



Sports Fans Hotspots and Frontier Research - Based on Scientometrics Analysis

Xueting Ku

Affiliation: Department of Physical Education and Sport Science, The Chinese University of Hong Kong

Email: kuxueting@link.cuhk.edu.hk

Abstract. [Purpose/Significance] As a concept that is not new, with the iterative development of social media, sports fans are receiving attention and scrutiny from both inside and outside the sports field. Breaking the circle in the field of sports, sports fans are gradually becoming a social phenomenon, closely related to the economy and society. Is research on sports fans lagging behind practice? How is research on sports fans developing? Where should future research be directed? These questions are still to be answered. [Methodology/Process] Based on scientometrics, CiteSpace, a scientific knowledge graph analysis tool, was used to analyze and research the published literature on sports fans at home and abroad in the past ten years. Techniques such as trend analysis of publication volume, keyword co-occurrence analysis, author and institution network analysis, cluster analysis and inflated word detection algorithm were used to reveal the research power, research hotspots, evolutionary development pulse and research frontiers in the field of sports fans at home and abroad. [Results/Conclusions] This study finds that sports fan research is at an early stage of development and has great potential for growth in the world. This study locates the development trends and core strengths of sports fan research in the past ten years, identifies the hotspots of sports fan research at three levels: psychological, social and economic, and explores future research on uncertainty, involvement, group dependence of sports fans, and motivation to participate in sports activities. The findings of this study can be used as a guide for future research on sports fans. The findings of this study may provide insights to guide future research in the field of sports fandom and to regulate sports fan practices.

Keywords: sports fans; sports fandom; scientometrics; research hotspots

1 Introduction

The development of professional events and the mobile internet has made the image of the sports fan more distinct and specific. Similar to other fan groups, sports fans are growing as a social force and are highly stable. Sports fans are present in social life and on social media in various guises, contributing to the development and spread of spectator sport. At present, there seems to be a "practice first, a theory later" situation regarding the phenomenon of sports fans. In practice, sports fans have become an

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important part of the fan base, contributing greatly to the social sports and the sports economy, forming corresponding community organizations, and becoming a common topic of discussion in the economic and mass media fields. This study attempts to answer these questions through a quantitative description of the external characteristics of the data and a qualitative interpretation of the existing literature by using scientometric methods to outline the current state of sports fan research over the past decade. The findings of this study will help guide the academic research trends of sports fans, regulate the ecology of sports fans, and promote the adaptive development of sports fan groups.

2 Review of the literature

2.1 Sports fans

"Fans" comes from the word "Fanatic", which means "exuberantly fascinated". Widely accepted in academic research is Jenkins' definition: a "fan" is someone who is actively and enthusiastically involved in business, entertainment, or ball games and who admires or is fascinated by sports stars or movie or song stars[1]. Colston Pullen defines a "fan" as a group of people who have a strong interest in a particular topic. "is also someone who has a deeper understanding of the topic[2]. It follows that the definition of a fan includes two core elements, namely "special liking" and "constant attention". From a psychological perspective, the core of a 'fan' is psychological identification and emotional attachment[3]. From a sociological perspective, fans are also a special kind of social group with the general characteristics of a traditional community, in terms of clear membership, continuous interaction, a consistent sense of community and norms, a certain division of labor, and the ability to act in concert[4].

With the professionalization of sports and the expansion of sporting competitions, sports fans have become an important derivative of competitive sports. Sports fans are defined as those who are emotionally invested in a sporting event or club and have a sense of belonging to the team[5]. A sports fan is defined as "an individual who is interested in and follows a sport, team, and/or athlete"[6].

2.2 Research related to sports fans

International research on sports fandom first emerged in 1975, and scholars in countries such as the United States and Japan began to study the motivations, behaviors, and relationships between sports fans and sporting events[7]. Zhang S L used the adoption of scientific knowledge mapping to analyze 257 sports fan research papers published between 1975-2019 in the Web of Science core database with the help of CiteSpace software[8]. Mastromartino B mentioned that there has been relatively more research on the relationship between sports organizations and their fans and a lack of exploration of the emotional experience of sports fan groups[9]. Winell E conducted a structured study of 42 academic articles published between 1992 and 2020. A structured review of 42 academic articles focused on the impact of commercialization on three aspects of fan identity perception, emotional attitudes, and individual behavior [10]. Trendafilova

S also mentioned in a systematic review that the areas most covered by scholars in sport sustainability are management, fan behavior, and facility management[11]. In China, by reading through 66 research papers and reviewing them, the researcher found that there are five key areas of research on sports fans, namely conceptual definition, relevant theoretical studies, formation causes and classification studies, behavioral studies, and online media[12].

2.3 Application of Scientometric in sports

In recent years, scientometric and related econometric research methods (e.g. bibliometrics, scientific knowledge mapping) have been widely used in the field of sport[13] and the Social Science Foundation's Kinesiology Project[14].It has also been introduced for different topics such as public sports service research[15] and various sports frontier hotspots (e.g. volleyball[16], tennis[17], athletics[18]). Combining the methods of scientometrics and the perspective of the field of kinesiology, this study can control the development of research in the field of sports from a macro perspective, provide bibliometrically relevant information to relevant researchers, improve the efficiency of researchers in acquiring effective information.

3 research methodology

3.1 Research methods and tools

Scientometrics is an interdisciplinary research method based on the principles of mathematical statistics and relying on computer-based analytical tools.[19,20]CiteSpace is a scientific and technical text mining and visualization software. The software supports many types of bibliometric studies, including collaborative network analysis, co-word analysis, author co-citation analysis, literature co-citation analysis, and textual and geo-spatial visualization, and presents the results in the form of a graph[20,21]. Given that CiteSpace version 5.8 will soon be withdrawn from the market, and after comparing the stability of CiteSpace 6.1.R2 and 6.1.R3 for mapping, this study finally settled on the latest version of CiteSpace 6.1.R3 for scientometric analysis.

3.2 Data sources

In terms of searching for literature data, to obtain comprehensive and systematic data on sports fan research over the last decade, the most influential of the Web of Science citation index databases, Science Citation Index Expanded (SCIE), was collected in this paper, and the search selected the Web of Science (later referred to as WoS). In addition, given the multiple expressions of "sports fan", it was found that "sports fan" as a keyword was the best way to cover all the literature related to sports fans. In the end, this study used "sports fan" as the keywords, the year of publication 2012-2022 (the last ten years), the type of literature selected was Article& Review, Article, and the subject search was used as the search method. A total of 2011 relevant articles were

obtained. In terms of literature screening, 512 irrelevant articles such as online publications, editorial materials, letters, and news were excluded, leaving a total of 1499 valid articles.

4 Research findings and analysis

4.1 Analysis of the annual volume of sports fan research articles

The pattern of growth in the volume of literature over time reflects, to a certain extent, the level of activity in this field of scientific research and can broadly reveal the characteristics and patterns of scientific development. As shown in Figure 1, the annual volume of literature on sports fan research has increased nearly 3.5 times from 79 articles in 2012 to 227 articles in 2021, with a wave-like upward trend in the annual number of articles published. In addition to this, the years in which the Summer Olympic Games were held, such as 2012, 2016, and after 2020, all saw a significant decline in annual article volume.

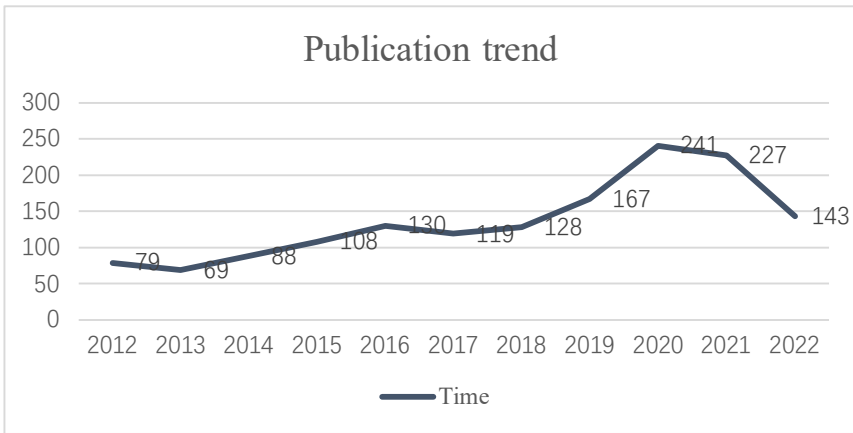


Fig. 1. Sports fan posting trends from 2012 to 2022

4.2 Sports fan research network analysis

CiteSpace provides users with three dimensions of scientific collaboration network analysis: Co-Author network analysis, Co-Institution network analysis, and Co-Country/Territory network analysis, which are flexible for different research fields and purposes. Each node represents an institution, author, or country/region, and the size of the node and label represents the number of articles published by the author, institution, or country/region, and the nodes are in the form of a wheel and ring, with different colors indicating different years of appearance. The thicker the edge, the closer and more frequent the collaboration.

Analysis of national/regional cooperation networks for sports fans.

According to the search results, the literature on sports fan research came from a total of 72 countries (regions), and the top 10 countries in terms of literature volume are listed in Table 1. Researchers have pointed out that a country with more than 25% of the total number of scientific and technological achievements in the world in a certain period is called the world scientific center for that period[22]. As can be seen from Table 1, among the top 10 countries in terms of literature volume, the United States leads the way, with the US leading the way in terms of research output in the field of sports fans (715 articles), accounting for approximately 47.54% of the total literature; in 2nd and 3rd place are the UK and Australia, both with over 150 articles, accounting for more than 10% of the total literature; in 4th-10th place are Canada, Germany, Korea, China, Spain, Israel, and Brazil. The seven countries in 4th-10th place are Canada, Germany, Korea, China, Spain, Israel, and Brazil.

Table 1. Chart of sports fans by country/region of posting

Ranking	Country/region	Number of articles issued	Contribution (%)	Centrality
1	America	715	47.540	0.47
2	UK	198	13.165	0.35
3	Australia	157	10.439	0.19
4	Canada	105	6.981	0.1
5	Germany	83	5.519	0.06
6	Korea	65	4.322	0.01
7	China	58	3.856	0.04
8	Spain	54	3.590	0.08
9	Israel	40	2.660	0.01
10	Brazil	36	2.394	0.03

Analysis of the sports fan agency cooperation network.

In CiteSpace, a critical path algorithm (Pathfinder) is selected, the network node is an institution, the time interval is chosen to be 1 year, and the TOP n% is chosen to be 25% to generate the knowledge graph. The Knowledge Map of Highly Prolific Research Institutions shows a clear centralized-discrete map of the close collaboration between these highly prolific research institutions (shown in Figure 2 below).

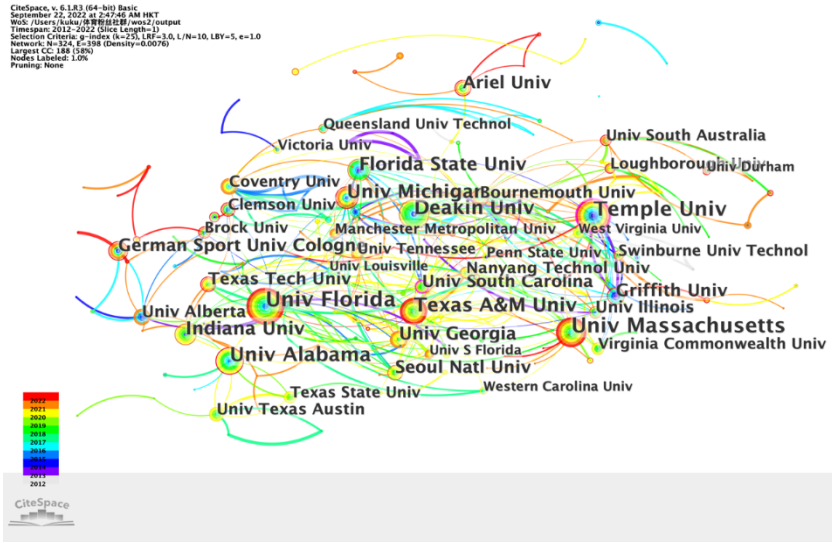


Fig. 2. Analysis of the sports fan agency partnership network

Table 2 lists the top 10 institutions in terms of the number of articles published (≥ 20 articles). A statistical breakdown of research institutions shows that universities in the US, UK and Australia are the main force in sports fan research. These institutions published 555 articles, accounting for 13.28% of the total number of articles published. The number of American universities amounts to 9, or 90%.

Table 2. Top 10 organizations in terms of sports fan posts

Rank	Institution	Dispatch Quantity	Country/District
1	University of Florida	36	USA
2	University of Massachusetts	34	USA
3	Temple University	32	USA
4	University of Alabama	28	USA
5	Deakin University	27	Australia
6	Texas A&M University	25	USA
7	University of Michigan	24	USA
8	Indiana University	22	USA
9	Florida State University	21	USA
10	University of Georgia	20	USA

4.3 Analysis of major source journals for sports fan research

Analysis of the concerns of the main source journals.

The table 3 below lists the high-volume journals in the sports fan research literature. In terms of the total number of articles in sports fan research (as shown in Table 3 below), the International Journal of Sports Marketing Sponsorship and the Journal of Sport Management both contain 87 articles, ranking them tied for 1st place in terms of the number of articles. Communication & Sport was ranked 3rd with 81 articles. The International Journal of Sports Marketing and Sponsorship is one of the world's leading journals in the sports marketing industry, with a five-year impact factor of 2.541, and the Journal of Sport Management is one of the leading journals in North America. an official journal of the North American Society for Sport Management, and Communication & Sport, a cutting-edge, with a five-year impact factor at 3.019. These journals are widely disseminated and recognized within the field of kinesiology. This shows that sports fan research is welcomed and recognized by journals and has great potential for research development.

Table 3. Sports fan publication journals

Publication title	Record number	The percentile
INTERNATIONAL JOURNAL OF SPORTS MARKETING SPONSORSHIP	87	5.8
JOURNAL OF SPORT MANAGEMENT	87	5.8
COMMUNICATION SPORT	81	5.5
SPORT MANAGEMENT REVIEW	77	5.1
EUROPEAN SPORT MANAGEMENT QUARTERLY	63	4.2
SPORT MARKETING QUARTERLY	61	4.1
SPORT IN SOCIETY	60	4.0
INTERNATIONAL REVIEW FOR THE SOCIOLOGY OF SPORT	48	3.2
INTERNATIONAL JOURNAL OF THE HISTORY OF SPORT	45	3.0
JOURNAL OF SPORT SOCIAL ISSUES	36	2.4

4.4 Analysis of hot spots and frontiers in sports fan research

As an important part and essence of an academic paper, a keyword is the author's distillation of the core research content of the article and represents the core topic and research area of the literature[23]. This study draws on the keyword clustering obtained from keyword co-occurrence analysis in Cite Space that reflects the results of analysis

mapping, the module value = 0.3199 (>0.3), indicating a significant cluster structure, and the mean profile value = 0.6861 (>0.5), indicating a reasonable clustering effect, especially for labels 4-6, team identification, social media and public health. health) have high S-values of 0.7 or more, which indicates that the clustering results are credible.

Table 4. Research hotspots under topic word clustering tags in the sports fan

Clustering label	Size	Cluster membership homogeneity	Average (year)	Common terms (LSI)
0	70	0.639	2015	demand (59.86, 1.0E-4); competitive balance (49, 1.0E-4); attendance (44.37, 1.0E-4); uncertainty (34.16, 1.0E-4); team identification (23.4, 1.0E-4)
1	69	0.674	2015	sponsorship (26.43, 1.0E-4); sports marketing (25.07, 1.0E-4); brand personality (18.87, 1.0E-4); brand management (17.4, 1.0E-4); fan engagement (26.17, 1.0E-4); service quality (18, 1.0E-4); sport fans (13.83, 0.001); loyalty (13.31, 0.001); sport consumption (11.34, 0.001)
2	68	0.656	2016	gender (32.03, 1.0E-4); race (24.32, 1.0E-4); sport (22.25, 1.0E-4); homophobia (20.43, 1.0E-4); masculinity (20.43, 1.0E-4)
3	60	0.657	2016	team identification (34.91, 1.0E-4); social identity (28.84, 1.0E-4); fan identification (21.7, 1.0E-4); social identity theory (18.98, 1.0E-4); consumer behaviour (14.5, 0.001)
4	46	0.776	2015	social media (47.55, 1.0E-4); twitter (14.28, 0.001); public shaming (12.39, 0.001); sport communication (12.39, 0.001); facebook (10.4, 0.005)
5	39	0.765	2017	public health (25.1, 1.0E-4); crime (17.63, 1.0E-4); mass-gathering medicine (13.21, 0.001); spectator sports (10.46, 0.005); south africa (8.8, 0.005)
6	32	0.707	2017	

The relevant labels are divided into three categories: psychological, social, and economic. Of these, the psychological dimension of relevance emphasizes fans as individuals and explores their psychology, including needs and involvement. There are four high-frequency keywords under the thematic clustering of needs: competitive balance, involvement, uncertainty, and organizational identity[26]. Past research by scholars exploring team identification among sports fans has, by no coincidence, often landed on economics. Researchers have noted that both team identification and perceived performance influence the outcome of fans' consumption behavior during the consumption process [27].

Frontier analysis of sports fan research.

Based on the relevant features of CiteSpace, the top 25 mutation topics with strong mutations in the field of sports fan research from 2012-2022 and the corresponding mutation strengths and durations were analyzed using CiteSpace, and the results are shown in Figure 5 below. As can be seen from the figure, the keywords that started mutating before 2012 are demand, television, sports marketing, commitment, competitive balance, reflected glory and consumer satisfaction. These keywords are stable research hotspots until 2018, but not enough to support their continued study as hotspots in the future; uncertainty, engagement and gender show very high mutation. The uncertainty of professional events is often an important reason why events or sports attract a large number of fans; viewers can become engrossed with the process of watching a ball game without knowing the outcome, and uncertainty and engagement are often co-occurring topics in the research field.

Top 25 Keywords with the Strongest Citation Bursts

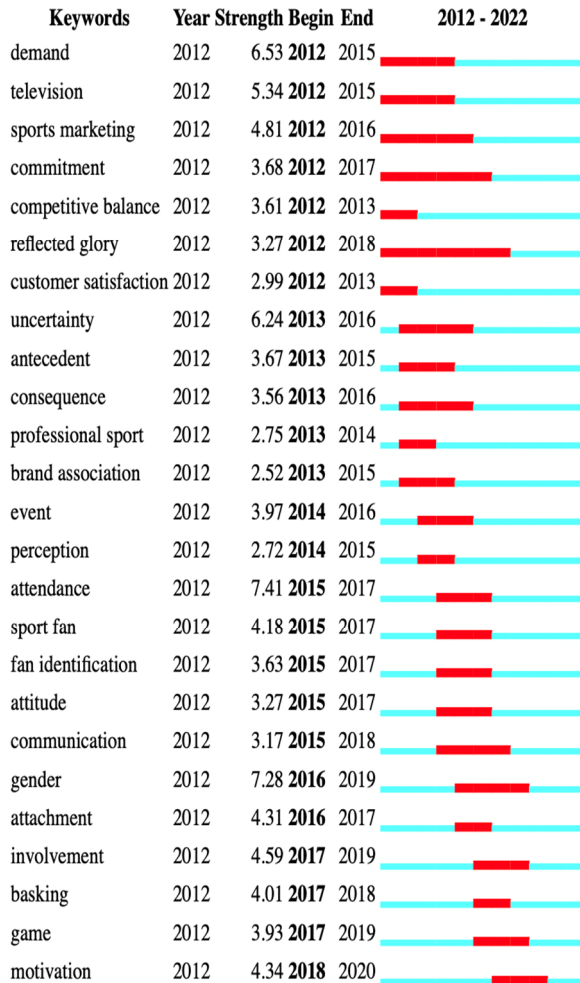


Fig. 4. Keywords for sudden changes in the sports fan segment

5 Summary

5.1 Summary of the study

At present, sports fan research in China is still in its infancy, lacking systematic knowledge or theoretical model construction. Therefore, this semi-study systematically

compares the past and present of the field of sports fans worldwide through bibliometrics and other means and provides an outlook on the future of research in the field. Specifically, the main findings of this study are as follows: (1) The number of sports fan research publications increases year by year, but there is a significant decline in the year following the Olympic year, and the research density of sports fans correlates with the Olympic cycle. (2) The dominance of the United States and American institutions in sports fan research is a result of well-developed sports clubs, a strong sports culture, and a well-developed sports economic system. (3) The wide range of disciplines in which the source journals of sports fan research are located illustrates the strong interdisciplinarity of sports fan research, and the trend of more and more disciplinary fields preferring to combine with sports can be seen through the intersection of sports fan-related research; at the same time, sports fan research is published in high quality and receives attention from leading journals in the field. (4) The hotspots of sports fan research include sports fan demand (participation, competitive balance) and fan involvement (loyalty, fan consumption power) at the psychological level; sports fan identity (social identity, social identity theory), public health (mass spectator sports, coping with large public events) and social media (sports communication) at the social level; and sports sponsorship (including brand management, brand marketing) and other core content. (5) The frontiers of sports fan research include gender, attachment, involvement, motivation and other related contents, showing a shift from focusing on the superficial emotions of sports fans to deeper motivations, about sports industry marketing to focusing on fans' feelings, reflecting the increasing humanistic concern in the field of sports fan research. (6) The occurrence of the New Crown epidemic brought about great fluctuations in the sports economy and an explosion of new research points on sports fans, and the changes in sports fan-related research in the context of New Crown pneumonia became a topic of concern for many researchers.

5.2 Suggestions for future research development

Research methodology: valuing bibliometrics as a new approach to sport research.

At present, the traditional approach to literature review has suffered from a lack of compatibility with new research developments. However, the use of bibliometric methods for literature reviews can provide a comprehensive and systematic overview of the field. Machine learning automatic clustering eliminates the need to manually review the content of the literature one by one, and greatly improves the efficiency of literature analysis in the process of doing a review; traditional literature reviews require researchers to read the retrieved literature one by one using their own accumulated knowledge, which is unfriendly to domain explorers who do not have much knowledge in the classification of subject content and easily misses important literature due to subjective energy limitations and the drawbacks of manual searching. It is also easy to miss important documents due to subjective effort and the drawbacks of manual searching. The use of CiteSpace software allows researchers to maximize the breadth of past literature in a literature review using high-quality databases and efficient econometric analysis methods.

Research orientation: focus on psychological mechanisms, comparative and interdisciplinary, and strengthen qualitative research to increase theoretical support.

A considerable number of applied sports fan studies have been conducted only on the phenomenon of sports fans. The relevant empirical studies are not sufficiently standardized, and are relatively homogeneous in terms of the groups and methods of analysis, with exploratory research being the main focus. To facilitate the construction of theoretical models and the shift in sports fan research from a focus on phenomena to a focus on mechanisms, the field needs more research using qualitative research methods such as rooting theory and virtual ethnography. If researchers struggle to engage with virtual fields like fan bases, or lack empathy for sports fan bases, their research will inevitably fall short of practice.

At a theoretical level, the psychological mechanisms of sports fan formation can be further systematized and differentiated from the commonly talked about entertainment fans to fill the lack of theoretical foundation. This study finds that the development of the internet has to some extent lowered the threshold for the public to learn about sports and watch professional events and that the Winter Olympics, Summer Olympics and even the Paralympic Games are now increasingly known to the public. However, we should pay attention to the crossover of disciplines, and aim to promote the development of the field of sports, with the relevant theories of kinesiology as the core, and the knowledge of other fields only as a method and theory borrowed for analysis. We must not put the cart before the horse. From a psychological point of view, how can we reasonably channel the negative emotions of the fan base due to the New Champions epidemic, to relieve their stress and avoid social and mass incidents? From a social perspective, how can the cohesive and relieving effect of sport be further exploited during the quarantine period? These are all topics to be further studied.

On the purpose of the study: emphasis on integration with practice.

From a national and social level, sports fans, as an increasingly large group, need to be regulated by relevant systems to promote the correct development of the group. Policies and regulations should be introduced at the national and social levels. At the level of fan base leaders and clubs, fan groups should be guided in a rational way to avoid polarisation or mass incidents, to play a role in concentrating the power of the group to do great things, and to actively integrate fan cohesion with the social mainstream, while avoiding the phenomenon of going against the social trend. At present, sports fan research still lags slightly behind the development of practice, and there is a disconnect between theory and practice. Future sports fan research should, firstly, incorporate practical trends in terms of projects and focus on the fan groups of emerging and popular sports; secondly, it should conform to the characteristics of fan groups in terms of depth, focusing on internal motivations and the essence behind the phenomenon. For example, current research does not seem to have reached the core of fan research, i.e. is a sports fan a status symbol with a sense of superiority, an insurmountable cultural boundary, or a threshold for social access? With the emergence of social media and opinion leaders, sports fan groups are increasingly gathered online, and the question of how to control the polarisation of fans within the group and the generation of related public opinion has become a new research question.

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