own blockchain using an open-source protocol derived from Bitcoin. Tokens are usually created in the form of smart contracts on a different blockchain, often via Ethereum. In other words, Ethereum tokens are a cryptocurrency that operates on the Ethereum blockchain [5].

In recent years, blockchain technology has also begun to be used in sports management. This technology offers various advantages, from reducing costs to generating additional revenue, and from auditing original products to archiving processes [6]. For example, through revenues provided by fan tokens, blockchain technology accelerates clubs' transition to an independent financing structure [7,8]. Fan tokens can be accessed through digital platforms such as Socios, Paribu, Bitci, and Binance. The main objective of these tokens is to maximize interaction between sports clubs and fans [9]. Furthermore, while blockchain technology is used for faster and intermediary-free contracts between players and clubs via smart contracts instead of traditional contracts, it is also used for online payment of seat tickets in sports halls and stadiums and for controlling banned hooligans' entry to stadiums [10].

The aim of this study is to demonstrate the place of blockchain applications in the sports industry to researchers through bibliometric analyses of academic studies. Within the context of the topic, it is anticipated that it will show the focal points of previous studies, research trends, untouched areas, and potential partnerships.

2. MATERIALS AND METHODS

2.1. Research Model

Bibliometric research is of great importance as it enables a comprehensive approach to the relevant topic or field, reveals the change and development of the subject over the years, and shows existing gaps and new topics to researchers who will conduct studies related to the field [11]. Additionally, through such research, scientists can develop a general understanding of the topic [12]. Various types of bibliometric analysis methods are preferred in the literature. In this study, VOSviewer software, considered more efficient, was selected. VOSviewer is defined as an important program for exploring evolutions, relationships, and new concepts in the literature, offering researchers visualization, mapping, and multidimensional analysis opportunities, enabling detailed analysis of datasets [13,14,15]. VOSviewer is a software tool supporting bibliometric analysis and data visualization, particularly useful for identifying frequently used terms and showing connections between them [13]. On the other hand, researchers prefer to use VOSviewer to examine trends, map thematic structures, and visualize bibliometric networks [15,16,17].

Within the scope of the research, the Web of Science (WoS) database was used. The selection of the Web of Science database can be considered an important factor regarding the reliability of research. The WoS database, which has a broad data spectrum from different disciplines, contains advanced search criteria for high-level data analysis as well as various control mechanisms. In this context, the hierarchical presentation of searches conducted in WoS on 12/06/2025 with the keyword "blockchain* and sports*" is provided in detail within the framework of selection criteria in accordance with the PRISMA protocol found in Fig. 1.

3. RESULTS

3.1. Co-author Analysis

Co-author analysis was conducted to reveal collaboration between authors and the highest connections. In the performed co-author analysis, the criteria were set as at least 1 author and at least 1 article. According to the analysis findings, 13 authors were grouped into 2 clusters, with 46 links among them.

According to the co-author analysis, the authors at the top in terms of link strength were Salil Bharany, Seada Hussen, Upinder Kaur, Visal Mehra, Ateeq Ur Rehman, Ravinder Singh Sawhney, and Prabhsimran Singh, each with 6 links. When looking at the number of works by authors according to the analysis results, Lennart Ante and Benjamin Schellinger produced 2 works, while other authors produced 1 work each. According to the results, it was found that the authors producing the most works were not among the most connected authors. The map related to the analysis is presented in Fig. 2.

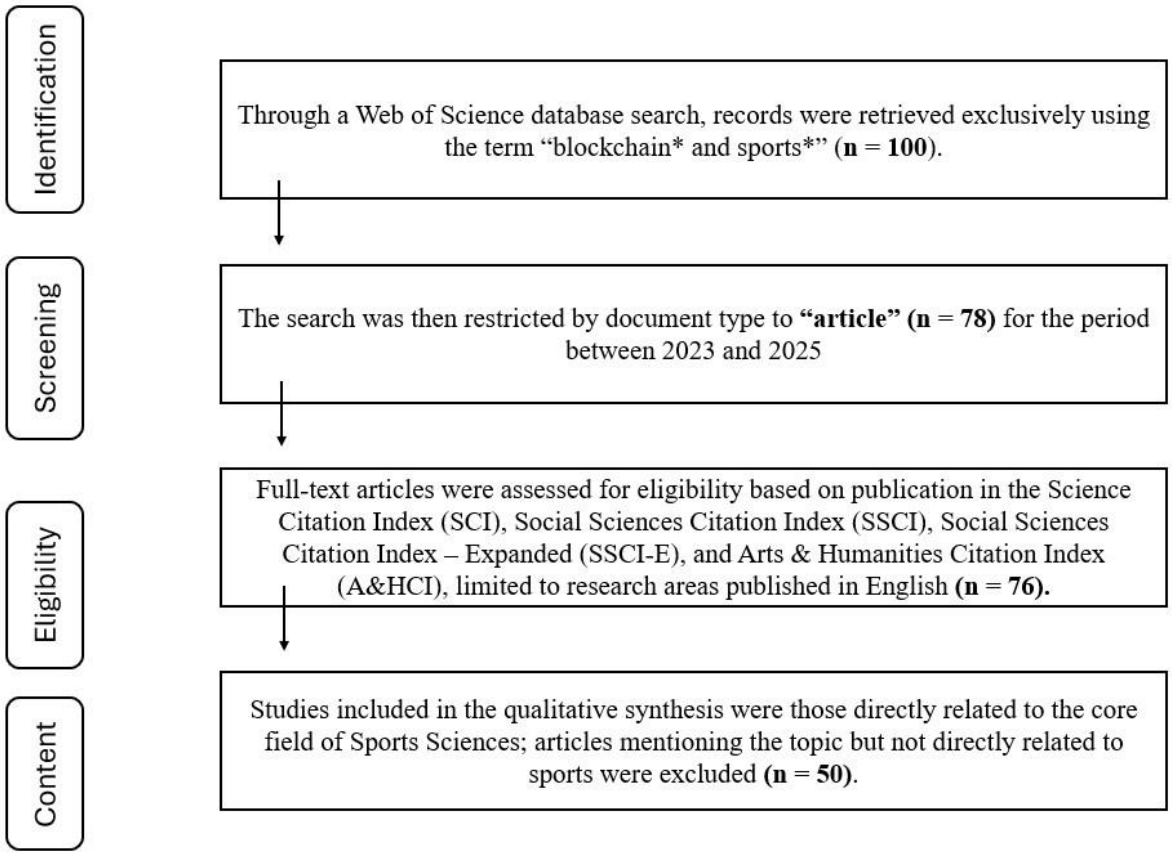

Figure 1. PRISMA protocol

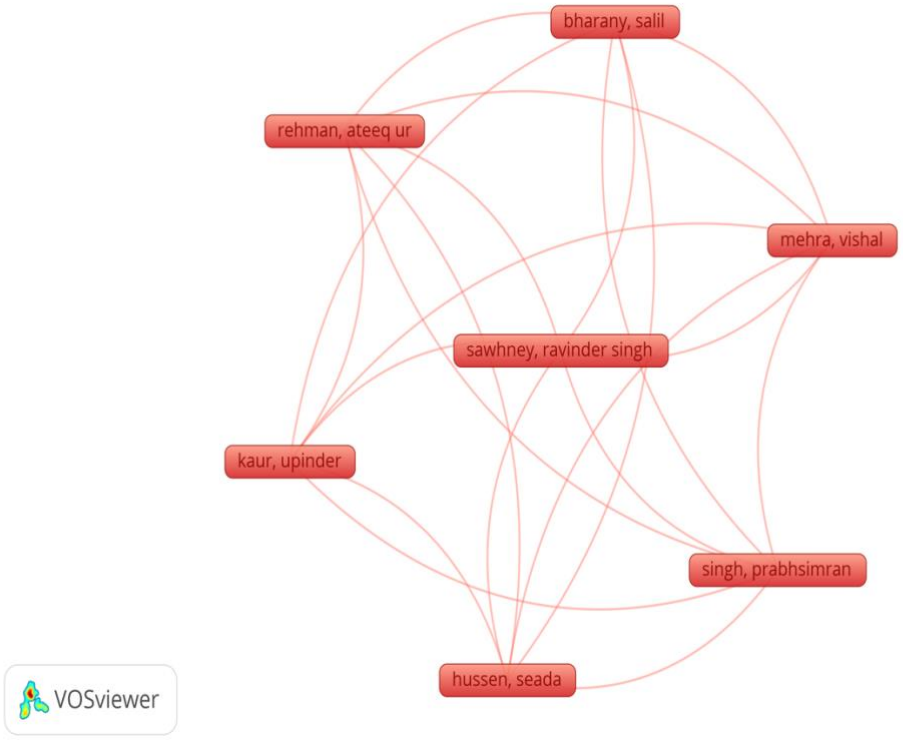

Figure 2. Map showing co-author analysis

3.2. Authors' Citation Analysis

The analysis was conducted according to the parameters of at least 1 citation and 1 article. According to the citation analysis results, the authors receiving the most citations were Mansoor Ali, Ekrem Hossain, Georges Kaddoum, and Faisal Naeem with 43 citations, followed by David Vidal-Tomas with 28 citations. It was understood from the analysis results that Georgios A. Antonopoulos (4), Kevin Dixon (4), and Argyro Elisavet Manoli shared the top position in terms of total link strength. The map related to the authors' citation analysis is given in Fig. 3. Figure 3 shows 7 authors forming 12 links among themselves in 4 clusters; this may indicate the absence of a unified research community in the field.

3.3. Countries' Citation Analysis

Countries' citation analysis was performed with at least 1 publication and at least 1 citation. According to the analysis results, when looking at the number of works by countries, China produced 21 works, the United Kingdom 5 works, followed by the USA, Germany, and India, each producing 4 works. Within the scope of the analysis, the countries receiving the most citations were China with 96 citations, the United Kingdom with 51 citations, followed by Canada and Lebanon, each receiving 43 citations. The map of the most connected countries from the analysis is given in Fig. 4. The map in Fig. 4, showing 7 countries forming 8 links among themselves and grouped into 2 clusters, may indicate that a limited number of countries engage in collaborative work

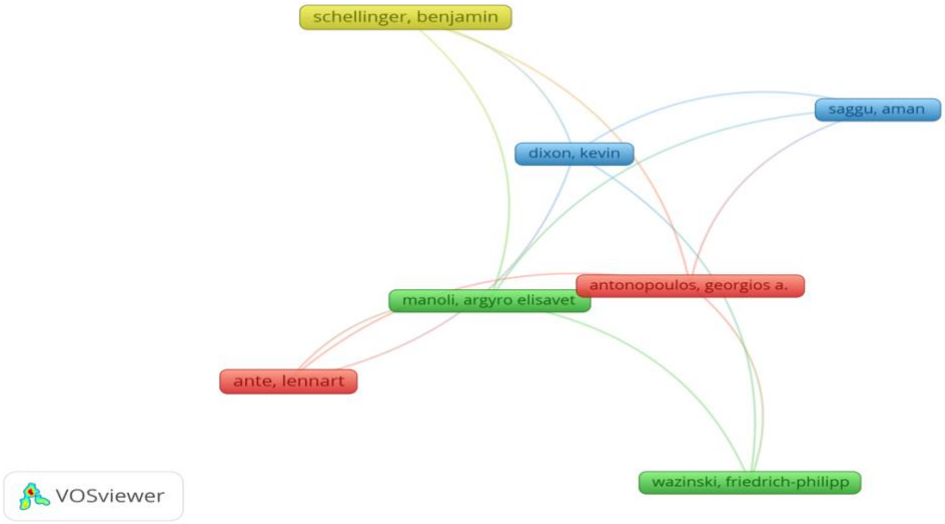

Figure 3. Map showing authors' citation analysis

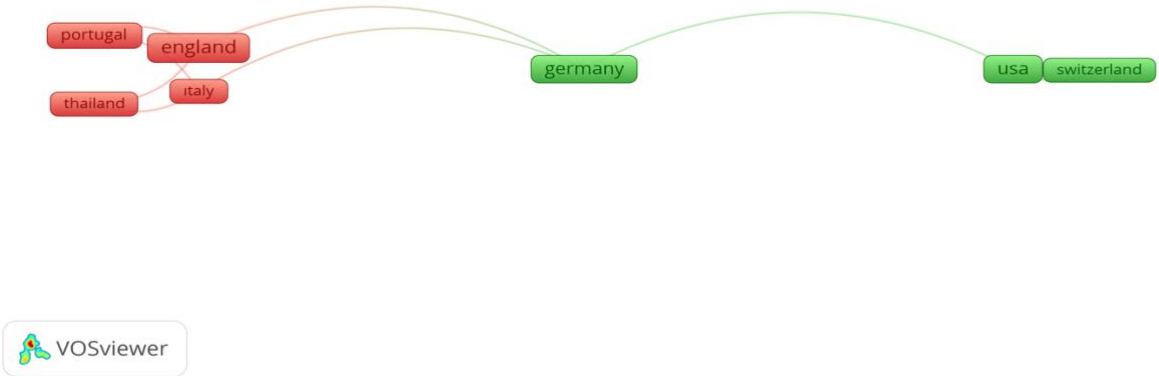

Figure 4. Map showing countries' citation analysis

3.4. Institutions' Citation Analysis

The analysis was created according to the parameters of at least 1 citation and at least 1 work. According to the institutions' citation analysis results, the institutions receiving the most citations were Lebanese American University, University of Manitoba, and Université du Québec with 43 citations, followed by UCL, UCL Centre for Blockchain Technologies, and Universitat Jaume I with 28 citations. When looking at the number of works by institutions, two institutions produced 2 works each, while the remaining institutions produced 1 work each. The map of the most connected institutions related to the analysis is given in Fig. 5. In the map in Fig. 5, it was observed that 7 institutions were grouped into 4 clusters and formed 12 links among themselves; furthermore, the limited number of institutions and links may indicate that an integrated research structure has not yet been established in the field.

3.5. Keyword Analysis

According to the keyword analysis conducted, the most used keywords are given in Figure 6. According to the analysis results, 174 words were grouped into 18 clusters and formed 791 links among themselves. The order is as follows: blockchain 19 occurrences, followed by cryptocurrency 8 occurrences, blockchain technology 7 occurrences, sports 6 occurrences, smart contract 4 occurrences, security 3 occurrences. In the map in Fig. 6. larger words and words closer to the center are more connected and more frequently repeated keywords.

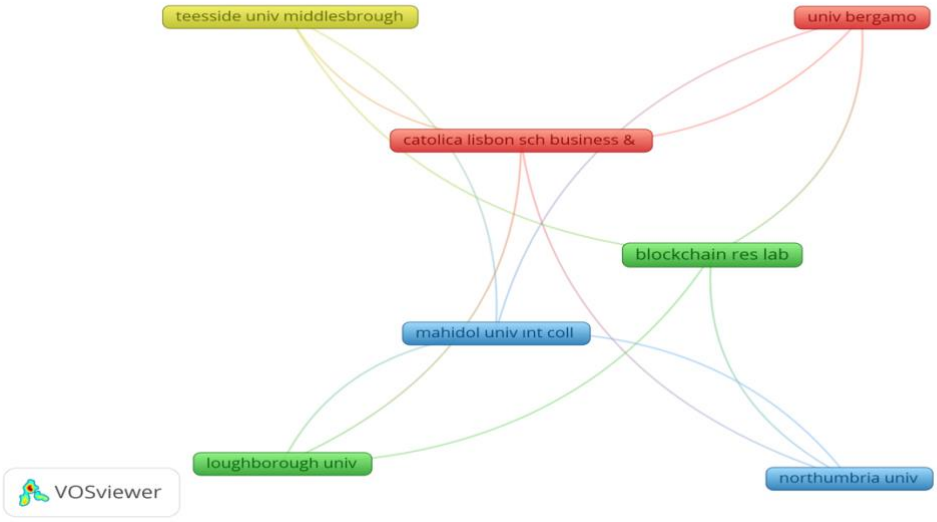

Figure 5. Map showing institutions' citation analysis

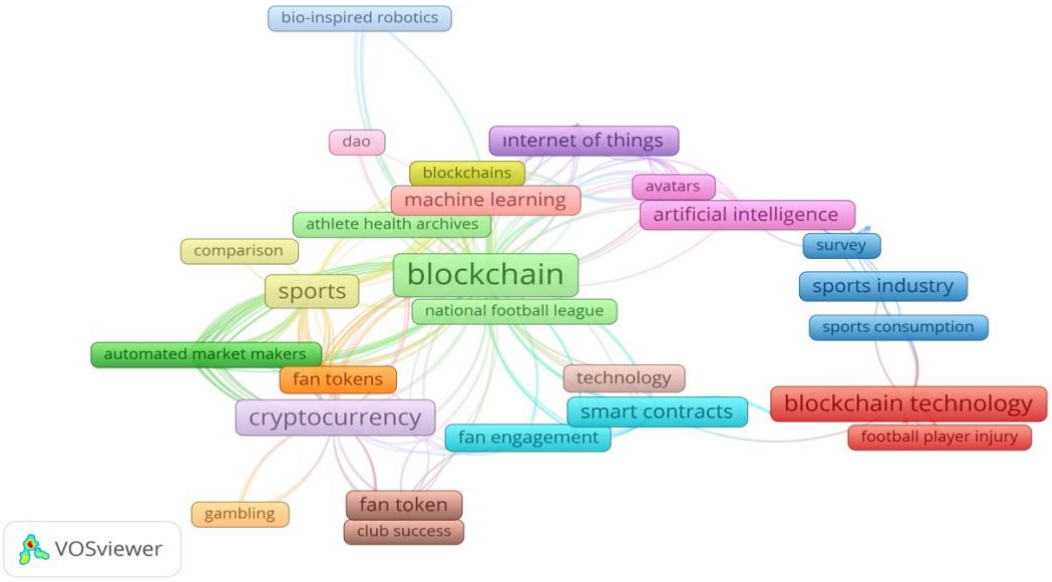

Figure 6. Map showing keyword analysis

3.6. Bibliographic Coupling Analysis of Documents

Bibliographic coupling serves as a tool guiding research by providing information. It can be defined as a method that helps identify research trends and increase the efficiency of access systems through knowledge sharing across various disciplines by revealing implicit connections between works. This analysis method is used to examine and compare connections between publications using bibliographic data. It involves matching elements such as authors, titles, and publication dates to determine similarities and connections between documents [18]. According to the bibliometric analysis of texts, 18 authors were grouped under 5 clusters and formed 39 links among themselves. The works with the most bibliographic coupling were, in order, Ali (2024) with 43 citations, Vidal-Tomas (2024) with 28 citations, and Lakhan (2023) with 24 citations. The works with the highest total link strength were found to be, in order, Fukuzawa (2024), followed by Ante (2024), and thirdly Monali (2025). The map related to the analysis is given in Fig. 7.

3.7. Authors' Co-citation Analysis

Co-citation analysis is a technique within bibliometric studies that demonstrates the relationship between two separate documents when they are simultaneously referenced by a third document. This approach aims to determine which documents are cited together by analyzing the bibliography sections of academic articles, thereby establishing a common citation relationship between documents [19,20]. This method provides the opportunity to examine connections and common characteristics between clusters by grouping authors and topics to analyze the intellectual structure of a field. Furthermore, through this technique, researchers can find connections between different studies and identify groups belonging to a specific topic or authors [21]. The analysis was conducted according to a minimum of 2 citations parameter. As a result of the analysis, it was observed that 236 units were grouped around 10 clusters and formed 3420 links among themselves. The analysis result showed that the author receiving the most co-citations was Ante, I. with 12 citations. The map related to the analysis is given in Fig. 8.

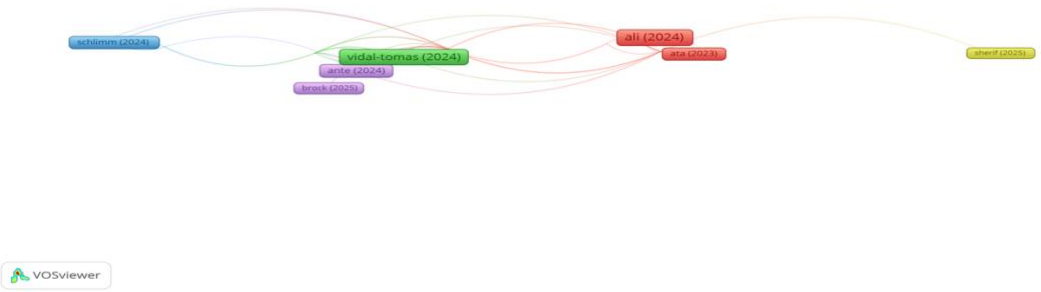

Figure 7. Map showing bibliographic coupling analysis of documents

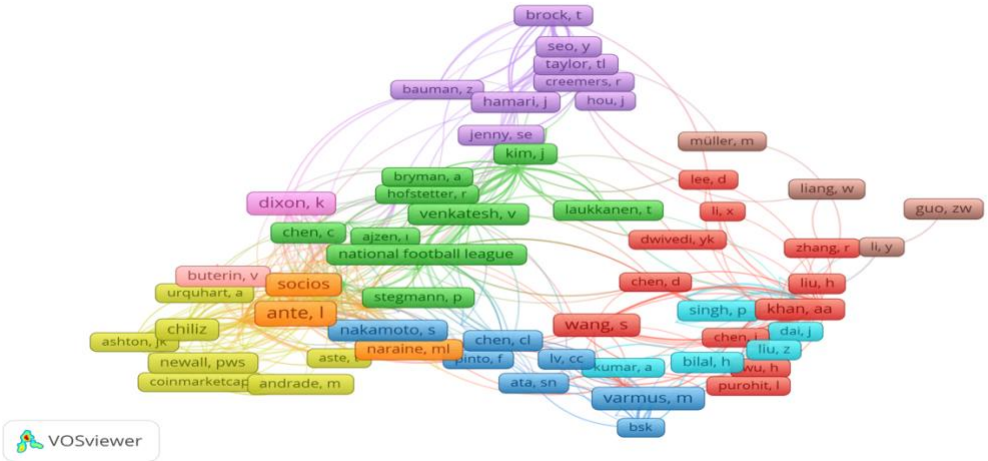

Figure 8. Map showing authors' co-citation analysis

3. DISCUSSION

This study analyzed the academic literature on blockchain applications in the sports industry between 2018 and 2025 using bibliometric methods, revealing current trends, leading authors, institutions, and countries related to the field. The findings indicate that blockchain technology is still in its infancy in the sports sector but stands out as a rapidly developing research area.

The bibliometric analysis results revealed that China is far ahead in terms of both the number of publications and the number of citations. This situation can be explained by China's investment and research-oriented policies towards both blockchain technologies and the digital transformation of the sports industry [22]. However, the limited nature of international collaboration networks (Figure 4) suggests that a global research synergy has not yet fully formed in the field. Similarly, the relatively weak connections between authors and institutions (Figures 2, 5) indicate a need to increase interdisciplinary and institutional collaborations.

Keyword analysis revealed that studies are predominantly concentrated around the concepts of "blockchain," "cryptocurrency," "blockchain technology," "sports," "smart contract," and "security" (Figure 6). This finding shows that research is generally focused on technological infrastructure and security, whereas application-focused topics such as sports management, fan experience, athlete contracts, digital ticketing, and NFTs (Non-Fungible Tokens) have not yet been sufficiently explored in depth. However, the literature emphasizes that blockchain technology carries significant transformative potential in the sports industry in areas such as fan tokens, smart contracts, and digital collectibles [2,9]. The prominence of Ante, I. in the authors' co-citation analysis suggests that this author is considered a fundamental reference source in the field. However, the clustering of citation networks around a few central figures rather than spreading across a broad spectrum may indicate that the field has not yet sufficiently benefited from theoretical and methodological diversity.

The findings of this study reveal that blockchain technology in the sports industry is still in the "access" and "awareness" stages, and that more applied and interdisciplinary research is needed for the transition to the "maturity" and "integration" stages. Particularly, increasing academic studies on topics such as blockchain-based revenue models for sports clubs, digital fan engagement, athlete career management, and management of sports copyrights is important [6,8].

2. Conclusion

This bibliometric analysis study systematically revealed the structure, trends, and main actors of the academic literature on blockchain technology in the sports industry between 2018 and 2025. The obtained findings show that there is an immature, scattered, and limited collaboration-based research ecosystem in the field. Specifically, the limited number and clustered nature of connections between authors, institutions, and countries point to the need to develop interdisciplinary and international collaborations. China's prominence with the highest number of citations and publications suggests a geographical focus in blockchain-sports research. Keyword analysis revealed that research is predominantly shaped around themes of blockchain, cryptocurrency, smart contracts, and security. This study, by mapping the current literature in the field, creates an important reference for future research; it emphasizes the need for deeper examination of blockchain applications in sub-fields such as sports management, finance, digital transformation, and fan engagement. Furthermore, it is recommended that the transformative impact of innovative applications such as NFTs, fan tokens, and smart contracts in the sports industry be addressed more comprehensively in academic studies.

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Conflict of Interest

No conflict of interest is declared by tehe authors. In addition, no financial support was received.

Ethics Committee

Ethics committee approval is required for any research conducted using qualitative or quantitative approaches that require data collection from participants using techniques such as surveys, interviews, focus group studies, observation, experiment, interview techniques, use of humans and animals (including materials/data) for experimental or other scientific purposes, clinical research on humans, research on animals, retrospective studies compliant with the Personal Data Protection Law. Since only Web of Science data were processed in this study, Ethics Committee approval is not required.

Author Contributions

Study Design, BGA; Data Collection, BGA; Statistical Analysis, BGA, ND; Data Interpretation, ND; Manuscript Preparation, BGA; Literature Search, BGA. All authors have read and agreed to the published version of the manuscript.

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