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Research Article

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A Literature Based Mapping Review on the Macroeconomic Impacts of Digital Transformation in Olympic Sports and Mega Events

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Abstract
This study examines the macroeconomic impacts of Olympic sports and mega-events within the context of digital transformation using bibliometric analysis. Olympic mega-events are not only sporting events but also complex structures intertwined with economic, environmental, and socio-political dimensions. Based on 81 publications from the Web of Science database, the analysis explored annual literature production, citation performance, country collaborations, key concepts, and thematic development. Findings show the first publication appeared in 1996, with significant growth after 2010 and an annual growth rate of 5.71%. The highest average citation occurred in 2014. Common word and abstract analyses highlighted concepts such as Olympic Games, technology, economic impact, and sustainable development. Thematic mapping indicated an interdisciplinary structure encompassing media, governance, urban planning, sports management, digital infrastructure, and politics. Eight main conceptual clusters were identified: operational processes, social dynamics, digitalization and health management, financial growth, media and social dimensions, international perspectives, and mega-event development. Host cities like Beijing and London hold particular significance, and the economic and social impacts of sports are expanding through digital transformation. Future studies should extend bibliometric analysis to databases like Scopus to deepen understanding of these evolving dynamics.

Keywords
Bibliometric analysis, sport, sustainable, technology

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Introduction

Since the mid-20th century, the world has undergone significant social, cultural, economic, and technological transformations. These changes have contributed to various developments, including increased per capita income and advancements in transportation and communication systems (Akyüz & Türkmen, 2016; Türkmen et al., 2013). Mega events play a critical role in enhancing the prestige of host cities and contribute to their competitiveness at both national and international levels by fostering investment and infrastructure development (Galván et al., 2008). In the digital age, these effects have become more pronounced, reshaping the relationship between sport, media, technology, and sustainable development. Hosting mega sporting events often accelerates infrastructure investment, expands employment opportunities, and diversifies economic activities, indicating the macroeconomic contributions of such events to host countries (Terekli & Çobanoğlu, 2018).

Olympic sports and mega events offer a valuable lens through which to understand the macroeconomic impacts of digital transformation. Digitalization has significantly reshaped the relationship between sport, media, and technology, fundamentally altering the fan experience through digital platforms. This transformation has not only changed how sports are consumed but has also redefined economic models, communication strategies, and cultural dynamics (Öktem et al., 2020). In particular, Olympic sports and mega events have become symbols not only of athletic achievement but also of the economic, technological, and environmental shifts driven by digitalization (Long et al., 2018). A noteworthy example is the study by Zhou et al. (2024), which treats mega sports events in China as quasi-natural experiments to examine their impact on green total factor productivity (GTFP). Their findings highlight how digital transformation contributes to green economic development in cities through mechanisms such as increased use of public transportation, investments in the digital economy, and industrial transformation. These factors suggest that digitalization functions not only as a technological shift but also as a driver of structural change at the macroeconomic level. Furthermore, debates over whether digitally rooted disciplines such as eSports should be included in the Olympic program illustrate how the boundaries of traditional sport are being redrawn. This evolving landscape calls for a multi-layered assessment of the macroeconomic

implications of digital transformation (Todt et al., 2020).

Digital transformation is reshaping not only data management, communication, and marketing, but also the organizational infrastructure of mega events. In this context, the study by Meyers (1996) stands out as an early and significant example. The research examines the evolution of smart card technology since the 1970s and its implementation during the 1996 Atlanta Olympics, highlighting how digital infrastructure enhances both economic and operational efficiency in mega events. The study also emphasizes that the speed at which technological innovations diffuse is directly related to user adaptation, which is a critical factor in understanding the broader macroeconomic implications of digital transformation. Moreover, digitalization plays a vital role not only in performance and audience engagement but also in ethical oversight. For instance, digital testing systems used to detect long-standing issues such as doping contribute to enhancing the integrity of sport. At the same time, these systems have broader implications, influencing the economic, political, and reputational dimensions of sport organizations.

In his study, Ningthoujam (2025) examined doping cases in the Olympic Games from 1968 to 2022 and highlighted the crucial role of digital test technologies, particularly in retrospective analyses, in detecting doping violations. These findings suggest that digital transformation is not merely a technological advancement, but also a process of economic and structural restructuring. In this context, the question of how the macroeconomic impacts of digital transformation in Olympic sports and mega events are addressed in the scientific literature is of great significance-both for academic researchers and policymakers. In addition to the search query shown in Figure 1. Advanced Search Screen, the keyword “bibliometrics” was added to the search. No prior bibliometric analysis focusing specifically on this topic was identified, underlining the novelty of the research area.

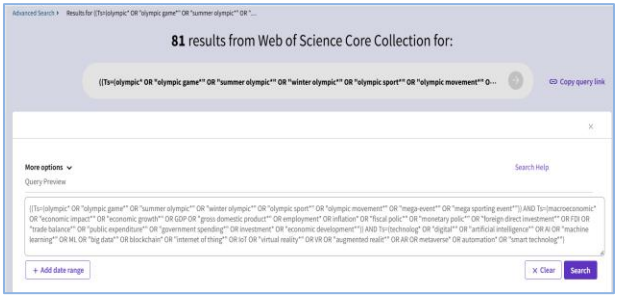

Fig 1. Advanced search screenshotused for the Web of Science database query

Therefore, a systematic evaluation of how the macroeconomic impacts of digital transformation in Olympic sports and mega events are discussed in the academic literature is warranted. This study aims to analyze these impacts using a bibliometric mapping approach. The analysis includes a wide range of bibliometric techniques, such as annual scientific production, keyword analysis, international collaboration networks, co-occurrence patterns, and thematic mapping. In doing so, the study presents concrete evidence of the field's development over time and its interdisciplinary interactions. Based on 81 academic publications retrieved from the Web of Science (WoS) database, this research seeks to offer a comprehensive framework for understanding the field's evolution, conceptual structure, and research trends. Accordingly, the following core research questions are addressed;

- What are the scientific production capacities and key bibliometric indicators of countries?
- How do the annual production values and average citation counts of academic publications on Olympic sports and mega events distribute over the years?
- What factorial structure exists in the abstracts of publications, and how has the network of co-occurring keywords developed?
- What distribution pattern emerges from the co-occurrence network analysis based on titles, abstracts, and keywords?
- What topics are most frequently focused on in the studies, and how does the word cloud distribution illustrate this?
- What distribution is displayed by the tree map of concepts found in titles and abstracts?
- What distribution pattern emerges from the frequency analysis of words in titles and abstracts over time?
- How are titles and keywords categorized into thematic clusters through thematic maps?

This study does not conduct a primary empirical analysis; rather, it provides a comprehensive mapping review of the existing literature examining the macroeconomic impacts of digital transformation in Olympic sports and mega events. This study is significant as it addresses the intersection of Olympic sports and mega events with digital transformation from a macroeconomic perspective, providing both theoretical and practical groundwork for future research.

Method

Research Model

This study employs a bibliometric analysis method based on quantitative research and scientific mapping techniques to map the macroeconomic impacts of digital transformation in Olympic sports and mega events. The study follows a literature based mapping review approach, focusing on identifying, classifying, and summarizing previous research rather than conducting new empirical measurements. Bibliometric studies provide an overview of past, present, and future research, identifying possible emerging research topics (Rojas-Lamorena et al., 2022). Bibliometric mapping has become one of the most effective methods for examining the dynamics of research areas across diverse fields such as finance, sports, accounting, information systems, technology, and bureaucracy. The bibliometric mapping method contributes to uncovering notable trends, popular studies, and potential research areas, helping to explore the trends in the literature (Aliusta, 2023; Alma, 2024; Castillo-Vergara et al., 2023; Chen et al., 2025; Ferreira et al., 2025; Filatova et al., 2023; Mudey et al., 2025; Rachmawati et al., 2023; Wang et al., 2023).

Data Collection

In this study, comprehensive searches were conducted in Clarivate's Web of Science (WoS) core collection, which is internationally regarded as the most recommended and reliable bibliometric database (Cai & Liao, 2025; Casado-Aranda et al., 2013; Hammerschmidt et al., 2024). A total of 81 publications, obtained on June 25, 2025, from the Web of Science (WoS) database, were retrieved using advanced search queries in the title, abstract, keywords plus,

and author keywords sections related to the macroeconomic impacts of digital transformation in Olympic sports and mega events.

The search query was carefully designed to encompass three dimensions relevant to this study: Olympic sports and mega-events, macroeconomic impacts, and digital transformation/technological advancements. The first set of keywords represents the scope of Olympic and mega-events (e.g., "Olympic*," "mega-event*") and ensures that the study targets the correct domain. The second set reflects macroeconomic variables encompassing various measures of economic performance (e.g., GDP, employment*, fiscal policy). The third set represents digital and technological trends (e.g., "digital*," artificial intelligence, internet of things, virtual reality, augmented reality, blockchain) to capture the literature addressing technological transformation. The combination of these three keyword sets ensures a comprehensive retrieval of relevant literature from the WoS Core Collection.

Data Analysis Tools

The obtained data were analyzed using the Bibliometrix R package, VOSviewer, and Sankey Diagrams. In this study, the Bibliometrix R package (Biblioshiny) was primarily used for performance analysis, including simultaneous analysis of titles, abstracts, and country-level contributions and assessment of thematic development. VOSviewer was primarily used to map common keyword networks, while Sankey Diagrams were used to visualize the flow of thematic and conceptual relationships (Conception, 2022; Dertli & Erden Dertli, 2025; Okine et al., 2025; Van Eck & Waltman, 2007; Van Eck & Waltman, 2010; Yao et al., 2025). This combination of tools allowed for both quantitative and visual bibliometric analyses, providing a comprehensive assessment of temporal trends, keyword co-occurrences, thematic clusters, and research contributions in the field of macroeconomic impacts of digital transformation in Olympic sports and mega-events.

By examining the 81 publications retrieved from the advanced search query in the Web of Science (WoS) database, both quantitative and visual analysis techniques were employed to evaluate various parameters. The keyword sets were designed to ensure that the retrieved publications accurately represent research on the macroeconomic impacts of digital transformation in Olympic sports and mega events. This approach provides a representative overview of the field and ensures that the bibliometric study is methodologically robust.

The study analyzed the following parameters: “main information,” “annual scientific production,” “annual average citation count,” “scientific production by country,” “co-occurrence network map of keywords,” “factorial analysis of abstracts,” “co-occurrence network of titles, keywords plus, and abstracts,” “word cloud of keywords plus and author keywords,” “tree map of titles and abstracts,” “word frequency analysis of titles and abstracts over time,” and “thematic map of keywords plus and titles.” These parameters helped uncover the temporal trends and thematic clusters of the field, contributing to a comprehensive evaluation of the visibility of Olympic sports and mega events in the literature. These analyses allowed for mapping temporal trends, keyword co-occurrences, thematic clusters, and country-level contributions, ensuring methodological clarity and reproducibility.

Findings

This section presents the bibliometric analysis data obtained regarding the macroeconomic impacts of digital transformation in Olympic sports and mega events.

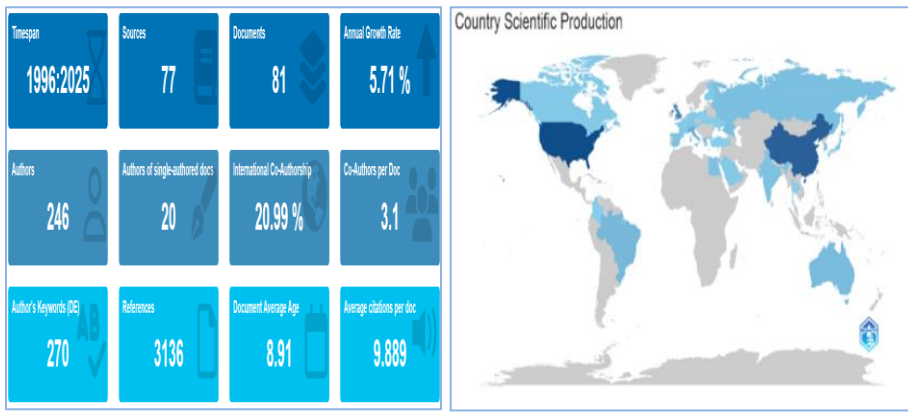

Fig 2. Main information and scientific production by country

In Figure 2, the bibliometric analysis of the macroeconomic impacts of digital transformation in Olympic sports and mega events reveals that the first publication occurred in 1996, with a total of 81 documents produced by 2025. The annual publication growth rate is 5.71% indicating a gradual but steady increase in research activity over the years. The documents have an average of 9,889 citations, and the average number of collaborations among authors is 3.1. Additionally, the international co-authorship rate is 20.99%.

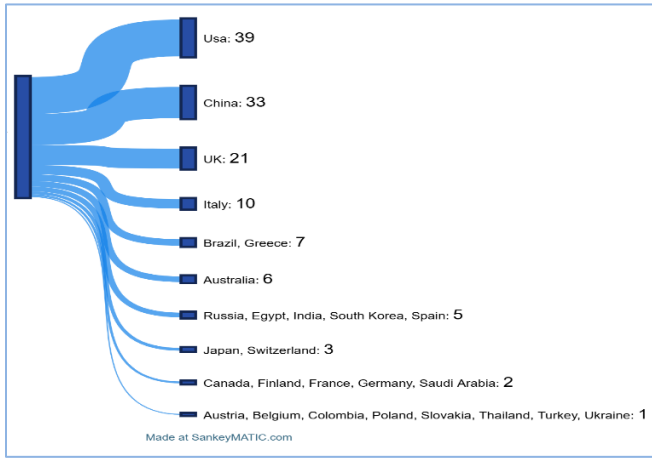

Fig 3. Countries scientific production

In Figure 3, the distribution of scientific production by country shows that the United States has the highest output with 39 publications, followed by China with 33, and the United Kingdom with 21.

Italy contributed 10 publications, while Brazil and Greece each contributed 7, and Australia contributed 6. Other countries, including Russia, Egypt, India, South Korea, and Spain, each had 4 publications; Japan and Switzerland had 3; and Canada, Finland, France, Germany, and Saudi Arabia each had 2. Austria, Belgium, Colombia, Poland, Slovakia, Thailand, Turkey, and Ukraine contributed 1 publication each.

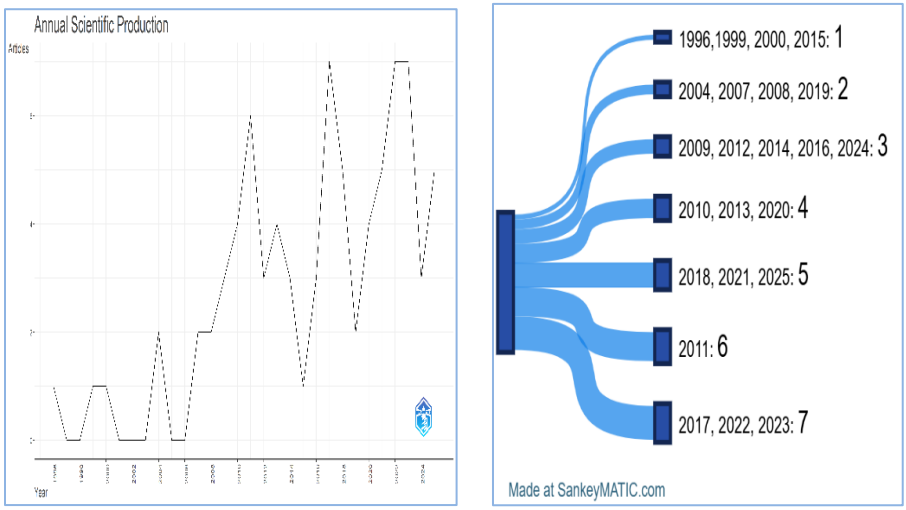

Fig 4. Annual scientific production

In Figure 4, the scientific production related to digital transformation in Olympic sports and mega events from a macroeconomic perspective is examined. The first publication was in 1996, and the production accelerated notably after 2010, with the highest production levels in 2017, 2022, and 2023, each with 7 publications. As of June 25, 2025, 5 articles have been published in the current year, indicating that production is ongoing. Since this data covers only the first half of the year, the number of publications is expected to increase with new releases by the end of 2025. This suggests that the topic remains current, and there is continued academic interest.

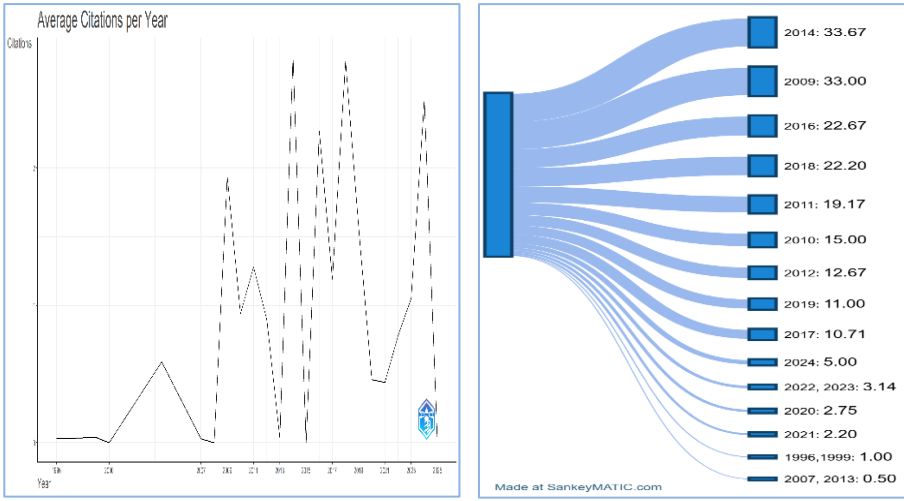

Fig 5. Annual average citations

In Figure 5, when examining the annual average citation values, it was found that the highest average citation occurred in 2014 with 33.67, followed by 2009, 2016, and 2018 with average citations of 33.00, 22.67, and 22.20, respectively. The year 2018 was also one of the periods with the highest academic impact on an annual basis. Data for 2025, as of June 25, has not yet received citations, showing a value of zero, but it is expected that this number will rise by the end of the year.

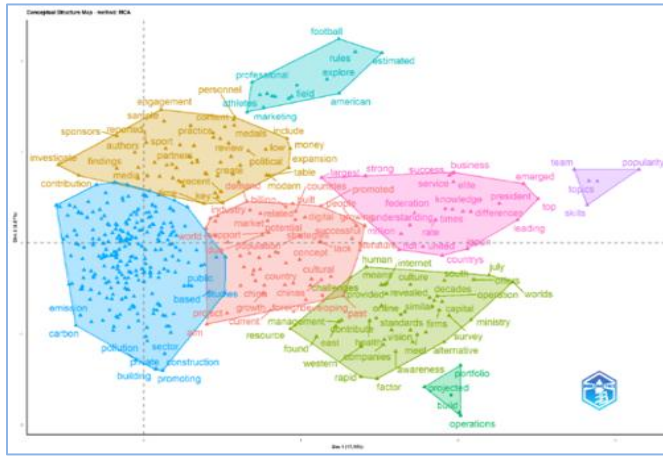

Fig 6. Factorial analysis

In Figure 6, the factorial analysis of the abstracts reveals eight conceptual clusters, providing a comprehensive overview of the thematic structure and research trends in the field. The first cluster focuses on operational processes, structuring, and planning themes, while the second and third clusters cover the social dynamics of sport, individual skills, and professional sports management.

The growing importance of digitalization, health management, and internet technologies is represented in the fourth cluster, while the fifth cluster emphasizes financial growth, business strategies, and success criteria. The media and social dimensions of sport are concentrated in the sixth cluster, while the seventh cluster highlights international perspectives, globalization, and cultural interactions. Finally, the eighth cluster includes theoretical and empirical studies on the development processes of the Olympics and mega sporting events.

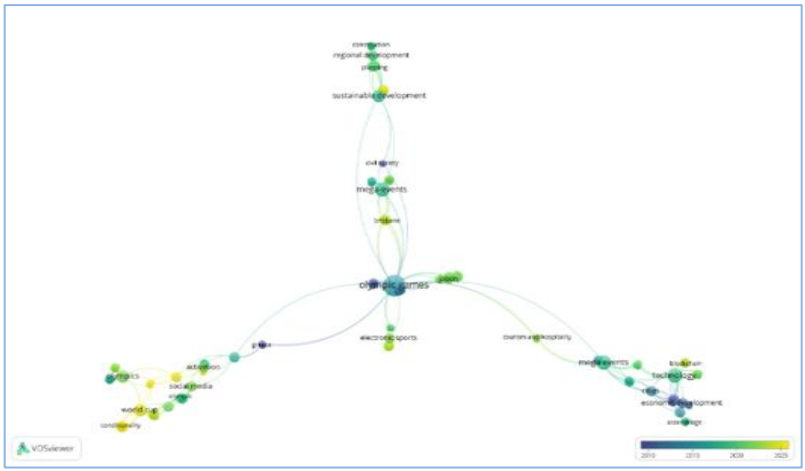

Fig 7. Co-occurrence network map of keywords

In Figure 7, the co-occurrence network analysis of keywords related to the macroeconomic impacts of digital transformation in Olympic sports and mega events revealed a network consisting of 134 nodes, 16 clusters, 395 links, and a total of 398 connection strengths. In terms of total connection strength, the most connected keyword is Olympic Games, with a connection strength of 34. Other prominent keywords include technology (total connection strength of 20), mega events (17 total connection strength), World Cup (16 total connection strength), sustainable development (15 total connection strength), cities (13 total connection strength), and Olympics/big data (12 total connection strength). Additionally, keywords such as COVID-19 pandemic, Japan, London, cycling, Giro d'Italia, mega events, performance management, performance measurement, sports event, sustainable tourism, Tour de France, tourism destination, tourism development and tourism innovation (11 total connection strength each), as well as economic impact, regional development, and social media (10 total connection strength each), were also identified as significant.

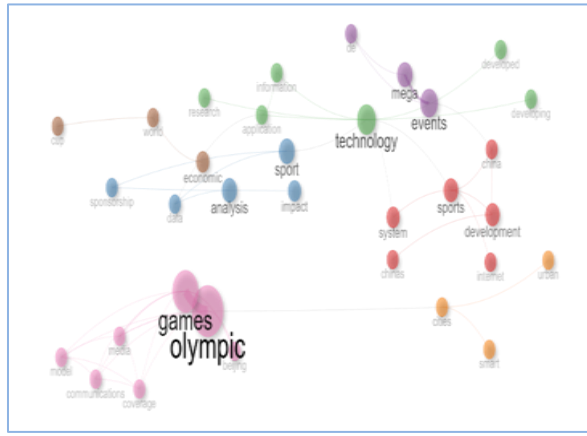

Fig 8. In the co-occurrence network analysis of titles

In the co-occurrence network analysis of titles presented in Figure 8, it was found that prominent keywords such as Olympics, games, mega, world, economic, technology, and media play a central role in the bibliometric structure of Olympic sports and mega events from a macroeconomic perspective.

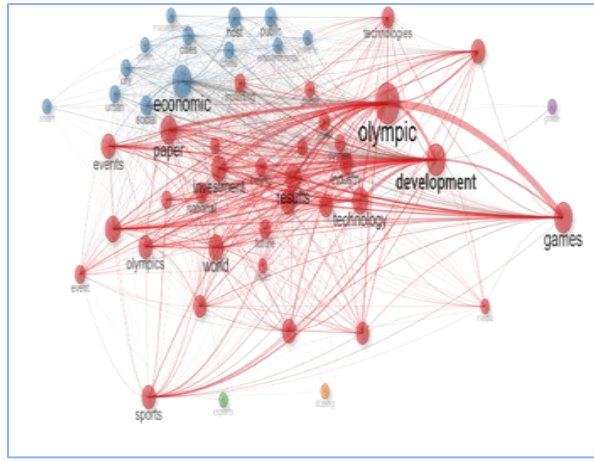

Fig 9. In the co-occurrence network analysis of abstract

Figure 9 in the co-occurrence network analysis of abstracts, keywords like Olympic sponsorship, games, economic, internet, technology, media, urban, smart development, and developing were highlighted, indicating their central role in the bibliometric structure of Olympic sports and mega events from a macroeconomic perspective.

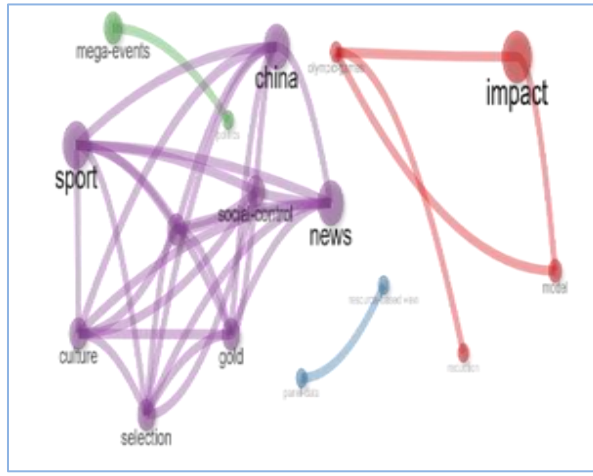

Fig 10. In the co-occurrence network analysis of keywords

Figure 10, the co-occurrence network analysis of keywords plus revealed that terms such as Olympic games, culture, resource-based view, mega events, and policy are central concepts in the bibliometric structure of Olympic sports and mega events from a macroeconomic perspective.

Fig 11. Keywords plus word cloud distribution

In the word cloud analysis of keywords plus presented in Figure 11, the most frequent keywords include impact (appearing 6 times), mega events (5 times), China (4 times), and Olympic Games and sport (4 times each). Additionally, keywords such as events, manage, model, news, politics,

technology, and economic impact appear 3 times each. Concepts like culture, developing countries, education, employment, energy, football, gates, gold, health, heritage, networks, panel data, performance, cuts, resource-based view, elections, sport, social control, social media, system, transformation, and world appear twice. These findings highlight the fundamental concepts and priorities in research on Olympic sports and mega events from a macroeconomic perspective in the context of digital transformation.

Fig 12. Author keywords word cloud distribution

Figure 12, in the word cloud analysis of author keywords, the most frequent terms include Olympic Games (appearing 9 times), mega events (4 times), technology (4 times), and Olympics, sustainable development, and World Cup (3 times each). Other frequently used keywords include activation, big data, cities, COVID-19 pandemic, economic development, eSports, information technology, Japan, London, regional development, science and technology, social media, sponsorship, economic privilege, economic impact, economic leverage, economic policy, economics and development studies, regional economy, and regional policy. These data reveal the key themes and focal points of research in the field of Olympic sports and mega events.

Fig 13. Tree map titles

In the tree map analysis of the titles presented in Figure 13, the most frequently occurring terms include Olympics (18 times), Games (13 times), sport and technology (9 times each), system (8 times), and development (7 times). Additionally, terms such as China, cities, analysis, economic, impact, media, and mega appear six times each. Words such as Beijing, application, data, and model occur five times, while information, internet, research, sustainability, urban, and world are each mentioned four times. These data indicate that themes such as Olympic sports, mega-events, urban contexts, digitalization, sustainability, and economic impacts are prominent in the literature.

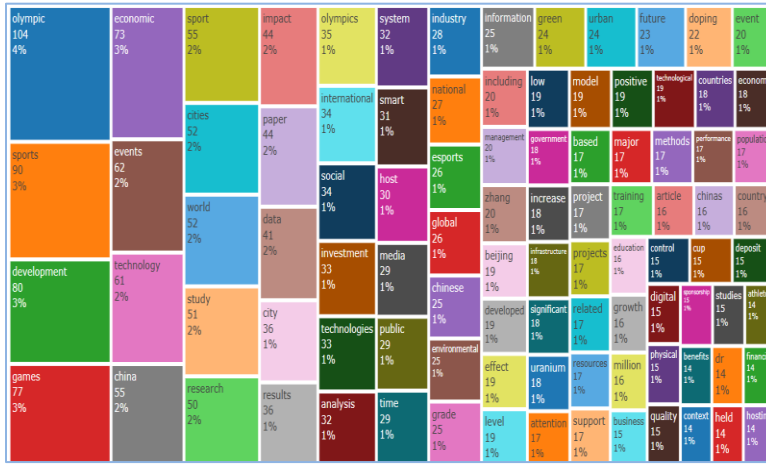

Fig 14. Tree map abstracts

Figure 14, in the tree map analysis of the abstracts, the most frequently occurring words include Olympics (104 times), sport (90 times), development (80 times), Games (77 times), economic (73 times), events (62 times), and technology (61 times). These are followed by China (55 times), cities and world (52 times each), study (51 times), and research (50 times). Additionally, the terms impact and paper appear 44 times each, data 41 times, cities and results 36 times each, Olympic Games 35 times, international and social 34 times each, and investment and technologies 33 times each. These findings suggest that in the abstracts, Olympic sports, economic impacts, technological developments, urbanization, research trends, and international dimensions are strongly associated with a macroeconomic perspective.

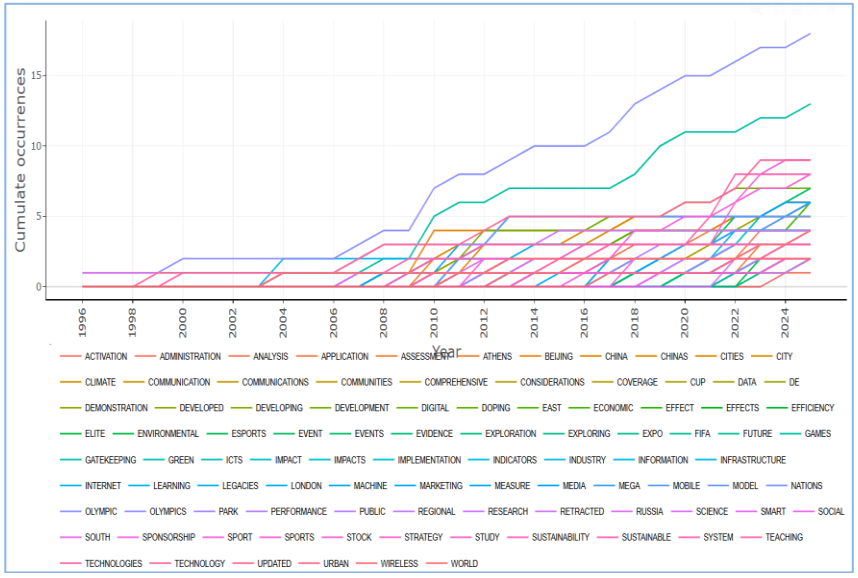

Fig 15. Word frequency over time titles

According to Figure 15, the frequency of words appearing in titles over the years has been tracked starting from 1996. Notably, terms such as Olympics, Games, sport, and technology have shown an upward trend over time. While the word Olympics consistently appears from 1996 onward, terms like technology, system, and development have been used more frequently since the early 2000s. In the period following 2010, there has been a noticeable increase in the usage of terms such as internet, data, model, sustainability, and urban, indicating a diversification of topics and a growing emphasis on contemporary technological and environmental concepts in titles.

Additionally, words such as China, Beijing, and megabecame prominent during the period surrounding the 2008 Beijing Olympics, while modern terms like digital, smart, and e-sports have gained attention in the post-2010 period. These findings clearly demonstrate an increasing diversity in the vocabulary of titles over time and a rising trend in the use of technology-related terms.

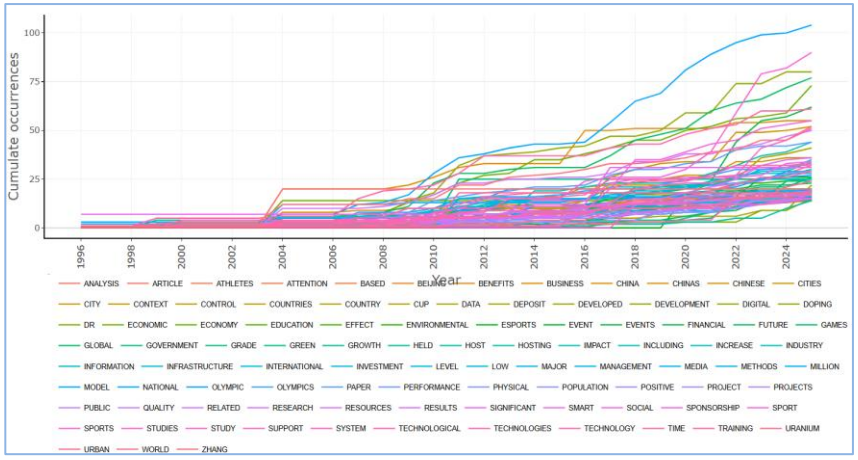

Fig 16. Word frequency over time abstracts

Figure 16 similar pattern is observed in the frequency of words in abstracts, where a marked increase has occurred over the years. In particular, terms such as Olympics, sport, development, economic, technology, and China have become increasingly prevalent, reflecting the substantial macroeconomic impact of the Olympics from both economic and technological perspectives. Starting in 2004, with China's preparations for hosting the Beijing Olympics, the frequency of terms like China, Beijing, and global rose sharply. Moreover, the presence of words such as investment, infrastructure, media, and social suggests that the Olympics are analyzed not only within the realm of sports but also in the context of economic growth, urban development, and social policy. In the post-2010 era, the increased use of terms like digital, smart host, technological, and global highlights the Olympics' close ties with contemporary technological and globalization processes. Altogether, these findings reveal that the Olympics are addressed from broad economic, technological, and social dimensions, and are increasingly viewed as strategic investments for host countries.

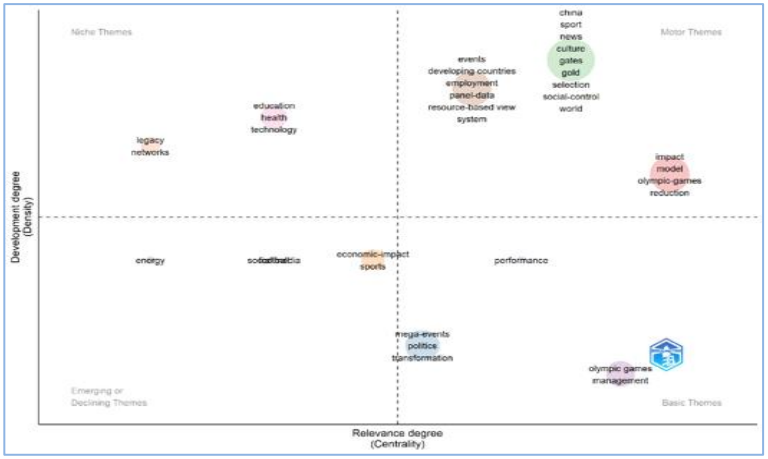

Fig 17. Thematic map keywords network

The thematic map of the keyword network presented in Figure 17 reveals significant findings related to the bibliometric analysis of Olympic sports and mega-events from a macroeconomic perspective. The analysis shows that terms such as impact, mega-events, China, and Olympic Games stand out with high relevance scores. In particular, the impact cluster is positioned at the center of the thematic structure, indicating its critical role within the field and highlighting its prominence in scholarly research. Similarly, the mega-events cluster plays a key role in the thematic organization. Keywords associated with China-including China, sport, and news-form essential components of this thematic structure and hold a significant place in the literature, especially when considered alongside subthemes such as cultural and social control. The Olympic Games emerge as a comprehensive theme that is examined in the contexts of both mega-events and economic impact. The term technology also constitutes a crucial conceptual area, particularly in connection with clusters related to education and health, offering insights into the macroeconomic effects of mega-events and Olympic sports. In this regard, technology plays a vital role in the management of sports organizations, the digitalization of events, and processes of economic transformation. In addition, clusters such as economic impact, events, education, energy, and football have also gained a certain level of importance in the literature.

This thematic map visualizes the overall structure of the field and its conceptual focal points, illustrating the multidimensional and interconnected nature of the macroeconomic impacts of Olympic sports and mega-events.

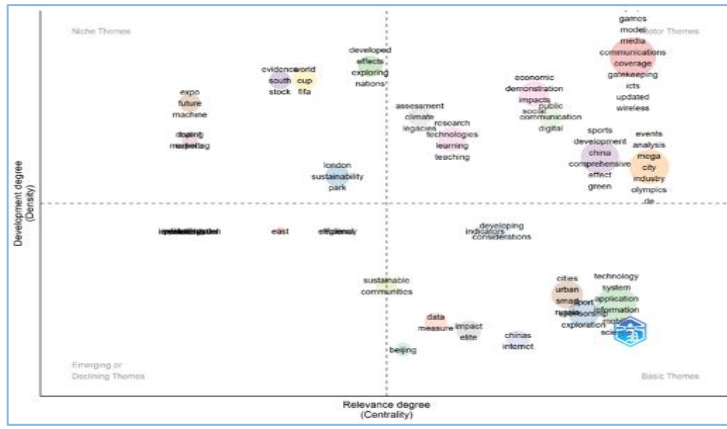

Fig 18. Thematic map titles

Figure 18 the thematic map of titles presents a significant finding in illustrating the thematic concentration within the literature on Olympic sports and mega-events. Upon examining the map, key concepts such as Olympics, sport, technology, economics, systems, cities, data, research, and sustainability emerge as dominant themes. The most prominent cluster is centered around the Olympics, encompassing concepts such as Games, media, models, and communications, indicating that the Olympics are explored within the frameworks of media coverage, information dissemination, and governance models. In the second cluster, the keyword sport is associated with political and social concepts such as impact and elites, highlighting that sport is not merely a physical activity but also embedded within a socio-political structure. The third cluster, technology, is analyzed in the context of developing and developed countries; terms such as effects, nations, and performance emphasize the role of technology in sports performance and national development. In the fourth cluster, the concept of sport reappears, this time linked with terms such as development, China, inclusivity, and green, reflecting the connection between mega sporting events and themes of sustainable development and environmental impact. The economic-themed eighth cluster features terms like impacts, social, and spectacle, indicating that the Olympics and mega-events are studied not only in financial terms but also as social and cultural phenomena.

Furthermore, the map reveals independent clusters built around themes such as data, systems, cities, research, sustainability, world, evaluation, Beijing, and London.

These clusters offer a comprehensive framework for understanding how Olympic mega-events intersect with topics such as urban planning, smart cities, environmental sustainability, digital transformation, legacy management, and global competition. The map also includes more specific topics such as exposition, doping, sponsorship, event, science, strategy, and implementation, supporting the notion of a multidimensional approach within the literature. Therefore, this thematic distribution clearly demonstrates that the Olympics and mega-events are not merely sporting organizations but complex political, economic, technological, environmental, and social structures. This finding underscores that the multi-thematic and interdisciplinary approach revealed through the bibliometric analysis significantly reinforces the position of the macroeconomic perspective within the field of sport.

Discussion and Conclusion

The bibliometric analysis conducted in this study examined the macroeconomic impacts of Olympic sports and mega-events in the era of digital transformation from an interdisciplinary perspective, systematically revealing the main themes in the literature. Based on the analysis of 81 publications, the study explored the development of the scientific structure across a wide spectrum from annual publication trends to thematic clusters. By integrating these findings, it highlights how the bibliometric results obtained within the scope of the study reflect the evolving conceptual framework of digital transformation in Olympic contexts, combining theoretical patterns with empirical evidence.

This bibliometric research offers a comprehensive and systematic overview of the current state and developmental trends in the field, addressing the macroeconomic effects of the digital transformation of Olympic sports and mega-events through a multidimensional lens. The findings indicate that academic production in this area, which began in 1996, gained momentum after 2010 and peaked between 2017 and 2023. This upward trend aligns with the co-occurrence results identifying technology, economic development, and sustainability as central research clusters, demonstrating that scholarly attention parallels the acceleration of digital innovation within mega events.

This trend demonstrates that Olympic events have increasingly become a focal point of academic interest in parallel with the rise of digital transformation. The highest average number of citations occurred in 2014, suggesting that the studies from that period made strong contributions both theoretically and practically.

This finding aligns with Reiche (2016) argument that traditional indicators such as medal counts or GDP based assessments fail to capture the complexity and economic impact of Olympic success. Therefore, the researcher emphasizes a more holistic approach that includes technological and institutional factors. This result corresponds directly to the thematic clusters identified in this study, confirming that the literature increasingly values integrative macroeconomic frameworks.

Keyword co-occurrence and thematic map analyses highlighted the prominence of concepts such as Olympic Games, technology, economic impact, sustainable development, urban planning, data, and globalization in the literature. These clusters reveal a dual thematic orientation: one focusing on economic sustainability and another on digital transformation, both of which underpin the evolving discourse on the macroeconomic dimensions of mega events. Factorial analysis and co-word networks revealed that subthemes such as digitalization, media management, cultural intraction, political structure and international strategies are strongly connected to the field.

The integration of these subthemes demonstrates that macroeconomic impacts cannot be fully understood without acknowledging the mediating roles of digital infrastructure and global communication systems. These findings echo the frameworks proposed by the World Ranking of Elite Sports Countries (WRCES) and Millet et al. (2023), which argue for scientifically based indices to measure global competitiveness and representativeness in sport. Similarly, the digital transformation process described in this study offers a new dimension for assessing macroeconomic performance through technological capacity, sustainability, and data-based innovation, rather than traditional performance outcomes.

Among the authors' keywords, the most frequently emphasized concepts were Olympic Games, technology, sustainability, and economic development, indicating a concentration of research trends around specific thematic foci. This alignment underscores that digital transformation has become both a

driver and a metric of macroeconomic development in the context of Olympic sports. However, no direct inference regarding the economic impact or sustainability of mega sport events can be drawn solely from bibliometric data. Sardi et al. (2025) discuss the economic dimensions of mega-sport events, which is related contextually, but our analysis only reports on thematic trends and keyword co-occurrences.

Hayduk (2020) examined the role of mega-sport events in high-tech exports and found that such events increased high-technology exports in host developed countries, whereas the same effect was not observed in developing countries. This finding reveals that the economic contributions of mega-events vary depending on a country's level of development, emphasizing the critical role of factors such as technology and infrastructure in their integration into local economies. Therefore, in assessing the macroeconomic impacts of mega-sport events, it is essential to consider not only digital transformation but also country-specific conditions and technological capacity.

A retrospective study by Ningthoujam (2025) on the digital detection of doping cases highlights the importance of digital technologies in preserving the ethical and economic integrity of Olympic sports. The implementation of retrospective testing has enhanced the effectiveness of doping detection, and these technological advancements also contribute indirectly to the economic sustainability of mega-events. By reducing doping scandals and protecting the reputation of sport, digital transformation directly influences the macroeconomic interests of host countries and sponsors. However, the high costs of digital technologies and variations in their implementation may hinder the full realization of the potential benefits of digitalization. This suggests that the macroeconomic impacts of digital transformation should be evaluated not only from a technological perspective but also from a political and ethical perspective. Similarly, Han (2025) has shown that psychological and motivational factors often exert their influence through indirect rather than direct means.

From this perspective, the indirect mechanisms through which digital transformation shapes macroeconomic and ethical outcomes, such as social motivation, institutional participation, and collective commitment, should also be considered when assessing its broader economic impacts.

The limited number of studies on the macroeconomic impacts of digital transformation suggests a need for further in-depth investigations into how

media representation intersects with economic development and societal transformation in the context of mega-events.

In their 2017 study, İmamoğlu et al. emphasize that this transformation has contributed to Turkey's global sporting achievements and has enhanced the efficiency of Olympic preparation processes. However, the study also notes that digitalization has not been implemented uniformly across all training centers, with some centers adapting to the transformation more rapidly than others. Accelerating the pace of digitalization in Turkey's athlete training centers could broaden the scope of success. Additionally, the study highlights that digital transformation has strengthened Turkey's sports brand, contributing to its competitiveness on the international stage. This transformation is also expected to facilitate the more efficient management of major events and increase sponsorship revenues. In conclusion, digitalization makes a significant contribution to the growth of Turkey's sports economy.

When all the data obtained are evaluated, one of the main contributions of this study is its demonstration of thematic diversity and interdisciplinary collaboration within the field. The findings reveal significant gaps in the existing literature and highlight areas that require further development. Although the study yields several important insights, there remain certain topics in the literature that are either underexplored or require deeper investigation. Primarily, the impact of Olympic mega-events on the political systems of host countries-particularly within authoritarian regimes-has not been sufficiently analyzed, presenting a critical gap for future research. The lack of comprehensive political impact analyses, especially regarding the social and economic implications of mega-events in authoritarian contexts, constitutes a notable deficiency. Future studies should therefore adopt a comparative approach to political transformations in both democratic and authoritarian systems.

Furthermore, issues such as social justice and access-framed under the theme of sustainability-require more detailed examination, particularly regarding their effects on low-income groups and broader dimensions of social exclusion.

These findings align with those of Cardoso et al. (2023) and Gretzel et al. (2018), who emphasize that, in the context of digital transformation, it becomes essential to explore the role of innovation in promoting sustainable tourism management practices that can ensure the long-term economic

viability of destinations hosting major sporting events.

Meyers (1996) demonstrates the potential economic benefits that the early implementation of smart card technology in mega-events can offer, depending on the adoption processes of the technology. His study highlights that the speed of adaptation to digital technologies is more dependent on user habits than on the rate of technological change itself. This perspective reveals that, when assessing contemporary digital transformation processes, both the technological infrastructure and user behaviors play a critical role in determining macroeconomic impacts. Therefore, when evaluating the effects of digitalization in sports and mega-events, it is essential to closely examine the speed of adoption and diffusion processes of technological innovations.

The micro level effects of technological innovations, particularly in areas such as artificial intelligence, blockchain, and augmented reality, require further empirical studies. It is important to investigate not only the macroeconomic but also the organizational and managerial transformative impacts of digital technologies. The micro level effects of digital technologies have not yet been fully explored, and more empirical research is needed on the concrete impacts of innovations such as artificial intelligence, blockchain, and augmented reality on event management. In line with this, Agbozo and Hayawi (2024) emphasizes that blockchain technologyalthough often debated as either a marketing trend or a temporary fashionholds a promising future for sports and related industries. His bibliometric study highlights that blockchain has achieved notable success in areas such as supply chain management, finance, and data governance, and that similar applications are beginning to emerge in the sports ecosystem. This suggests that the integration of blockchain into mega sport events could enhance transparency, financial traceability, and stakeholder trust, reinforcing the broader economic and managerial impacts of digital transformation.

In line with these findings, Azhagumurugan et al. (2025) emphasizes that the integration of the Internet of Things (IoT) and sports has created new opportunities within the sports industry, particularly through the use of wearable sensors and devices for real-time data collection and analysis. The author also highlights that the implementation of lightweight algorithms and edge computing with artificial intelligence capabilities remains an underexplored but promising field. As these technologies evolve, they are expected to enhance athlete performance, healthcare systems, and the overall

sports economy, thereby reinforcing the transformative potential of digitalization in Olympic sports and mega events.

Additionally, while countries like China, Japan, and the United Kingdom are prominent in the literature, there has been a lack of comparative analyses of digital transformation and macroeconomic effects in developing countries. Finally, limiting research to the Web of Science database may exclude certain regional and interdisciplinary studies; thus, integrating sources such as Scopus, Google Scholar, and local data repositories is believed to enhance the inclusiveness of the literature. However, Yuan et al. (2019) affirm the importance of the Web of Science database for bibliometric research. Furthermore, a bibliometric systematic review on sports sponsorship was conducted for the first time by Varea-Calero et al. (2025), with researchers suggesting that sports sponsorship studies should be explored within an interdisciplinary framework.

In conclusion, Olympic sports and mega-events are strategically significant for countries in the digitally transforming world, particularly in terms of economic growth, urbanization, and technological transformation. This study, by mapping the bibliometric landscape of the field, clearly outlines the trends, gaps, and priorities in the literature. The synthesis of findings highlights that technological innovation, sustainability, and macroeconomic resilience form the core conceptual triad shaping future research directions. It emphasizes the need for future research to further enrich the literature, particularly focusing on social impact, political transformation, micro level effects of technological innovations, and ethical dimensions.

In line with Liu et al. (2025), future research should broaden the scope beyond macroeconomic and technological aspects. Key directions include professionalization and promotion strategies for emerging sports, digital education and youth engagement, and the use of data-driven management systems. Studies should also examine innovative training technologies, wearable analytics, and AI-based platforms to enhance athlete development, while fostering interdisciplinary collaboration to support the long term sustainability of the Olympic ecosystem.

Policy Implications

The findings of this study suggest that international sports organizations and urban planners should integrate digital transformation strategies into the macroeconomic planning of mega-events. Establishing international standards to assess technological capacity and sustainability performance, and strengthening digital inclusion are critical to global equity. Furthermore, multi level collaboration among local governments, the private sector, and international federations should support the alignment of digital transformation goals with long term economic sustainability.

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Author contributions

The aspects of the study handled by each author are given below: Ş.D: conception, design, data collection and processing, fundings, meterials and process, writing, critical review; Y.S.B.: conception, design, supervision, materials, data collection, literature review, analysis and critical review; V.A: data collection and writing.

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