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From mega-events hosting to scientific leadership: A seven-decade scientometric analysis of pioneer countries

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Abstract: Mega-events have always been an attractive topic for sports management academics. We used scientometric software packages to look at the studies on this topic that have been added to the Web of Science database in the last 68 years. Not only did we give an overview of the background information of the researchers, the status of their collaborations, and the countries and institutions they represented, but we also pointed out active and influential publication sources on this topic. We focused on the Olympic Games and other sports mega-events like the FIFA World Cups, as well as the environmental, tourism, economic, social, political, and cultural aspects of these events. We also made a list of the countries,

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organizations, and scholars who have made important contributions to the field. Researchers in sports management and sporting event hosts can both use this study as a guide for their own work.

Subjects: Sports Management; Events

Keywords: sports mega-event; Olympic Games; FIFA World Cup; scientometric analysis; host country

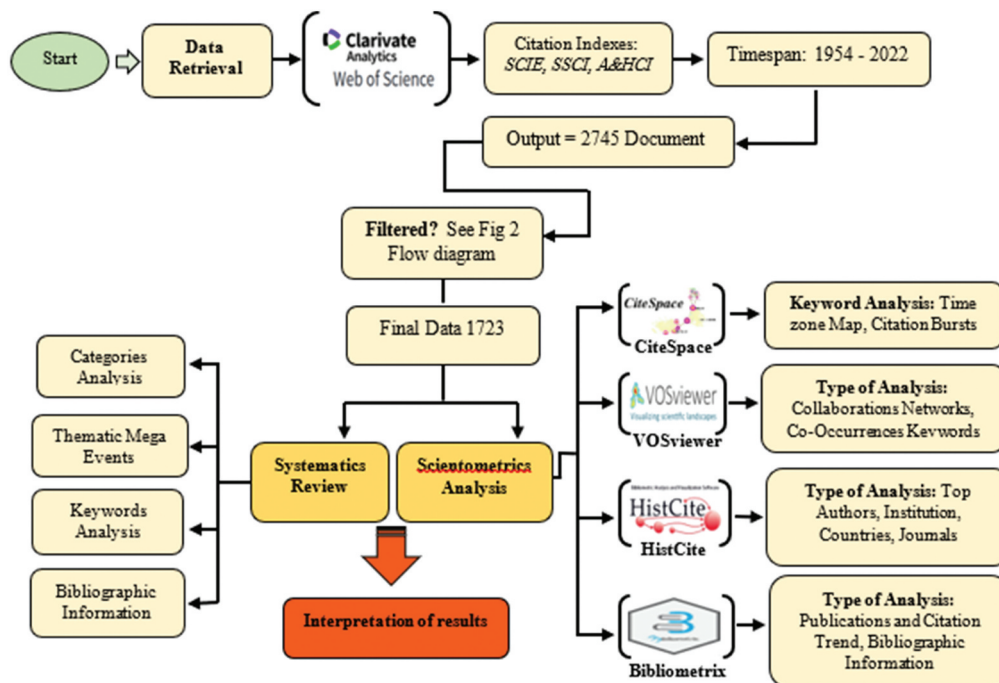
1. Introduction

The role of mega-events in developing the sports industry cannot be understated. However, there has been an ongoing debate regarding the definition of this term, which was first introduced by Marris in 1987 in his work “Impact of Mega-Events and Attractions.” For almost four decades, researchers have offered varying interpretations of what constitutes a mega-event. According to Müller (2015), a mega-event is a one-time occurrence that has a fixed duration, significantly impacts the host community, and requires extensive long-term planning and prohibitive costs for infrastructure and facility construction. Müller also identifies several key characteristics of a mega-event, including its ability to attract a large many, induce significant changes to the environment and population, provide access through mediated channels such as television broadcasting, and have considerable economic impacts on the host communities. Roche (2000) offers a different perspective, defining mega-events as commercial and sporting events that have distinctive and dramatic features and are highly popular among the general public. Overall, the concept of mega-events continues to evolve, and ongoing research and discussion will undoubtedly shape our understanding of this critical term.

The increasing involvement of various stakeholders in mega-events, along with rising competition among host cities, has led to substantial spending on infrastructure renovation, stadium construction, and media rights (Park et al., 2019). Such investments are not only necessary for preparing local infrastructure for the mega-event but also for improving the host city’s image and visibility to attract tourism and investment. Kobierecki and Strożek (2021) have demonstrated the positive impact of hosting mega-events on the visibility and familiarity of host countries by analyzing fluctuations using Google search engines. Moreover, the process of organizing a mega-event serves as catalysts on branding for host countries (Ferrari & Guala, 2017), influencing changes in their sports policy. Chen et al. (2021) analyzed China’s policy documents and found that the two events hosted by China, the 2008 Summer Olympics and the 2012 Winter Olympics, played a significant role in promoting sports in the country and streamlining policy-making and legacy planning for future sports mega-events. However, organizing mega-events also presents significant security challenges that need to be addressed (Ludvigsen, 2018; Lee et al., 2014). Therefore, ensuring the safety and security of participants and spectators must be a top priority for host cities and event organizers.

Mega-events have the potential to bring about various legacies, including transformation in the host city, infrastructural changes, improved urban management, increased business opportunities, and enhanced city or country image (Cheng & Yu, 2013; Chen, 2011; Gratton & Preuss, 2008; Herstein & Berger, 2013; Preuss, 2007, 2009, 2015). However, the economic, social, cultural, political, and environmental implications of mega-events for host communities can be significant (Elahi et al., 2021), including both positive and negative impacts. While the economic impact of mega-events was examined by Porter and Fletcher (2008) and Scandizzo and Pierleoni (2018), the social impact was explored by Ribeiro et al. (2021) and Waitt (2003), and the cultural impact was studied by Konstantaki (2008) and Lee et al. (2014). The political impact of mega-events was analyzed by Malfas et al. (2004) and Elahi et al. (2021). Furthermore, the environmental impact of mega-events was explored by Elahi et al. (2021) and Malfas et al. (2004), while the image impact was studied by Gripsrud et al. (2010) and Ferreira and Giraldo (2020). Finally, legacy impacts were

Figure 1. Overview of the Study Process.



examined by Leopkey and Parent (2012) and Girginov and Preuss (2022). It is worth noting that less tangible impacts such as social and cultural, are equally crucial for host communities and may only sometimes be positive (Vico et al., 2019). Negative impacts such as safety concerns, alcoholism, loss of authenticity, social tensions, prostitution, and increased traffic in the city can also have significant consequences for the host communities (Kim & Petrick, 2005).

Numerous review studies have been conducted on various aspects of mega-events. Elahi et al. (2021) analyzed 40 studies to categorize sports mega-events positive and negative effects on host cities, including cultural, political, social, economic, and environmental impacts. Mair et al. (2021) presented a framework for identifying and measuring the social impacts associated with bidding and hosting mega-events, while Weed et al. (2015) found that relying solely on the demonstration effect of mega-events to inspire new participants in sports was unlikely to be effective. However, effectively leveraging a demonstration effect in the pre-games period may enhance sports engagement, as exemplified by London 2012. McCartney et al. (2010) conducted a review of 54 studies to examine the effects of mega-events on the socioeconomic determinants of health in the host city. They concluded that the available evidence was insufficient to support or disprove health benefits for the host city and proposed that organizers of such mega-events must include relevant long-term evaluation in the planning phase to justify benefits for the host city. Scheu et al. (2021) conducted an extensive literature review on the legacy of the Olympic Games and observed that research on the Olympic legacy increased significantly since 2008, with more focus on the legacy of the Summer Olympic Games compared to the Winter Games. They identified “urban development” and “beliefs and behavior” as the most scrutinized facets of the legacy framework.

A scientometric analysis provides a systematic examination of existing studies and aims to identify emerging trends in a particular area. Jiménez-García et al. (2020) and Escamilla-Fajardo et al. (2020) adopted this bibliometric technique to detect trends and influential research issues in sports tourism and sustainability, and entrepreneurship and innovation in football, respectively. Oliveira et al. (2021) examined developments in football tourism across meta-level, meso-level, and micro-level factors by analyzing articles published in tourism-based journals. However, to our knowledge, no scientometric analysis of mega-events has been conducted so far. Therefore, this

study aims to provide a systematic and intellectual structure of the existing literature on mega-events through scientometric analysis. The study intends to help researchers and practitioners understand the current literature and identify future trends.

This study seeks to address several central questions, including the trend of publications and citations in the field of mega-events, the most active and influential researchers, countries, institutions, and journals, the status and pattern of scientific collaboration, the most important mega-events in terms of publications and thematic areas, the evolution of research on mega-events over time, and the most studied categories of mega-events. Through this analysis, the study aims to contribute to the ongoing discussions and debates about the impacts and implications of mega-events for host communities and their long-term legacies.

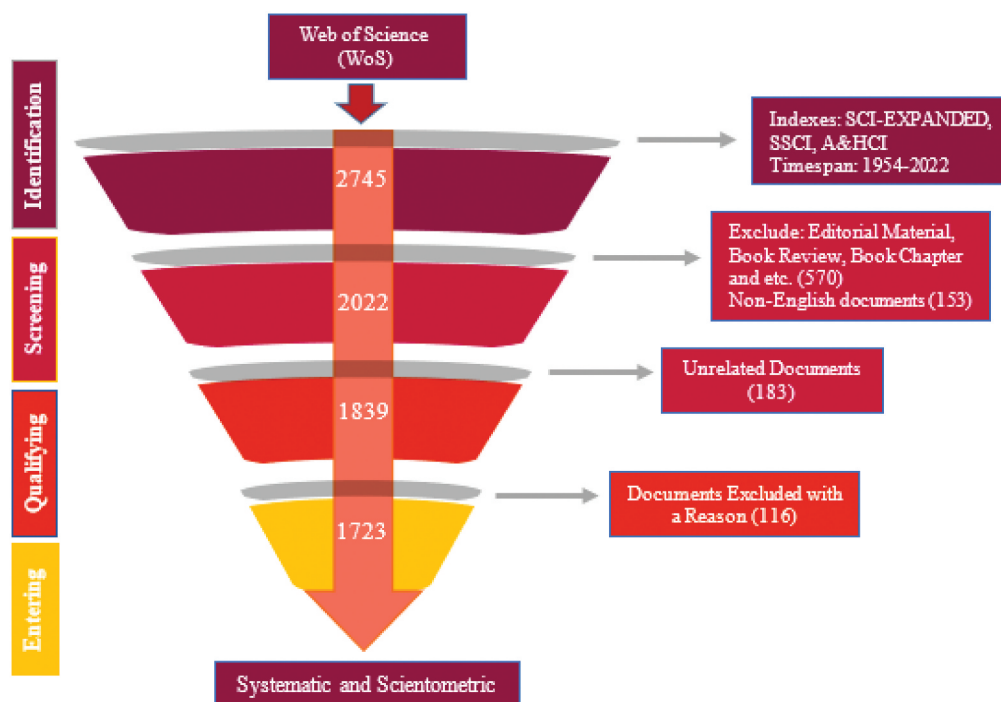
2. Method

Through a rigorous research method, the study aims to provide a comprehensive and in-depth analysis of the literature on mega-events, shedding light on the trends, patterns, and key themes in the field. It combines scientometric analysis and systematic review to examine published studies on mega-events in the last 68 years, using data from the Web of Science database spanning from 1954 to 2022. The research method consists of four steps. The first and second steps describe the data recovery method, inclusion and exclusion criteria for the studies. In contrast, the third and fourth steps involve the systematic review and scientometric analysis. A detailed process flow chart is provided in Figure 1, outlining the steps taken to gather, filter, and analyze the data.

2.1. Step one: Data recovery

Web of Science is widely recognized as the most reliable and well-known citation index in the world (Olawumi & Chan, 2018). Compared to other databases, this citation index is considered more prestigious due to its ability to provide comprehensive and reliable information, as well as accurate evaluation indicators for journals, authors, and articles (Gholampour et al., 2022). Therefore, in this research, we have selected the Web of Science core collection Clarivate analytics and its three valid indexes, Science Citation Index-Expanded (SCIE), Social Sciences Citation Index

Figure 2. Flowchart of Systematic Review



(SSCI), and Arts & Humanities Citation Index (AHCI), to review the current literature on mega-events (Noruzi et al., 2022). To do this, we used the keywords related to mega-events listed in Appendix A, and conducted a search using two tags (TI, KY), Boolean operators (OR, AND), the exact phrase term ("), and the Wildcards (*) symbol. The data was then extracted in plain text batches of 500 from the Web of Science database.

2.2. Step two: Inclusion/exclusion criteria

In the first step, data collection was performed in the Web of Science database using the selected search term, resulting in the retrieval of 2,745 documents. Two reviewers screened the data and excluded studies that did not meet the inclusion criteria. The inclusion criteria specified that only research articles and reviews written in English, published between 1954 and 2022 in the Web of Science database, and focusing on the Olympic and Paralympic Games (summer and winter), as well as the FIFA Men's World Cup, would be considered. Conversely, the exclusion criteria listed the types of studies that would not be included in the research project such as editorial material, book reviews, book chapters, and any studies not written in English. Additionally, studies published outside of the specified period (1954–2022) or in databases other than Web of Science were also excluded. Finally, studies that did not focus on the Olympic and Paralympic Games or the FIFA Men's World Cup were not included in the research project.

First, research and review articles written in English were selected for the study, while other documents were excluded. Second, articles that did not mention the Olympic and Paralympic Games (summer and winter) or the FIFA Men's World Cup in their titles and abstracts were excluded. Furthermore, studies that appeared to meet the inclusion criteria were scrutinized in full text, and those that were not relevant to the present study were excluded. After identifying the selected studies, the necessary information was extracted and entered into software for review. A detailed illustration of this process is shown in Figure 2.

2.3. Step three: Systematic review

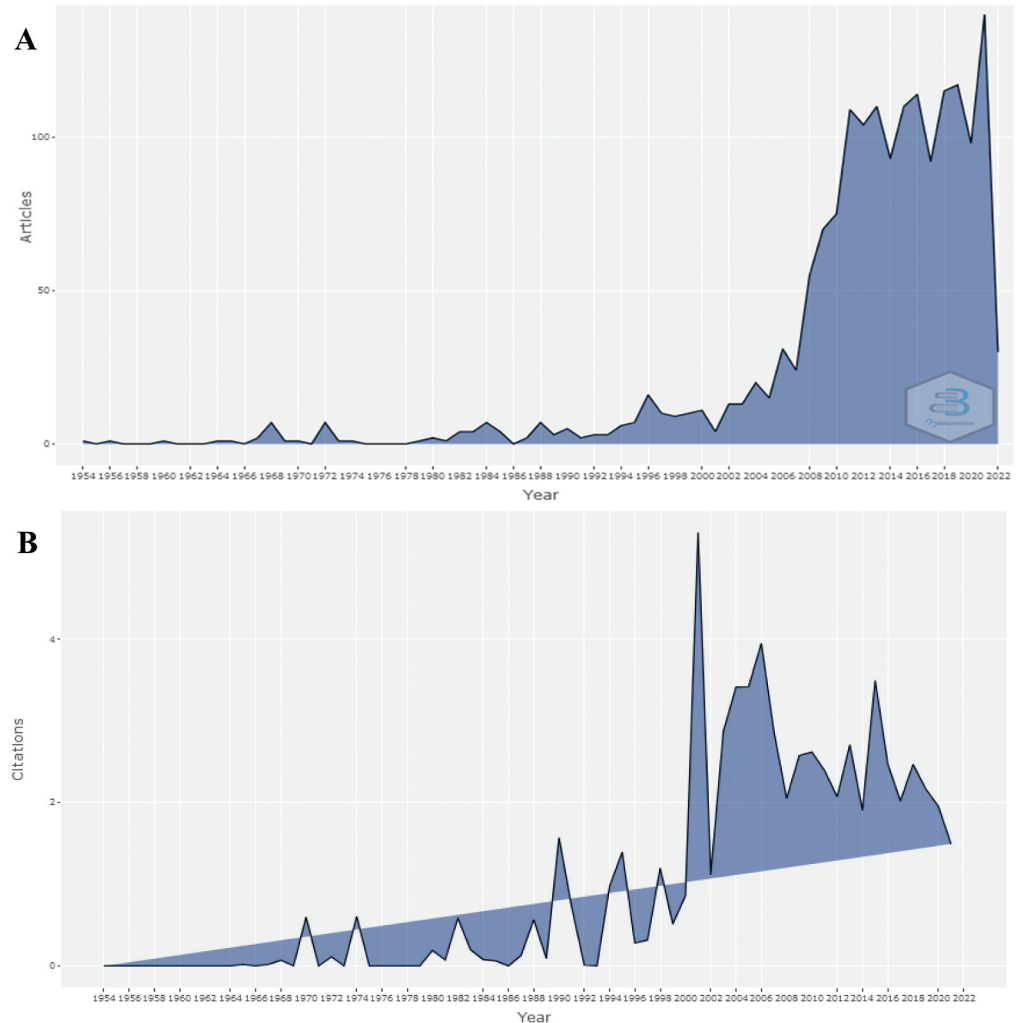
A systematic review offers researchers a comprehensive overview of relevant studies within a particular field. Such reviews serve as a roadmap for novice and young researchers, while providing experienced researchers with profound insights into their research field. While most scientometric studies focus on quantitative aspects, this research aims to present an in-depth systematic review of mega-events alongside a scientometric study. The study aims to gain deeper insight into the themes of mega-events, their main categories, keywords analysis, and bibliographic information (including collaboration and authorship status). To achieve this goal, scientometric software capabilities were utilized. VOSviewer and CiteSpace software were used to identify themes, while VOSviewer software was used to identify co-occurring keywords. CiteSpace software analyzed keywords via citation bursts capabilities and time zone maps. Bibliometric information was identified using Bibliometrix software program. The identification of themes related to mega-events was achieved by studying the title, abstract, and text of the articles.

2.4. Step four: Scientometric analysis

Scientometric studies are essential for analyzing and understanding the scientific field. These studies can help scientists strengthen their systematic review by providing comprehensive insights into research trends and patterns (Porter et al., 2002). By utilizing these sophisticated scientometric tools, we were able to conduct a comprehensive analysis of the literature on mega-events, providing valuable insights into research trends, patterns, and key themes in the field. In this study, we utilized several scientometric software tools, including HistCite, VOSviewer, Bibliometrix R, and CiteSpace, to analyze the literature on mega-events.

HistCite is a powerful software package that provides a broad range of bibliometric information and visualization options (Noruzi et al., 2022). Using this software, we were able to identify the most active and influential countries, institutions, researchers, and journals in the field of mega-events and present them in the form of tables and charts (Garfield et al., 2006).

Figure 3. Annual Distribution of Publications (a) Average Annual Citations (b).



VOSviewer, developed by Van Eck and Waltman with the support of Leiden University, specializes in depicting scientific collaboration networks, co-citation networks, co-occurring keywords, bibliographic coupling networks, and other scientometric studies (van Eck & Waltman, 2010). We used VOSviewer to analyze the scientific collaboration network in the field of mega-events.

Bibliometrix R-package is an open-source software provided by Aria & Cuccurullo, offering researchers tools for quantitative research in bibliometrics and scientometrics (Aria & Cuccurullo, 2017). We used the scientometric section of Bibliometrix R Package software to plot the publication trends and citations of mega-events articles.

CiteSpace is a powerful tool for scientific visualization and analysis, enabling researchers to draw and analyze trends and transient patterns in scientific literature, identify hot and emerging topics, and evaluate subject areas based on timelines and time zones (Chen, 2006). We utilized CiteSpace to map the timeline and keywords with citation bursts in the field of mega-events (see Table 1).

3. Results

3.1. Scientometric analysis

3.1.1. Annual distribution of scientific publications and citations

The evolution of research output in the field of mega-events reflects the varying degree of attention that the scientific community has given to this area of study over time. According to studies, there has been a steady increase in the number of articles published on this subject. Figure 3(a) illustrates that the publication rate of articles during the last five decades of the 20th century (1954–2000) was challenging. In this period, a mere 141 articles were published, which is equivalent to only 8.18% of the total publications. Furthermore, the average annual growth rate of articles published during this time was 3.06, indicating that this field of research was still in its exploratory stage, and there was less attention paid by the scientific community.

The first article in this period, entitled “Experiences with Electroacoustic Equipment used at the 1952 Olympic Games in Helsinki” was published in the journal *Acta Acustica united with Acustica*. Generally, due to the importance of the Olympic Games compared to other events, researchers have studied various aspects of this event. However, at the beginning of the 21st century (2021–2022), and due to the widespread media coverage and the impacts of these events on the host communities, they have attracted the attention of the scientific community more than ever.

Figure 4. Collaborations Network of Authors (a) Collaborations Network of Authors During Various Periods (b).

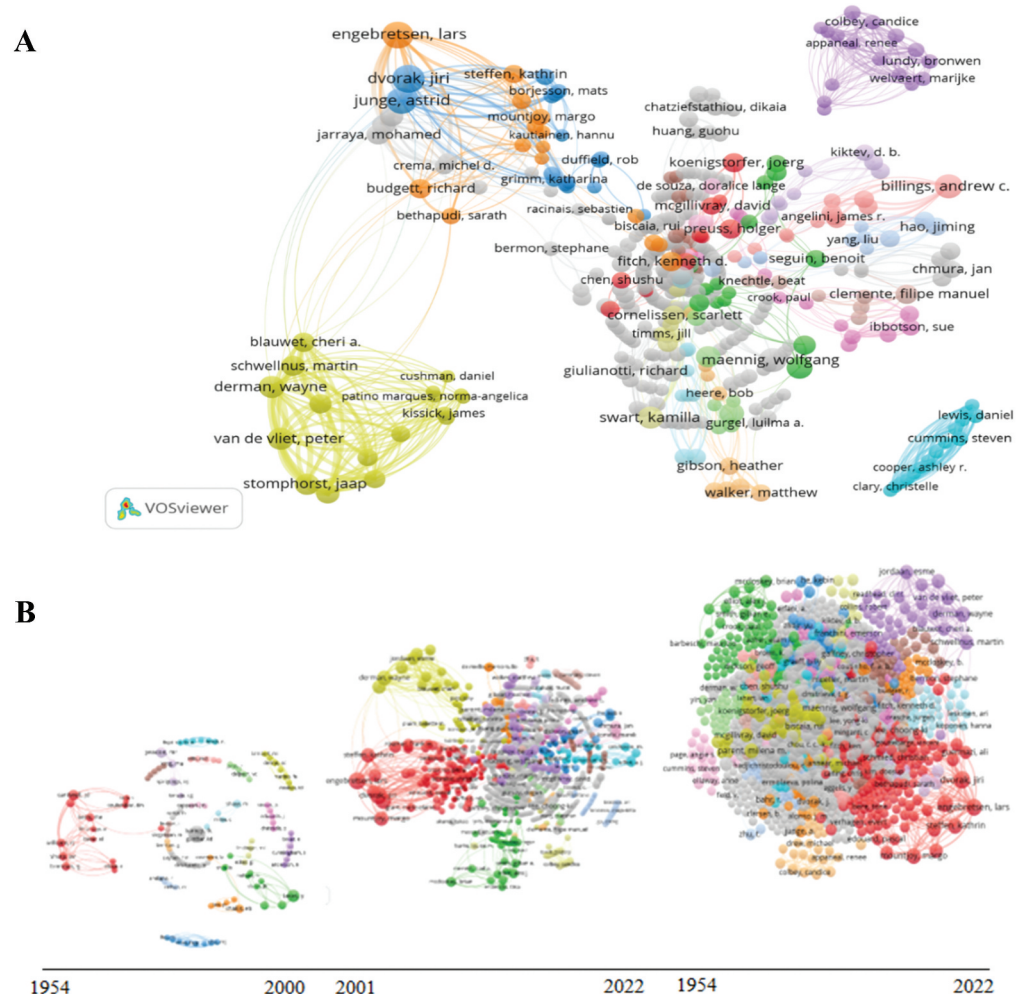
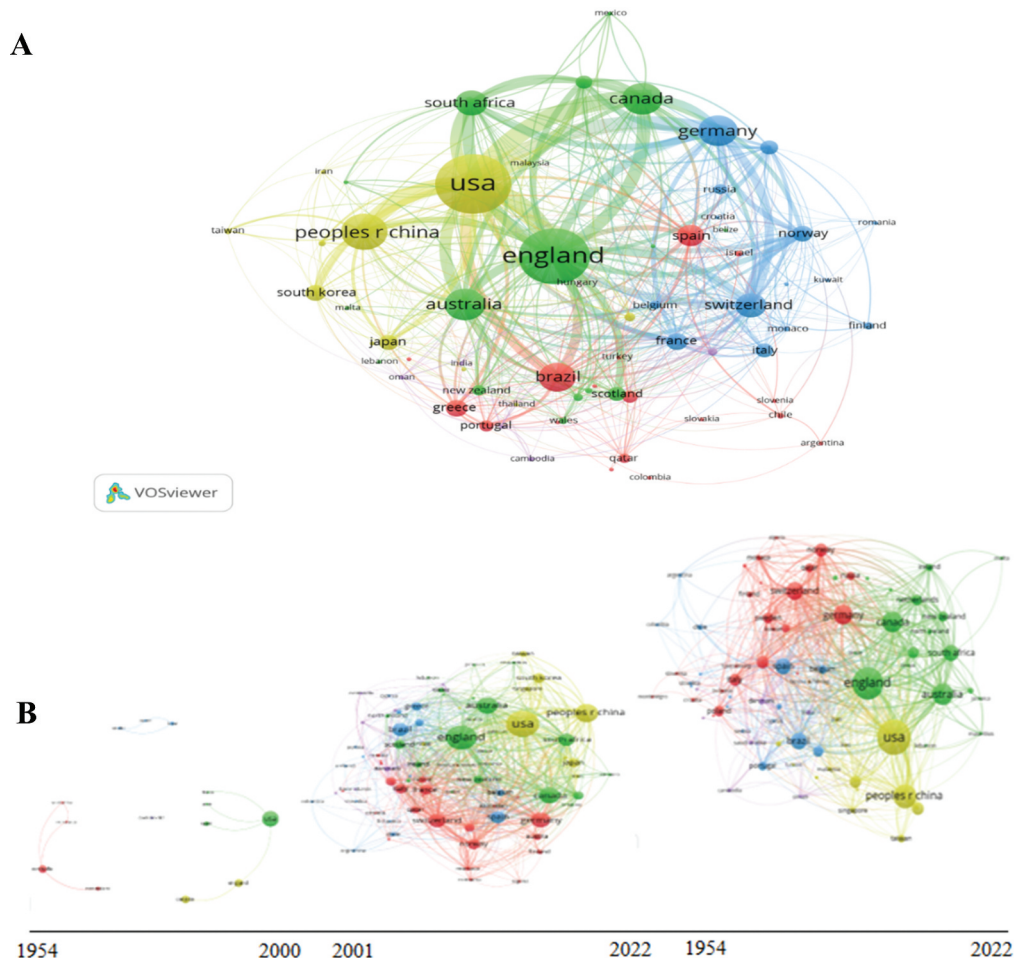


Table 1. Top 10 Influential Authors in Mega-Events

Rank	Author	TP	TPY	TC	TCY	ACPP	PY-Start	Subject Area
1	Dvorak J	21	1.17	1983	110.17	94.43	2004	Sports Medicine
2	Junge A	17	0.94	1490	82.78	87.65	2004	Sports Medicine
3	Engelbrechtsen L	17	1.21	1047	74.79	61.59	2008	Sports Medicine
4	Billings AC	17	1.89	174	10.24	19.33	2013	Sports Media
5	Derman W	14	1.27	581	52.81	41.50	2011	Sports Medicine
6	Fitch KD	14	0.74	581	30.58	41.50	2003	Sports Medicine
7	Schwellinus M	13	1.18	562	51.09	43.23	2011	Sports Medicine
8	Blauwet CA	13	1.44	454	60.56	34.92	2013	Sports Medicine
9	Van de Vliet P	13	1.44	459	51.00	35.31	2013	Sports Medicine
10	Muller M	12	1.20	579	57.90	48.25	2012	Sports Events, Sustainability, Cities

TP = Total Publications; TPY = Total Publications Per Year; PY-Start = Publication Year Start; TC = Total Citations; TCY = Total Citations Per Year; ACPP = Average Citations per Publication

Figure 5. Collaborations Network of Countries (a) Collaborations Network of Countries During Various Periods (b).



A total of 1,582 articles, equivalent to 91.82% of the publications, were published in the early decades of this century, and an average annual growth of 71.91 in this century confirms the scientific community's attention to the published output of these events. A review of the articles in this period showed that most researchers focused on the Olympic Games and the FIFA World Cup, including community impact, legacy, economic, social, political, environmental, tourism, image, injuries, illness, and athlete performance.

The average annual citation status of mega-event articles from 1954 to 2022 is shown in Figure 3(b). The results show that the highest average citation rate of mega-event articles was from 2001, 2006, and 2015 with average citations of 5.3, 3.6, and 3.5. On the other hand, the total number of 1,723 articles reviewed received 31,722 citations. The citation trend of articles confirms that the number of citations to articles in 2011, 2015, and 2013 was 2868, 2675, and 2669, respectively, more than in other years. It is worth noting that according to research results, articles published in 1965, 1967, 1981, 1985, 1987, 1989, and 1992 also received less than ten citations. It is also important to note that articles published in 1954, 1956, 1960, 1964, 1969, 1973, 1979, and 1993 were not cited until the research was conducted.

3.1.2. Analysis of authors

Figure 4(a) specifically illustrates the network of scientific collaboration of researchers in the field of mega-events who participated in at least two articles together. The network consisted of 624 researchers and 1,190 links. The results show that researchers such as Jiri Dvorak (29 links), Astrid Junge (21 links), and Lars Engebretsen (20 links) had the highest number of connections in the

network and were able to form a high scientific collaboration in this field. Figure 4(b) Network status depicts the collaboration of researchers in different periods. In the last five decades of the 20th century (1954–2000) only 231 researchers participated in the production of these articles, this number in the early decades of the 21st century (2021–2021) to 4,181, which shows that the amount and intensity of collaborations have increased since the beginning of the 21st century.

The study revealed that more than 4,150 researchers collaborated on articles related to mega-events. Table 1 presents the publication and citation records of the ten most active researchers in this field. Notably, Jiri Dvorak was the most prominent researcher, having published 21 articles, followed by Astrid Junge, Lars Engebretsen, and Andrew C Billings, each with 17 publications, and Wayne Derman and Kenneth D Fitch, with 14 publications. However, it is important to acknowledge that publication rate is only one of the indicators used to identify active authors, and researchers' citation rate and impact should also be considered. Regarding impact, Jiri Dvorak, Astrid Junge, and Lars Engebretsen were the most widely cited researchers in the field, with 1,983, 1,490, and 1,047 citations, respectively. It is noteworthy that the most influential researchers are those whose citations exceed the number of their published works. Accordingly, Dvorak, with an average of 94.43 citations per article, Junge, with an average of 87.65, and Engebretsen, with an average of 61.59 citations per article, were the most influential researchers in this field.

3.1.3. Analysis of countries

The state of the countries' scientific collaboration network in the field of studies on mega-events shows that 70 countries (based on the organizational affiliation of the authors) collaborated scientifically in publishing. These countries were able to collaborate 504 times in the publication of 1,723 published articles in this field. Overall, the results of the collaboration show that England with (48 links), the USA (47 links), Switzerland (38 links), South Africa (33 links), Canada (33 links), France (33 links), and Australia with (31 links) the highest they formed a scientific collaboration in this field Figure 5(a). In other words, the largest amount of this collaboration was between the USA-England, the USA-Canada, the USA-China, and the USA-Germany. Figure 5(b) depicts the state of the collaboration network of countries in different periods. In the first period (1954–2000) only 17 countries participated in the production of these articles, this number reached 70 in the early decades of the 21st century (2001–2021), which shows that the amount and intensity of collaboration have increased since the beginning of the 21st century.

Table 2 provides an overview of publication and citation status across 12 countries that have actively produced research on mega-events. In general, the USA (380 articles), England (374 articles), and China (171 articles) emerged as the most prolific countries with authors publishing extensively on the topic of mega-events. Canada, Australia, Germany, and Brazil, on the other hand, had fewer active researchers in this field. In terms of hosting mega-events, the USA had been a pioneer, having hosted nine events, followed by France (seven events) and Germany (five events). These countries had scholars active in publishing articles about mega-events, and played a prominent role in hosting mega-events. The results also showed that the authors from the USA (10,096 citations), England (8,527 citations), and China (4,947 citations) ranked as the most cited. In other words, England and the USA had an average annual revenue of US\$ 258.39 and their authors having an average of 240.38 citations per article were the two leading countries in this field. An interesting point in Table 2 was the emergence of Norway (41.44 citations per article) and Sweden (38.47 citations per article) came in first and second places. Although these countries had been ranked twelfth and ninth in terms of productivity, with fewer articles, they were recognized as the most influential countries in the field of mega-events.

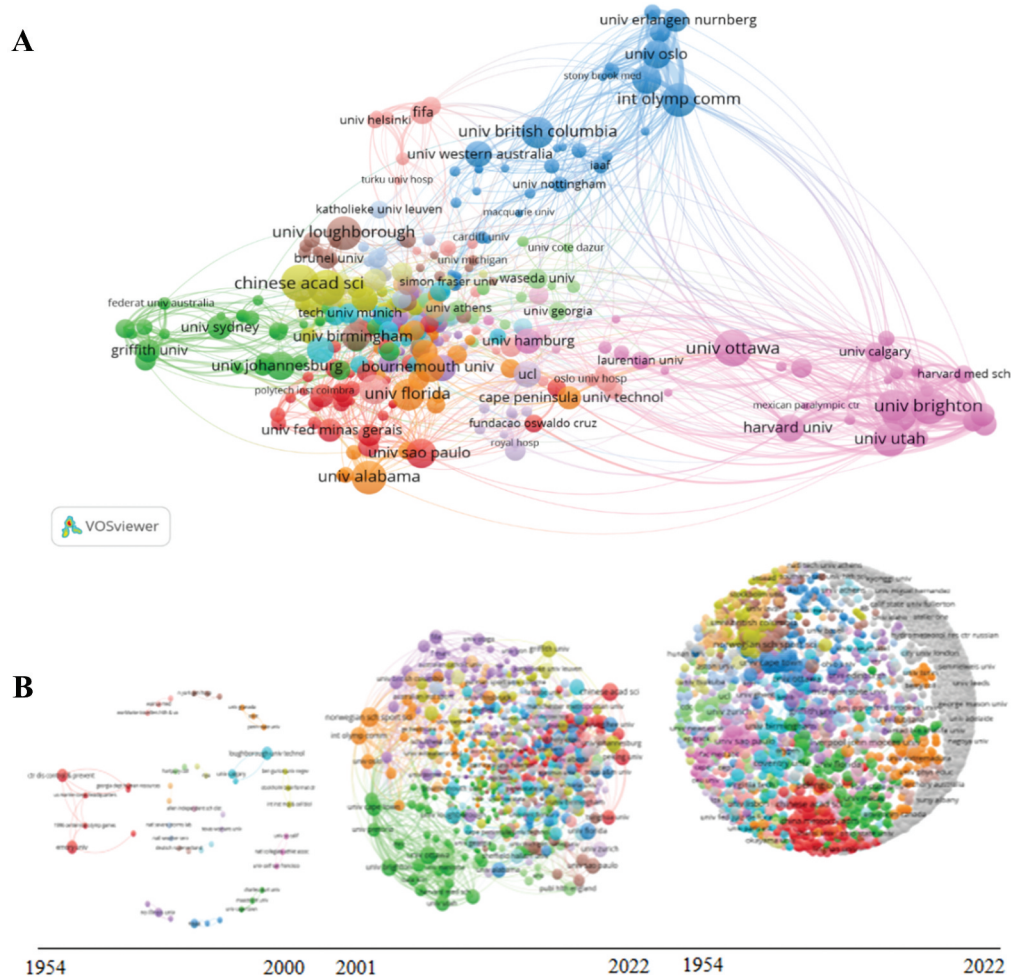
3.1.4. Analysis of institutions

Figure 6(a) indicates the nature and structure of scientific collaboration between institutions and universities in the field of mega-events. The results show that more than 1,800 institutions participated in the publication of these articles. Thus, the institutions in Figure 6(a) collaborated on at least two articles. The collaboration network of institutions consists of 555 nodes and 1,579

Table 2. Top 12 Influential Countries in Mega-Events

Rank	Country	TP	TPY	TC	TCY	ACPP	PY-Start	Number of Mega-events
1	USA	380	9.05	10096	240.38	26.57▼	1980	9
2	England	374	11.33	8527	258.39	22.80▼	1989	4
3	China	171	8.14	4947	235.57	28.93	2001	2
4	Canada	151	3.02	3600	72.00	23.84	1972	3
5	Australia	142	4.18	2795	82.21	19.68	1988	2
6	Germany	133	6.05	2576	117.09	19.37	2000	5
7	Brazil	119	7.44	1168	73.00	9.82	2006	3
8	South Africa	97	5.71	2261	133.00	23.20	2005	1
9	Switzerland	87	4.83	3347	185.94	38.47▲	2004	3
10	Spain	79	2.39	1771	53.67	22.42	1989	2
11	France	51	2.13	912	38.00	17.88	1998	7
12	Norway	48	2.09	1989	86.48	41.44▲	1999	2

Figure 6. Collaborations Network of Institutions (a) Collaborations Network of Institutions During Various Periods (b).



In other words, the the International Olympic Committee (IOC) with (54 links), Harvard University with (38 links), the University of Ottawa (35 links), and the University of Brighton (35 links) had the most key role in the scientific collaboration network of institutions and organizations publishing articles. Also, the status of collaboration between institutions in different periods is illustrated in Figure 6(b). The trend of institutional collaboration indicates that the level of collaboration has increased in the early decades of the 21st century (2001–2021) compared to the last five decades of the 20th century (1954–2000). In general, the number of participants has increased from 75 institutions in 1970–2000 to 1,821 institutes from 2001 to 2021.

The 10 active and influential institutions in the field of mega-events (see Table 3). The IOC with 39 and Loughborough University with 33 papers were the most prominent organizations and institutions in this field. They were followed by the Chinese Academy of Sciences, Stellenbosch University, and the University of Ottawa. The results showed that scientific papers published by IOC-affiliated researchers in 1905 and Peking University in 1929 cited more influence on the scientific community. The IOC with an average of 119.06 and Peking University with an average of 115.27 citations per year had the highest annual citations among other institutions. A critical point in Table 3 was the five-step promotion of Peking University and the eight-step promotion of FIFA, which by publishing fewer articles was able to surpass their counterparts and rank first to third most influential institutions. It was important to note that these institutions were the most influential in the field of mega-events with an average of 72.

Table 3. Top 10 Influential Institutions in Mega-Events

Rank	Institution	TP	TPY	TC	TCY	ACPP	PY-Start	Region
1	IOC	39	2.44	1905	119.06	48.85▼	2006	Switzerland
2	Loughborough University	33	1.27	937	36.04	28.39	1996	England
3	Chinese Academy of Sciences	25	1.19	982	46.76	39.28	2001	China
4	Stellenbosch University	25	1.56	922	57.63	36.88	2006	South Africa
5	University of Ottawa	25	1.56	625	39.06	25.00	2006	Canada
6	Peking University	24	1.60	1729	115.27	72.04▲	2007	China
7	University of Brighton	23	1.44	646	40.38	28.09	2006	England
8	University of Utah	21	1.05	611	30.55	29.09	2002	USA
9	University of Alabama	21	1.75	231	19.25	11.00	2010	USA
10	FIFA	20	1.11	1355	75.28	67.75▲	2004	Switzerland

3.1.5. Analysis of journals

A total of 662 journals published research findings related to mega-events. A review of journal publishing status showed that more than 29% of the published articles on mega-events were published in the ten journals presented in Table 4. *International Journal of the History of Sport* with 126 articles, *British Journal of Sports Medicine* with 57, and *Sport in Society* with 50 articles had the largest share in this field. Among them, *British Journal of Sports Medicine* (impact factor = 13,800) and *Tourism Management* (impact factor = 10,967) were the most important publishing sources in this field, which had a higher impact factor than other journals. It should be noted that these two journals were also among the top 25% of journals (Q1) in their field. The results showed that *British Journal of Sports Medicine* had 2,350 citations and an average of 88.86 citations per article, and *Tourism Management* had 1,955 citations and 41.23 citations per article on average.

3.2. Second analysis: Systematic review

3.2.1. Bibliographic information

Table 5 shows that 4,181 researchers from 1,821 institutes across 70 countries have contributed to 1,723 published articles, published in 622 journals, and received 70,495 citations. The average number of per article citations was 18.23, and the yearly number of citations was 1.855. The majority of articles (1,670) were research articles, while only 53 were review articles. Those authors used 3,698 keywords, while the Web of Science used about 2,357 keywords to index the articles. Regarding authorship, 402 single-authored publications and 3,779 multi-authored publications were identified. On average, every 0.412 articles had one author, and every 2.43 researchers contributed to one article. The collaboration index was 3.26, indicating a relatively satisfactory level of collaboration in the field of mega-events.

3.2.2. Thematic and keywords analysis

A review of studies shows that researchers in most studies on mega-events paid special attention to the Olympic Games. In general, the findings in Figure 7 indicate that 1,155 articles, i.e., more than 67% of the Olympic Games studies were examined from various aspects. The FIFA World Cup with 359 (20.84%) and the Paralympic Games with 82 (4.76%) received the most attention. Studies have shown that research on the Olympic Games paid special attention to the London 2012, Rio de Janeiro 2016, Beijing 2008, and Tokyo 2020 Games. Also among the studies on the FIFA World Cup, the games of 2010 South Africa, 2014 Brazil, 2018 Russia, 2006 Germany, 2022 Qatar, 2002 Korea-Japan and 1998 France were the most studied.

Table 6 presents the topics with the most articles for the four Olympic games and FIFA World Cup events. The results showed that most studies on the Beijing 2008 Olympic Games focused on air pollution control, the environment, and residents' perceptions. Research on the London 2012, Rio de Janeiro 2016, and Tokyo 2020 Olympic games delved into various topics, such as legacy, sports participation, public health, injury and illness related to sports, COVID-19, overheating, and postponement of games. Similarly, studies on the four FIFA World Cup games (Germany 2006, South Africa 2010, Brazil 2014, and Russia 2018) addressed a diverse range of issues, including betting, investment, and sponsorship, legacy, residents' perceptions, image and branding, tourism, infrastructure, transportation, access to public education, welfare, illness, health, and nutrition, player and team performance, and policy.

To gain an understanding of the key themes in the field of mega-events, the keywords used in articles were analyzed. Figure 8(a) and Table 7 and 8 provide a comprehensive overview of these themes. Seven distinct themes were identified based on the authors' keywords, and the four themes are described in detail below.

Theme 1 Olympic Games: This theme with 60 occurrences is the largest theme in this field, It involves Olympic Games, legacy, China, Beijing 2008, air pollution, Rio de Janeiro 2016, and London 2012. This theme is marked in red and the main year of keyword release is 2014. This theme has paid special attention to issues related to the Olympics and its impacts such as legacy, environment, and sustainability.

Table 4. Top 10 Influential Journals Publishing Research on Mega-Events

Rank	Journal	TP	TC	ACPP	IF	Q	Region
1	International Journal of The History of Sport	125	754	5.98▼	0.648	4	England
2	British Journal of Sports Medicine	57	2350	41.23▲	13.800	1	England
3	Sport in Society	50	214	4.28	1.725	4	England
4	Leisure Studies	35	902	25.77	2.949	3	England
5	Sustainability	30	220	7.33	3.251	2	Switzerland
6	International Review for the Sociology of Sport	29	483	16.66	3.78	2	USA
7	European Sport Management Quarterly	27	710	26.30	4.0	2	England
8	International Journal of Performance Analysis in Sport	23	315	13.70	1.95	3	Wales
9	Tourism Management	22	1955	88.86▲	10.967	1	England
10	Communication & Sport	20	186	9.30	3.178	3	USA

Note. IF = Impact Factor; Q = Quartile

Table 5. Bibliographic Information of Mega-Events Articles

Part A. Main Information About Data	Results
Authors	4,181
Institutions	1,821
Countries	70
Journals	662
Publications	1,723
Citations	31,431
Average Citations Per Publications	18.23
Average Citations Per Year Per Publications	1.855
References	70,495
Part B. Publications Types and Contents	
Article	1,670
Review	53
Author's Keywords (DE)	3,698
Keywords Plus (ID)	2,357
Part C. Authors	
Authors	4,181
Author Appearances	5,613
Authors of single-authored Publications	402
Authors of multi-authored Publications	3,779
Part D. Authors Collaboration	
Publications per Author	0.412
Authors per Publications	2.43
Co-Authors per Publications	3.26
Collaboration Index	3

Theme 2 FIFA World Cup: This theme with 47 occurrences is the second largest theme. It involves Mega-Events, FIFA World Cup, South Africa, Brazil, 2010 FIFA World Cup. This theme is marked in green and its main year is 2015. The issues raised in this theme indicate that this theme has paid attention to the World Cup games, the impacts (on tourism, destination image, and media), and the security of the event.

Figure 7. Percentage and Number of Mega-Event Publications

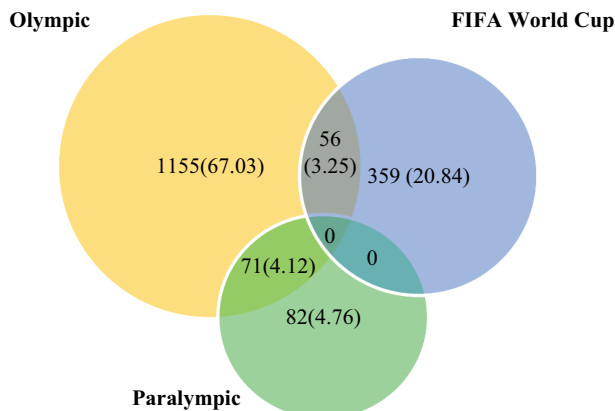


Table 6. Four recent Olympic Games and FIFA World Cup Events and Identified Topics

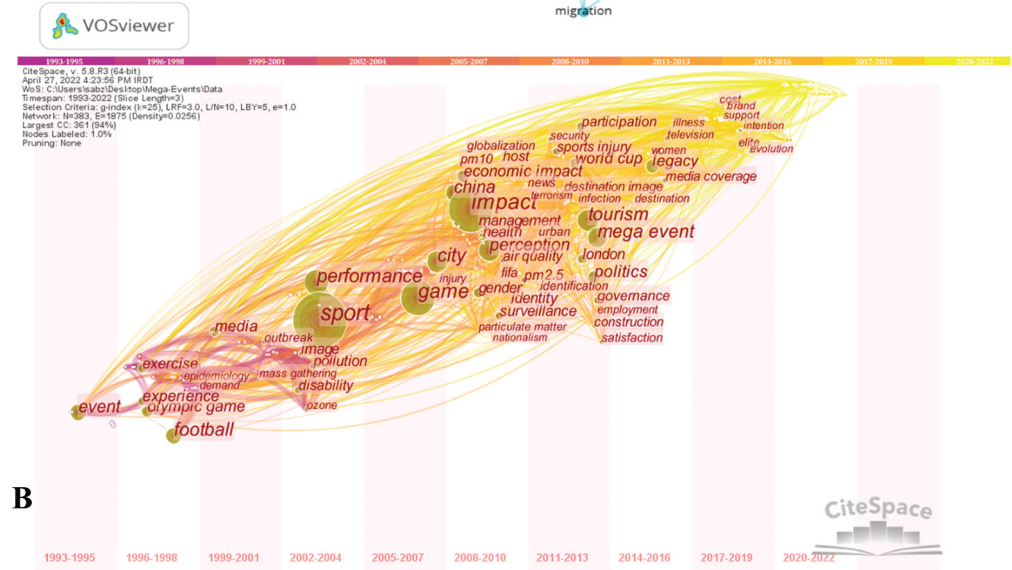
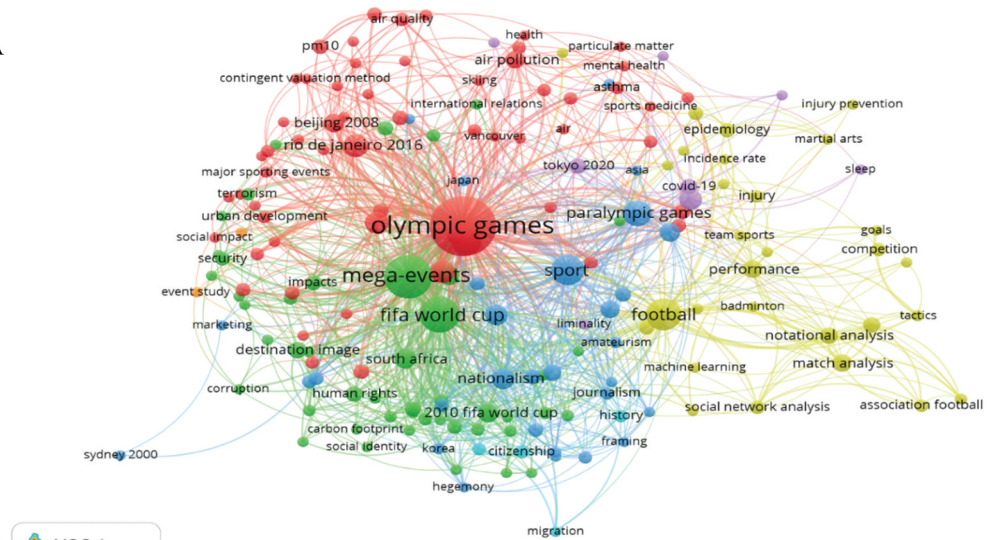
Mega-events		Summary	Resources
Country	City		
Olympic Games			
China	Beijing 2008	air pollution and its control, environment, residents perceptions, destination image	Shen et al. (2011), Wang & Xie (2009), Long et al. (2018), Zhou & Ap (2008), Jin et al. (2011), Lai (2018), Gibson et al. (2008)
England	London 2012	legacy, sport and public participation, public health, sports injuries and illnesses	Davies (2012), Kokolakis et al. (2019), Brown et al. (2017), Hayday et al. (2019), McCloskey et al. (2014), Enock & Jacobs (2008), Bethapudi et al. (2013), Jones et al. (2013)
Brazil	Rio de Janeiro 2016	legacy, sports injuries and illnesses	Yamawaki et al. (2020), Ribeiro & Almeida (2021), Kompel et al. (2018), Yoon et al. (2018)
Japan	Tokyo 2020	COVID-19, heatstroke, game postponement	Majumdar (2021), Guerreiro et al. (2020), Lei & Wang (2021), Taku & Arai (2020), Shimizu et al. (2021)
FIFA World Cup			
Germany	Berlin 2006	predict results and betting, investing and financial support	P. Andersson et al. (2009), Wunderlich & Memmert (2016), Feddersen et al. (2009), Nufer & Bühler (2010)
South Africa	Johannesburg 2010	legacy, residents' perception, image and branding, tourism	Swart et al. (2011), Bek et al. (2019), Hermann et al. (2013), Kaplanidou et al. (2013), Berger (2010), Knott et al. (2017), Bresler (2011), Marschall (2012)
Brazil	Rio de Janeiro 2014	illnesses, health and nutrition issues, transportation, tourism	Gaines et al. (2014), Eberhardt et al. (2016), Da Cunha et al. (2014), Ritter & Tondo (2014), Pereira (2018), Meurer & Lins (2018), Swart et al. (2018)
Russia	Moscow 2018	athlete and team performance, politics and image	Tuo et al. (2019), Yi et al. (2019), Meier et al. (2021), Rocha & Wyse (2020)

Theme 3 Sport: This theme with 30 occurrences is the third largest theme of mega-events. This theme involves sport, Paralympic Games, nationalism, media, disability, gender, globalization, women, etc. This theme is marked in blue and its main year is 2014. The issues in this theme indicate that this theme has paid special attention to issues related to sport and the role of the media in presenting issues such as nationalism, globalization of politics, and patriotism.

Theme 4 Football: The fourth largest theme in this network is marked in yellow and has 29 occurrences. It focuses on research fields such as football, performance, match analysis, national

Figure 8. The Author Keywords Co-occurrences Network (a) Time Zone Map of Co-occurrences Keyword (b).

A



B

analysis, and performance analysis. The main year for this theme was 2016, indicating that it is the youngest theme formed among the others. The keywords in this theme suggest that football research was primarily focused on issues related to match analysis and injuries.

To comprehensively understand the developments in the field of mega-events, this study utilized CiteSpace software to analyze themes over time. The issues raised in each period represent researchers' focal points on the subject of mega-events. Figure 8(b) illustrates the nodes and links moving from left to right, from the early years to the present (Gholampour et al., 2020). The picture reveals that in the early years (1993–2004), researchers focused on examining the events and their functions, as evidenced by the high occurrence of words such as sport, performance, event, football, Olympic games, and ratio. From 2005 to 2010, researchers shifted their focus towards the impacts of the events, as indicated by the high occurrence of keywords such as impact, city, perception, and economic impact. Additionally, due to Beijing hosting the Olympics during this period, researchers paid special attention to the climate of Beijing, resulting in the presence of keywords such as air quality, PM2.5, PM10, health, and host. It should be noted that the most frequently occurring keywords in each period reflect the research focus of the time, but they are not the only indicators of research attention.

Table 7. Top Four Themes in Mega-Events

Themes	Label	Keywords and Frequency	Size	Mean Year
Red	Olympics, impacts	Olympic Games (534), Legacy (58), China (32), Beijing 2008 (43), Air Pollution (18), Rio de Janeiro 2016 (35), London 2012 (35), Sustainability (14), Social Media (11), Doping (11), PM10 (10), Mass Gatherings (10)	60	2014
Green	FIFA World Cup, impacts	Mega-Events (215), FIFA World Cup (137), South Africa (26), Brazil (25), 2010 FIFA World Cup (21), Destination Image (15), Human Rights (13), Tourism (11), Impact (11)	47	2015
Blue	Sport, impacts	Sport (82), Paralympic Games (53), Nationalism (30), Media (28), Disability (22), Gender (19), Globalization (16), Women (11), National Identity (10), Content Analysis (11)	30	2014
Yellow	Football, Analysis	Football (92), Performance (19), Match Analysis (18), National Analysis (15), Performance Analysis (14), Epidemiology (11)	29	2016

Between 2011 and 2016, the primary research centers focused on studying the impacts of mega-events. Topics such as tourism, legacy, politics, image, destination image, media coverage, and sports injury were given significant attention. Security issues related to mega-events, particularly the London Olympics, World Cup in Brazil, and Olympic Rio de Janeiro, were also a significant focus, as evidenced by keywords such as security, terrorism, world cup, mega-event London, and Brazil. From 2016 to 2022, the topics of the previous period continued to be prominent, but several new themes emerged, including mental health, emotion, support, brand, identification, decision making, intention, evolution, motivation, loyalty, elite, cost, climate change, job satisfaction, framework, involvement, and bus rapid transit. Furthermore, the COVID-19 pandemic, which led to the postponement of several mega-events, became a crucial theme for research.

3.2.3. Categorization and documentary analysis

Table 9 highlights a significant increase in publications related to mega-events during the second decade of the 21st century (2011–2021). The trend is reflected in the color spectrum, with both cool and warm colors visible. Most of the published articles on mega-events were found in the fields of social science, hospitality, leisure, sport and tourism, sport sciences, humanities, and business and economics, with 695, 499, 285, 226, and 207 articles, respectively. This indicates

Table 8. Top 20 Keywords with Strongest Citation Bursts



















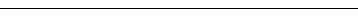

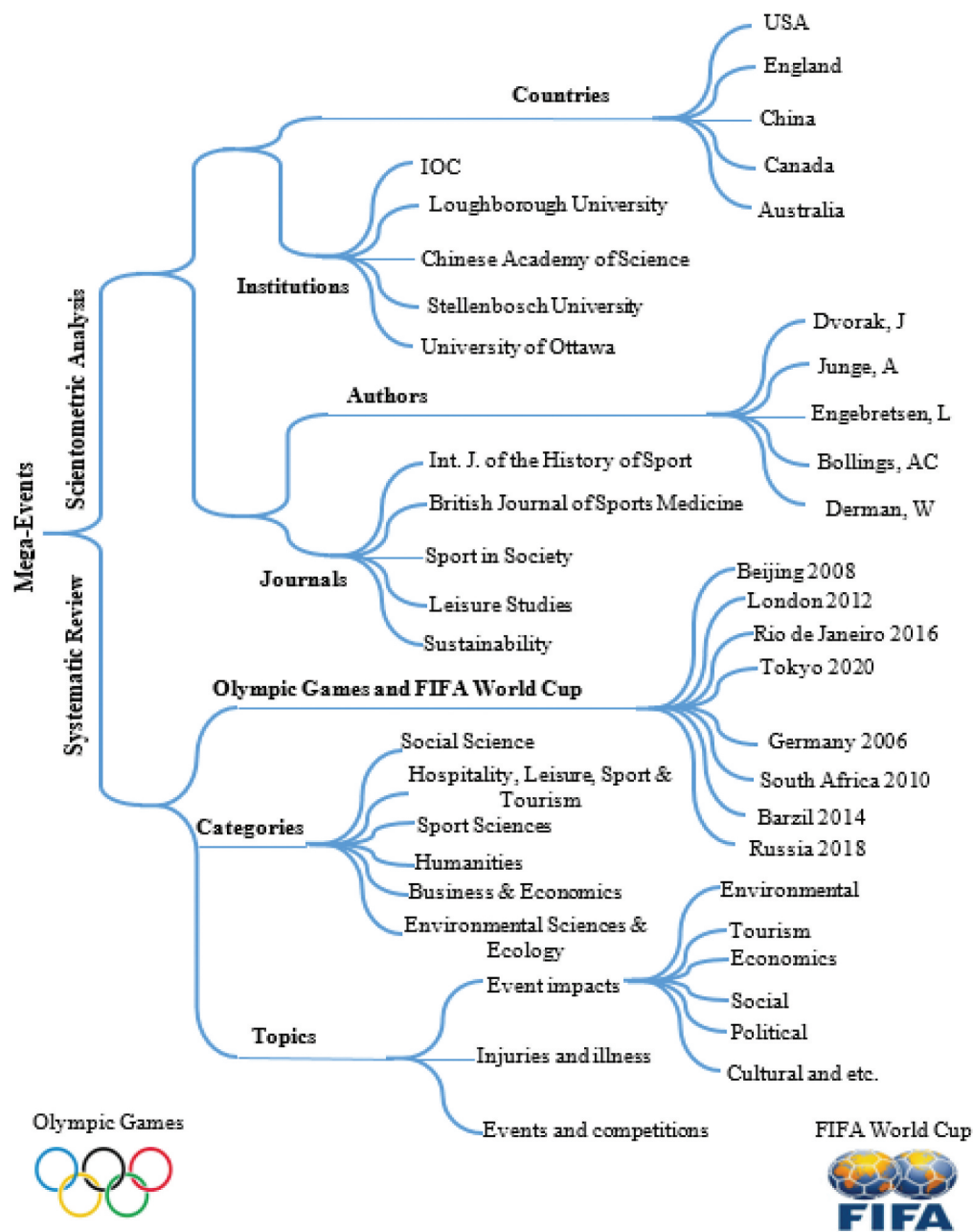
Keywords	Strength	Begin	End	1993 - 2022
Experience	3.47	1997	2010	
Attitude	4.01	2005	2013	
China	7.62	2008	2014	
Pollution	3.44	2008	2012	
Air Quality	7.05	2009	2013	
PM2.5	3.65	2009	2010	
Outbreak	4.28	2012	2016	
Security	4.08	2012	2013	
Terrorism	3.78	2012	2014	
Gender	5.84	2014	2017	
System	3.47	2014	2015	
Surveillance	3.78	2015	2016	
Behavior	3.52	2015	2018	
Legacy	5.02	2017	2022	
Tourism	4.27	2017	2019	
Power	3.8	2017	2020	
World Cup	5.22	2018	2019	
Participation	3.7	2018	2022	
Identification	3.58	2019	2022	
Success	4.52	2020	2022	

Table 9. Main Category Distribution of Publication on Mega-Events Research

Category	1954–1960	1961–1967	1968–1974	1975–1981	1982–1988	1989–1995	1996–2002	2003–2009	2010–2016	2017–2022	Total
Social Science	0	1	3	1	5	4	9	62	277	333	695
Hospitality, Leisure, Sport & Tourism	0	0	0	0	3	3	4	39	223	227	499
Sport Sciences	0	0	0	0	7	7	19	47	96	109	285
Humanities				2	7	7	9	15	133	53	226
Business & Economics	0	0	0	0	0	4	3	39	73	88	207
Environmental Sciences & Ecology	0	0	0	0	1	1	4	24	69	72	171
Sociology	0	0	2	0	0	0	0	14	63	70	149
History	0	0	0	0	2	0	0	6	97	45	150
Management	0	0	0	0	0	0	0	18	35	42	95
Economics	0	0	0	0	0	1	2	18	34	32	87
Communication	0	1	0	0	0	0	0	0	43	32	76
Public, Environmental Occupational Health	0	0	0	0	0	0	2	21	25	27	75
Psychology	0	0	1	0	4	0	3	8	26	33	75
Science Technology	0	0	1	0	0	0	0	2	16	43	62
Meteorology Atmospheric Sciences	0	0	0	0	0	0	4	8	34	13	59

that researchers primarily focused on the social, sport, tourism, humanities, and business and economic aspects of mega-events. The high number of articles on these subject areas confirms the significant impact of mega-events on tourism, the economy, and trade. Additionally, environmental sciences and ecology received significant attention, with a large volume of articles published in this field, indicating that researchers and event organizers have emphasized environmental issues in relation to mega-events. It should be noted that an article could be classified into multiple subject areas.

Figure 9. A Hierarchical Summary of Mega-Events Research



4. Discussion

Mega-events have long been a focal point for research attention, given their significant and often far-reaching effects, both positive and negative. As a result, scholars have been interested in examining the economic, social, cultural, political, and environmental aspects of these events. The findings of this study are likely to be useful for academics, policymakers, and experts in this research field. Mega-events are a highly promising field of research, as evidenced by the collaboration of 4,181 authors from 1,821 institutes who collectively published 1,723 articles in 662 journals. While only 14.92% of authors and 30.83% of institutions published more than one article, less than 1% published more than ten articles in this field. The trend of publishing and citing mega-events steadily increased, potentially due to widespread media coverage, the significant impacts (both positive and negative) of these events on host communities, the expansion of scientific disciplines, and the growing number of researchers, students, and scientific journals. It is noteworthy that

mega-events research received significant attention and engagement from the scientific community, with a total of 31,431 citations across 1,723 articles. This equates to an average of 462 citations per year, indicating a substantial level of interest in this field of study.

The USA and other influential countries in the mega-events field had produced a substantial amount of research, indicating their dominance in this area. Notably, these countries had also hosted a large number of mega-events, which could account for their higher volume of related studies. Additionally, scholars from Europe and the Americas had exhibited greater interest in mega-events compared to those from other continents, possibly due to their frequent hosting of such events. These results aligned with earlier research by Andersson et al. (2021), Amponsah et al. (2018), and Breuer & Forrest (2018). It was noteworthy that at least one mega-event had taken place in every one of the ten countries. Europe, the Americas, Asia, Oceania, and Africa had been the primary hosting regions for mega-events, with Europe holding the most (23 events), followed by the Americas (15), Asia and Oceania (2 each), and Africa (1), as presented in Table 2. These findings emphasized the importance of comprehending the experiences and effects of hosting mega-events in various parts of the world.

Studies have found that the amount and intensity of collaboration have steadily increased over time, and the number of production components, including researchers, institutions, and participating countries, has significantly grown in the early decades of the 21st century (4,181, 1,821, and 70, respectively) compared to the last three decades of the 20th century (231, 75, and 17, respectively). This indicates that the field of mega-events has not only been able to maintain researchers' interest but has also expanded it over time. In other words, key players, such as Dvorak, the IOC, England, and Canada, with the most scientific connections, played a crucial role in the network of scientific collaborations. Furthermore, the most widely published researchers and institutes, including Dvorak and Junge, along with the IOC, had the highest number of citations (Figure 9).

A review of research papers by Dvorak and Junge revealed that their scientific work mainly focused on topics such as injuries and illnesses among athletes at major sporting events such as the FIFA World Cup and the Olympic and Paralympic Games, as well as the use of drugs and supplements. In addition, other researchers such as Billings, Muller, Maennig, Parent, and Swart investigated the impact of mega-events on urban living, environmental sustainability, economics, marketing, religion, tourism, legacy, and brand image. A thematic analysis of the authors' published articles demonstrated the diversity of research topics about mega-events. Similarly, the scientific activities of Peking University showed that there was a focus on topics such as air pollution and pollution control during the 2008 Beijing Olympics. However, a review of articles by FIFA researchers showed that their main focus was on sports injuries and illnesses, medical evaluations of athletes, referees and pre-match assistants, as well as the use of medications and dietary supplements. Some academics at the University of Florida also addressed topical issues such as the impact of mega-events on community, legacy, social well-being, tourism, image, resident perception, patriotism, activism participation, and branding.

In addition to the aforementioned factors, it is important to consider the publishing sources for mega-events research. The findings of this study revealed that researchers primarily focused on publishing in seven journals, which served as a crucial platform for disseminating research on mega-events (Figure 9). Geurin and Naraine (2020) also identified the *International Journal of the History of Sport* as a superior outlet for this type of research. These findings were consistent with the results of the current study, which found that this journal published the largest number of articles on mega-events. Furthermore, a thematic review of these articles revealed that the researchers primarily focused on mega-events and their associated impacts, including injuries and diseases that threaten athletes.

The majority of published documents on mega-events focused on the Olympic Games, accounting for over 67% of publications, while the FIFA World Cup accounted for over 20%. The most extensively researched Olympic Games were Beijing 2008, London 2012, Rio de Janeiro 2016, and Tokyo 2020, while the FIFA World Cups of Germany 2006, Africa 2010, Brazil 2014, and Russia 2018 garnered the most attention from researchers. These findings aligned with Geurin and Naraine's (2020) research, which also highlighted the Olympic Games of Beijing 2008 and London 2012 as the most studied events. Researchers paid particular attention to themes such as the impacts of sporting events, injuries and illnesses, and the events and competitions themselves. Among the impacts, the environmental, tourism, economic, social, political, and cultural effects were the most prominent (Figure 9), consistent with the findings of Elahi et al. (2021). Additionally, keyword analysis revealed that the main research topics in the field of mega-events fell under four categories: Olympic Games, FIFA World Cup, sport, and football. This study presented a comprehensive and systematic review of the last seven decades of research on mega-events, using the scientometric method to offer a broad view of the results.

The number of publications and citations related to mega-events has increased significantly since the beginning of the 21st century compared to the last decades of the 20th century. Also, the number of participants (researchers, countries, and institutions) in publishing documents related to mega-events in the 21st century has expanded compared to the 20th century. Particularly, the USA and other countries were leaders in hosting mega-events. Regarding mega-events, attention was also paid to the Olympic games as it can be seen from the considerable number of publications related to this event. The study of the theme of these articles indicated that researchers paid special attention to the social, tourism, sport, human, trade, and economic aspects and environmental issues of these events (Figure 9). However, we hope that this research will provide a valuable resource for researchers to better understand researchers, institutions, countries, journals, and research fields related to mega-events and insights for future studies.

The present study presents the past, present, and current trends in 68 years of research related to mega-events. It is useful for students, lecturers, researchers interested in studies on mega-events, planners, policymakers, organizers, and countries hosting mega-events. This study relies on systematic review and scientometric methods to use search criteria such as authors, institutions, countries and active and influential journals, and other bibliographic information concerning these events. It will be useful to study the scientific literature in this area. This study also provides themes prominent for mega-events, patterns of scientific collaboration, and research trends. The findings of this study can offer insights for researchers and practitioners interested in understanding the impacts and implications of mega-events, and can provide future research directions and policies for hosting such events.

4.1. Limitations

As in all research, this study has some limitations affecting the generalizability of the findings. First, this systematic and scientometric analysis examined only articles indexed in the Web of Science database; however, some of the most widely used citation databases (Scopus and PubMed) fell outside the scope of this study. Second, in extracting data from the Web of Science database, its core collection was also emphasized on, so it does not include other Web of Science database sets. Third, in the core collection of the Web of Science database, only three main indexes of this database (SCI-EXPANDED, SSCI and A&HCI) were considered and other indexes were not included in the research. Fourth, another limitation of this study is that we focused only on research articles and review articles indexed in the Web of Science core collection and did not consider other citationable items. Fifth, this study focused on English-language publications, so publications in other languages were not included in this research. Sixth, it included those studies that used the search strategy stated in Appendix A. We did not include studies on the events beyond the scope of the search strategy. Last, in this study, the Olympic and Paralympic Games, and FIFA Men's World Cup were not included.

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Disclosure statement

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Appendix A

Search strategy

TI=(“Mega event*” AND Sport* OR “mega sport*” OR “sport* mega event*” OR “mega sport* event*” OR “world cup*” AND “FIFA” OR “world cup*” AND “Football” OR “Olympic game*” OR “Summer Olympic” OR “Winter Olympic” OR “Paralympic Games” OR “host community” AND “mega sport*” OR “host country” AND “mega sport*” OR “impact event*” AND “mega sport*”) OR AK=(“Mega event*” AND Sport* OR “mega sport*” OR “sport* mega event*” OR “mega sport* event*” OR “world cup*” AND “FIFA” OR “world cup*” AND “Football” OR “Olympic game*” OR “Summer Olympic” OR “Winter Olympic” OR “Paralympic Games” OR “host community” AND “mega sport*” OR “host country” AND “mega sport*” OR “impact event*” AND “mega sport*”)
