Modelling the structure of the sports management research field using the bertopic approach
Modelización de la estructura del campo de investigación de la gestión deportiva mediante el enfoque bertopic

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Abstract. Sports management is a field of study that has grown significantly. However, little is known about its structure. Therefore, this article presents an unsupervised cluster learning approach based on a thematic analysis of abstracts. It applies to a large corpus of sports management documents to gain insight into the structure of the discipline. A total of 3,704 records were downloaded from the Scopus database. Data were processed using the BERTopic approach. The results indicate that sports management is a growing and highly collaborative field of study. The themes (or topics) were diversified (25 clusters). Due to their proximity, seven meta topics were also identified. While the interest in major sports events and the social impact of sports tourism has lessened in recent years, other fields of study, such as entrepreneurship, innovation and sports club management, have captured the interest of researchers.
Keywords: Sports management, bibliometric analysis, topic modelling, BERTopic, UMAP, hDBSCAN.

Resumen. La gestión deportiva es un campo de estudio que ha crecido considerablemente. Sin embargo, se sabe poco sobre su estructura. Por ello, este artículo presenta un enfoque de aprendizaje de clusters no supervisado basado en un análisis temático de los resúmenes. Se aplica a un amplio corpus de documentos de gestión deportiva para conocer la estructura de la disciplina. Se descargó un total de 3.704 registros de la base de datos Scopus. Los datos se procesaron mediante el enfoque BERTopic. Los resultados indican que la gestión deportiva es un campo de estudio en crecimiento y de gran colaboración. Los temas (o tópicos) estaban diversificados (25 clusters). Debido a su proximidad, también se identificaron siete metatópicos. Mientras que el interés por los grandes eventos deportivos y el impacto social del turismo deportivo ha disminuido en los últimos años, otros campos de estudio, como el espíritu empresarial, la innovación y la gestión de clubes deportivos, han captado el interés de los investigadores.
Palabras clave: Gestión deportiva, análisis bibliométrico, modelización de temas, BERTopic, UMAP, hDBSCAN.

Introduction

Sports employ millions of people worldwide (Eurostat 2020). Most of the population has practiced or watched sports. Industrialization has been essential in changing how sports are produced and consumed (Belfiore et al., 2019) and have evolved from an amateur pastime to a major industry (Hoye et al., 2018). In the early twentieth century, the management of sports organizations involved techniques and strategies evident in most modern businesses, governments, and nonprofit organizations (Hoye et al., 2018). On the one hand, in the 1980s, physical education professionals realized the need for business-minded professionals in sports administration and management, leading to the emergence of sports management (Parkhouse et al., 1982). As a result, sports management experienced a period of widespread acceptance as an academic discipline (Zeigler, 2007). On the other hand, the global sports market has become crowded, and managers must understand the global environment in which they operate (Belfiore et al., 2019).

These changes in the scholarly field and industry have caused the discipline of sports management to grow at an accelerated rate (Ciomaga, 2013; Rozo Rondón et al., 2022). The North American Society for Sports Management (NASSM) has recently defined sports management as "an essential common body of knowledge in sports management that is cross-cutting and relates to management, leadership and organization in sports, behavioral dimensions of sports, ethics in sports management, sports marketing, communication in sports, sports finance, sports economics, sports business in a social context, legal aspects, sports governance, and professional preparation for sports management" (NASSM, 2018). To sum up, sports management is a dynamically growing field of research, which translates into an increase in scientific research (Lis, 2020) and a need to examine the sports management literature's themes and trends (Ciomaga, 2013).

Accordingly, thematic and bibliometric studies have been conducted on documents published in sports management journals (Ciomaga, 2013; Del Rio et al., 2017; Gholampour et al., 2019; Pitts & Pedersen, 2005; Shilbury, 2011), as well as in the field of sports management to understand the field's evolution (Lis & Tomanek, 2020; López-Carril et al., 2019; Pitts, 2001). Pitts (2001) reviewed all the literature on sports management published before 2000. The author concluded that sports management was limited to mainly the management of university sports and some professional sports. A few years later, Pitts and Pedersen (2005) conducted a content analysis of articles published between 1987 and 2003, specifically in the Journal of Sports Management (JSM). The authors classified the articles according to their subject matter: articles published in sports management and organization of skills in sports dominated in number, followed by sports marketing, sports business in a social context, and

sports management in education. The remaining topics represented a small percentage. Five years later, Shilbury (2011) examined different journals related to sports management and marketing, *i.e.*, the Journal of Sport Management (JSM), Sport Marketing Quarterly (SMQ), European Sport Management Quarterly (ESMQ), and Sport Management Review (SMR). JSM was the leading journal and the most cited in three of the four journals studied, followed by SMQ. Marketing and, in particular, articles about consumer behavior were considered the research topics with the highest impact. The authors noted that the multidisciplinary focus of most sports journals might impede the ability of those in the field to establish more robust patterns of influence.

Furthermore, Ciomaga (2013) conducted a bibliometric study on articles published in three sports management journals between 1987 and 2010. Changes and diversity in organizations and consumer motivation in sports marketing were highlighted as dominant and influential trends throughout this period. In contrast, less influential trends include the economics of sports and sports events, the impact of sports events, and the status of sports management as a research area.

After several years, the bibliometric study conducted by Del Rio et al. (2017) showed that in 2008, interest in sports management grew rapidly, especially in the United States, Spain, and Australia. Studies were published in specialized sports management journals such as the International Journal of Sport Management and Marketing, JSM, and SMR. In 2018, Núñez-Pomar et al. (2018) analyzed the five journals of sport economics and management indexed in JCR until 2011. Among other interesting results, the authors highlight that Trevor Slack is the author with the highest number of collaborations and Chelladurai the most productive. They also note that the most repeated words in the articles analyzed were football and competitive balance. One year later, Gholampour et al. (2019) conducted a bibliometric analysis of SMR and highlighted the researchers affiliated with universities in the United States of America and Australia. In addition, the keywords "sports development," "sponsorship," "intercollegiate athletics," "sports sponsorship," "sports management," "sports policy," "social media," "professional sports," and "sports marketing" were the most frequent and popular topics in this journal.

Lastly, Lis and Tomanek (2020) noted that the main thematic areas in the field of research were differentiated into the following: (1) professional sports management, (2) physical activity and health, (3) sports personnel, (4) information knowledge management in sports management, (5) governance in sports, (6) sports education and learning, (7) human beings in sports, and (8) fans in the sport. Furthermore, the emerging themes in scientific research were (1) the use of new information technologies (including social media), (2) sustainable development in sports, (3) fan satisfaction, and (4) physical activity. In this regard, López-Carril et al. (2019) also reviewed the sports

management field. The authors found that this research field is emerging (multidisciplinary) and growing. Furthermore, the evolution of the topics showed that the discipline is continually sensitive to the needs of the industry and connects practice and theory, highlighting eSports, Big Data, social media, and sports entrepreneurship, among other trends. Despite all the studies described above, the legitimacy of this field of study is in some cases questioned.

Most recently, other articles have used different approaches to study the evolution of the sport management research field. Gammelsæter (2021) questioned the widespread conceptualization of sport as an industry and business in the field of sport management research. To do so, they reviewed the recent debate in the field of sport management research in its three main journals (European Sport Management Quarterly, Journal of Sport Management and Sport Management Review). The findings indicate that due to the massive increase in research articles published in the top journals over the last decades, the debate on where sport management research is going and who it serves is scarce. In the same vein, Stenling and Fahlén (2022) analyzed the ways in which authors frame their research contributions in sport management articles published in the three sport management journals mentioned above. In this way, they provided a basis from which to reflect on what is considered valuable knowledge in the field of sport management.

Mils (2021) highlighted the importance of market structures in positioning sport management and in pushing the institutional boundaries on which most of the research in this field is based. He synthesized the work and proposed that framing the discipline of sport management in the context of politics and market power allows for a more legitimized and inclusive area of social science than sport economics. Cunningham et al. (2021) provided an overview of sport management and the development of the field since the publication of the text edited by Brooks (1981). These researchers summarized the developments in this field of study and classified them into three groups: (1) young field, (2) enduring issues, and (3) emerging trends. Finally, more recently, Stokowski et al. (2022) explored the field of sport management through sport management faculty perceptions of the discipline from around the world. These authors based their approach on Foucault's discourse theory, with their findings showing a lack of consistency within the sport management field in terms of their perceptions.

Beyond the considerations outlined above, the field of sports management research remains unexplored from a bibliometric perspective (Lis & Tomanek, 2020). Due to the abundant number of documents published, filtering to the most valuable content is complex without the help of text mining toolsets and unsupervised clustering analysis that fosters the discovery of new themes and reduces authors' bias via quantitative algorithms. "The automation of tasks significantly reduces the workload required to find

and read every document, select documents for research, identify publications on similar topics, or discard irrelevant articles from the analysis" (Wawak et al., 2020, p.422). Although many scholars have suggested the need to establish the direction of the discipline to increase the field's legitimacy, no empirical evidence exists in which the sports domain has been systematically and longitudinally analyzed (Kim et al., 2020). According to Porter, Kongthon and Lu (2002), mapping the field of sports management research should thus continue with other approaches to address large volumes of unstructured text (in this study, abstracts). In this regard, our analysis applies BERTopic (Grootendorst, 2020) that follows similar methods of Top2Vec (Angelov, 2020) and differently uses c-TF-IDF metric to create dense clusters (or topics) and to determine the topic terms.

In summary, the purpose of the present study is to present a general examination of the field of sports management literature and answer the following question: What are the characteristics of the sport management research field (evolution of articles published per year, most productive authors, rate of collaboration between authors, topics…)?, and (2) Which topics have gained popularity in recent years in the sport management research field? As a novelty to previous studies in the sports domain, this article conducts a thematic analysis based on a dimensionality reduction method (UMAP) followed by an unsupervised (hierarchical) cluster (hDBSCAN). We apply this approach to a large corpus of sports management documents to show the structure of the discipline. Three thousand seven hundred four records are downloaded from the Scopus database, whose abstracts are processed.

Methods

Data collection

The referred journal documents (as the higher-ranked scientific contributions) for building this bibliometric analysis were extracted from Scopus on April 10, 2020 following Kraus et al. (2022) recommendations. No time restrictions were established in the search, compiling all the articles published on this subject from its beginnings to the date of the search (1996- April 2020). Scopus is selected because it includes the most journals indexed in Web of Science (WoS). Additionally, Scopus has a more significant number of journals (and therefore references) than WoS (Baler-Fuentes et al., 2020). Following Sánchez-Franco and Calvo-Mora (2022), according to Mongeon and Paul-Hus (2016), Scopus is one of the most comprehensive social science databases and is similar to databases like WoS in that it is made for document searches (e.g., in peer-reviewed journals) and citation analyses (Meho & Yang, 2007). Furthermore, Terán-Yépez et al. (2020) estimate that Scopus has access to around 84% of WoS publications and more indexed journals; therefore, choosing Scopus lowers the likelihood of missing documents during the search. Future studies should, however, sup-

plement our work with other databases, such as the Web of Science, to prevent omitting references. This research includes only referred journal documents (articles, conference proceedings, reviews, or letters; referred to as "documents" from this point forward) written in English. The documents were extracted using query #1 (see below).

Query #1: KEY((sport*+entrepreneur*) OR (sport*-management*) OR (sport*+event*) OR (sport*+touris*) OR (sport*+sponsor*) OR (sport*+communicat*) OR (sport*+brand*) OR (sport*+consumer*) OR (sport* AND social*-media*) OR (sport* AND social*-net*)) AND SUBJAREA (BUSI OR SOCI OR DECI OR PSYC OR ECO OR NEUR) AND DOCTYPE (ar OR cp OR re OR no OR le)

The concepts presented above were selected for implementing the search string based on the NASPE-NASSM Sports Management Program Standards (2002) and the latest areas commented on in the WASM (World Association for Sports Management), EASM (European Association for Sports Management) and NASSAM (North American Association for Sports Management) conferences. In addition, our study removed documents that did not address the research problem based on analyzing the journals and the abstracts.

These documents were revised following the PRISMA protocol (Moher et al. 2009). The search string retrieved 4108 documents. In the screening phase, the proceeding papers, book chapters and article that were not accessible were delete (n=16). In the next step, in the eligibility phase, 388 documents were excluded following these two criterias:(1) Sport management was not the main focus of the article; (2) Documents were related to training methods, physical activity practice or sports medicine. The four authors revised the title and abstracts of the documents, and in case of in the case of discrepancies, these were resolved after consensus with the corresponding author.The final dataset yields 3,704 documents (in 991 publications) authored by 6,419 authors (and 2,744 first authors identified by author ID). In Figure 1, these procedure can be observed.
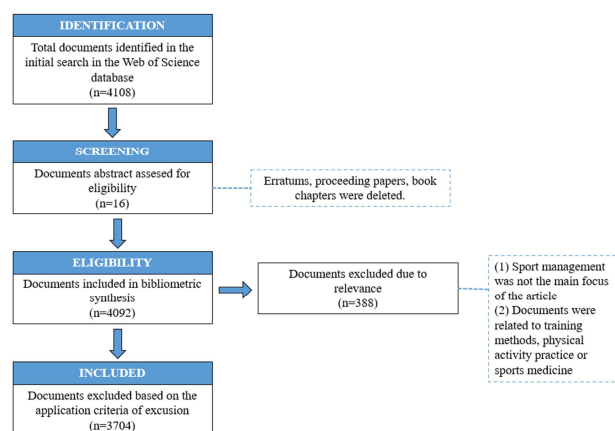

Figure 1. PRISMA protocol

Data cleansing

Following Sánchez-Franco et al. (2021; *cf.* also Sánchez-Franco & Rey-Moreno, 2021), the research re-

moves and normalizes noise from the text. Specifically, punctuation, capitalization, digits, and extra whitespaces are discarded in step (1), standard abbreviations and acronyms are normalized in step (2), a list of stop words (*i.e.*, noninformative words) are removed to filter out overly standard terms irrelevant to the research problem in step (3), spelling is checked in step (4), the terms are lemmatized in step (5), and several characters such as ampersands and punctuation marks are removed or replaced by regular letters in step (6). Authors' names and publications' names with different variations are also normalized. Lastly, our process omits terms shorter than three characters, and the most frequent word n-grams (extracted from author keywords) are used in combination with unigrams.

Data mining

Our research analyzes the intellectual structure (*i.e.*, a network of primary references within a research domain; *cf.* Zupic & Cater, 2015) related to sports management research publications indexed in the Scopus database. It focuses on the last four decades of research. Considering changes in business models and the analysis of latent themes identified by topic modelling algorithms, our study focuses mainly on the evolution of topics identified in abstracts. Abstracts "represent a concise summary of the article, (…) minimize the chance of identifying peripheral/minor topics and are fairly comparable in terms of format/style across journals" (Daenekindt & Huisman, 2020).

"By employing a quantitative approach for the description, evaluation, and monitoring of publications, it is possible to conduct a clear, systematic, and reproducible review process improving the quality of [literature] reviews" (Zhang, 2020, p.4-5). In this regard, our research applies topic modelling to these abstracts, *i.e.*, a computer-assisted technique to reveal phenomenon-based constructs and grounded conceptual relationships in textual data. See Figure 2.
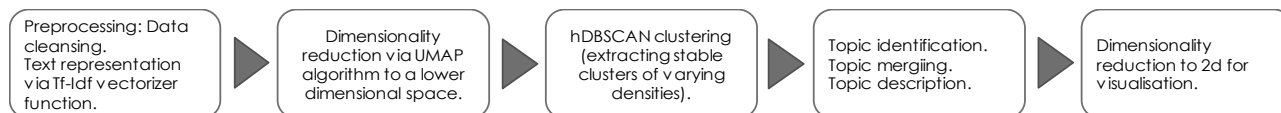

Figure 2. From Scopus Sports-abstracts to dense topics via NLP.

In contrast to classical topic identification models (*e.g.* Latent Semantic Analysis, LSA; Probabilistic Latent Semantic Analysis, PLSA, or Latent Dirichlet Allocation, LDA, among others), our research first transforms our corpus abstracts into 5,000-dimensional vectors designed for semantic textual similarity. In this sense, BERTopic supports diverse embedding models to embed the documents and terms. In our case, our analysis applies a custom embedding previously created through the Tf-Idf vectorizer function (from scikit-learn 1.0.2 package) that converts our collection of documents to a matrix of Tf-Idf features. Second, our study lowers the dimensionality of embeddings using Uniform Manifold Approximation and Projection (UMAP) (McInnes et al., 2018), which adequately preserves local structure. This proposal reduces our embedding to 60 dimensions (hereafter referred to as 60d-UMAP) and measures distances between datapoints via cosine similarity. Third, we employ an unsupervised hierarchical clustering (referred to as hDBSCAN in this study; Campello et al., 2013) to identify similar documents of varying densities in each cluster (or topic). hDBSCAN extends DBSCAN and extracts stable clusters of varying densities (arbitrary shapes and sizes and noisy points). The minimum size of the clusters is set at 25. Furthermore, the number of samples or density threshold (*i.e.*, the minimum number of samples required before an area can be considered dense and a point to be a core point) is set at 25.

Fourth, our study rates the importance scores for each n-gram by applying a class-based TF-IDF approach (hereafter referred to as c-TF-IDF) that supplies all documents within a single class with the same class vector.

In summary, the purpose of our research is to assess the thematic dynamism of sports research. Our study allows researchers to evaluate its latent structure and define future research guidelines. Bibliometric analysis and topic modelling combine thematic trends, gaps, and weaknesses in the sports domain and answer the above research questions. In this context, our approach builds a bidimensional space to easily visualize the continuous topical representation by applying the UMAP approximation (with an equivalent topological structure).

Results and discussion

Generic results: Documents published by country, journal, year, and collaboration index

In Figure 3, a third-degree polynomial model reveals a significant increase in the number of documents published between 1980 and 2021. As time passes, the sports domain becomes more productive, with an (average) annual percentage growth rate of 33.75%. In addition, the relative growth rate (or logP(t)-logP(t-1)) decreases as the years pass (mean RGR $_{\text{average 1990-1999}}$ = 0.30, mean RGR $_{\text{average 2000-2009}}$ = 0.19, mean RGR $_{\text{average 2010-2020}}$ = 0.14). This finding is in line with Gammelsæter (2021), who highlighted that the number of articles published about sport management have increased enormously in the last few years.
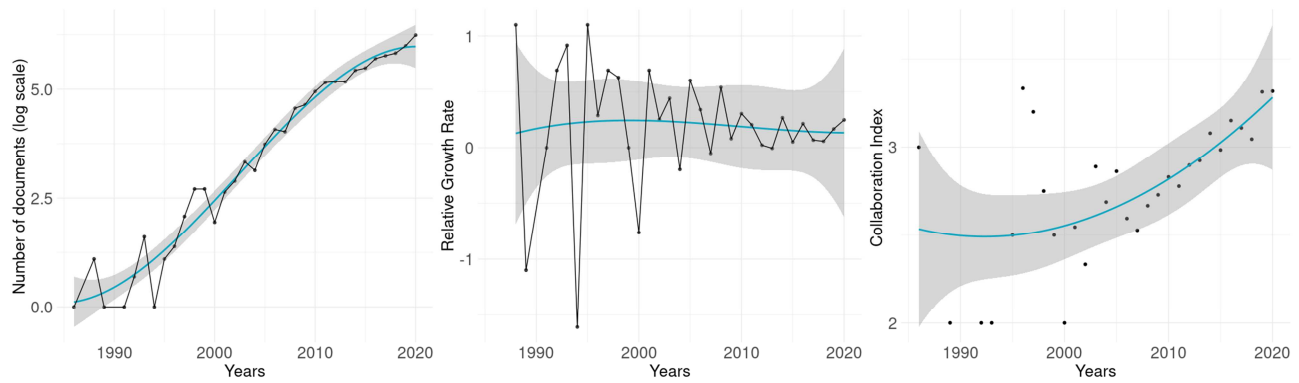
Figure 3. The number of documents over the years (on a log scale), RGR, and Collaboration Index of the sports field.

The extracted documents are published in 96 countries (and 2,290 institutions), specifically from the United States (1,042), United Kingdom (506), Australia (418), Canada (285), and Spain (252). The five journals with the most articles are the International Journal of Sport Management and Marketing (162), Journal of Sport and Tourism (130), Sport Management Review (112), International Journal of Sport Marketing and Sponsorship (97) and Sustainability (84). Among the journals that have published the most articles on sport management are two of the five sport economics and management journals analyzed by Núñez-Pomar et al. (2018).

A total of 5,152 authors (80.30%) published one document, 683 authors (10.60%) published two documents, and 239 authors (3.72%) published three documents (see Figure 4). Table 1 shows that Ferran Calabuig published 35 of the documents included in the dataset (DF = 0.200), followed by Kyriaki Kiki Kaplanidou (33, and DF = 0.226), Daniel C. Funk (32, and DF = 0.161), Vanessa Ratten (27, and DF = 0.385), and Heather J. Gibson (25, and DF = 0.208).
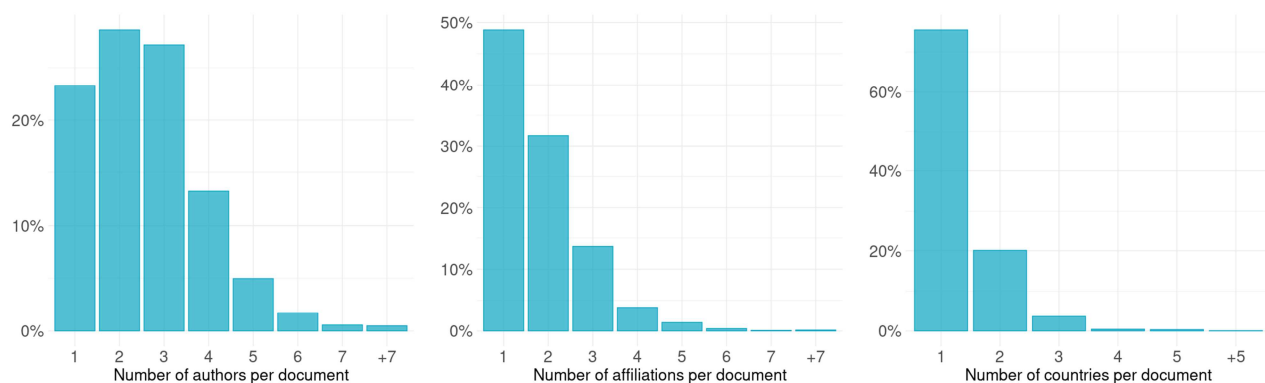

Figure 4. The distribution of individual documents according to the number of authors, the number of affiliations, and the number of countries.

Furthermore, following Lotka's law, the Beta coefficient is 2.44, analogous to other business and management domains, and the C constant is 0.52 with an r^2 score of 0.96 (see Lotka's law for measuring productivity). The p-value of the two-sample Kolmogorov–Smirnov test between the empirical and theoretical distributions of Lotka's Law is > 0.05. Therefore, there is no significant difference between the observed and theoretical Lotka distributions.

The overall collaboration index (CI), or the average number of authors in articles with multiple authors, is 3.07 (median = 3 and sd = 1.20). Overall, the research team is composed of two to four co-authors. The annual IQ shows an upward trend, i.e., single-authored documents decrease significantly. In this regard, our results indicate a higher number of documents with multiple authors (76.70%) than single-authored contributions (23.30%) in sports management. Single authors published 864 documents. Two authors published 1,057 documents (28.5%). Three or more authors published 1,783 documents (48.20%). In contrast, single affiliations (48.80%) and single countries (75.40%) represent significantly higher percentages.

Finally, the small-worldness index, estimated against 1,000 random networks, is 37.84 (neighbors >=3; Humphries & Gurney, 2008), demonstrating a small-world structure.

Table 1.
Summary of top 40 authors ordered by total documents.

Author	TP	diverse	h-index	DF	FA	MA	rank
Ferran Calabuig	35	0.341	19	0.200	7	35	1
Kyriaki Kiki Kaplanidou	33	0.378	20	0.226	7	31	2
Daniel C Funk	32	0.353	21	0.161	5	31	3
Vanessa Ratten	27	0.280	17	0.385	5	13	4
Heather J Gibson	25	0.336	16	0.208	5	24	5
Milena M Parent	23	0.414	16	0.273	6	22	6
Norm J O'Reilly	22	0.300	17	0.318	7	22	7
Kirstin Hallmann	20	0.264	15	0.737	14	19	8
Pamela Wicker	20	0.380	14	0.647	11	17	9
Nico Schulenkorf	17	0.217	15	0.417	5	12	10
Kevin R Filo	16	0.361	16	0.562	9	16	11
Laurence Chalip	16	0.316	14	0.125	2	16	12
Laura J Misener	16	0.132	13	0.312	5	16	13
Maria Huertas Gonzalez-Serrano	16	0.217	10	0.500	8	16	14
Manuel Alonso-Dos-Santos	16	0.350	3	0.688	11	16	15
Matthew Lamont	15	0.338	13	0.500	7	14	16
Doyeon Won	15	0.383	12	0.200	3	15	17
B Chris Christine Green	14	0.351	12	0.214	3	14	18
Christoph Breuer	14	0.326	11	0.143	2	14	19
Juan Manuel Nunez-Pomar	14	0.297	10	0.143	2	14	20
Marko Peric	14	0.330	10	0.769	10	13	21
Dimitra Papadimitriou	13	0.331	11	0.538	7	13	22
Sheranne Fairley	13	0.346	11	0.667	8	12	23
Weisheng Chiu	13	0.391	11	0.769	10	13	24
Becca Leopkey	13	0.282	10	0.538	7	13	25
Matthew Walker	13	0.208	10	0.154	2	13	26
Melville Saayman	13	0.183	10	0.231	3	13	27
Kamilla Swart	13	0.301	4	0.231	3	13	28
Pablo Galvez-Ruiz	13	0.205	3	0.308	4	13	29
Daniel S Mason	12	0.352	11	0.333	4	12	30
Sukkyu Kim	12	0.254	2	0.167	2	12	31
Benoit Seguin	11	0.300	10	0.364	4	11	32
Nerilee Hing	11	0.000	10	0.545	6	11	33
Bob Heere	11	0.338	4	0.273	3	11	34
Andre Richelieu	11	0.264	3	0.444	4	9	35
Christos Anagnostopoulos	11	0.299	3	0.182	2	11	36
David Parra-Camacho	11	0.245	3	0.636	7	11	37
Gregory A Cranmer	11	0.000	3	1.000	10	10	38
Martin Schnitzer	11	0.327	3	0.545	6	11	39
Popi Sotiriadou	11	0.255	3	0.400	4	10	40

Note: TP: Total documents; Diverse: Rao-Stirling diversity of authors across topics (0-25); h-index: H-Index; DF: Dominance Factor; FA: First-authored documents; MA: Multi-authored documents.

Thematic analysis: Description

BERTopic approach leads to 25 clusters restricted to dense areas. This finding explain the diversification of this field of study, which aligns with previous studies (*e.g.*, Lis & Tomanek, 2020; López-Carril et al., 2019). The average probability of cluster membership ranges from 0.68 to 1. A total of 1,959 documents are considered noise (associated with sparse regions) and excluded from clustering; *i.e.*, the noise points do not meet the clustering criteria. For instance, in hDBSCAN, a cluster split is accepted only if both newly formed clusters have at least the minimum size of data points. Figure 5 shows the condensed clustering tree extracted from hDBSCAN.

To correctly interpret the topics in Figure 7, each topic's most relevant terms are displayed closely related to one another (see Figure 6) and as a function of their c-TF-IDF values (see Figure 7). Furthermore, Table 2 (column TPC) and Figures 8 and 9 present each cluster's specific characteristics. In particular:

▪ The topics are identified, including if only a few abstracts are present (a minimum of 25 abstracts in this study) and are cohesive (or dense). In this regard, the size of the clusters varies from the most prominent clusters composed of more than 100 items (Clusters 10, 14, 15, 16, 20, and 23) to minor clusters of less than 30 items (Clusters 2, 12, and 18).

▪ The age of the clusters varies; for example, some clusters show that the first document was published in 1988; in others, the first document was published in 2009.

▪ Figures 8 additionally shows the countries that appear most frequently in these clusters. It provides data on the top 10 countries per topic based on centrality metrics. In this case, degree centrality measures how many countries in which an author engages, fostering information flow and propagation. Betweenness centrality measures a country's capacity to connect other countries within the cluster.

▪ Figure 9 also shows the rates at which the topics

are growing (or decreasing). The rates express the annual change in a topic as a percentage. Figure 9, therefore, helps to visually understand whether topics are on a growth trajectory or not compared to the previous year.
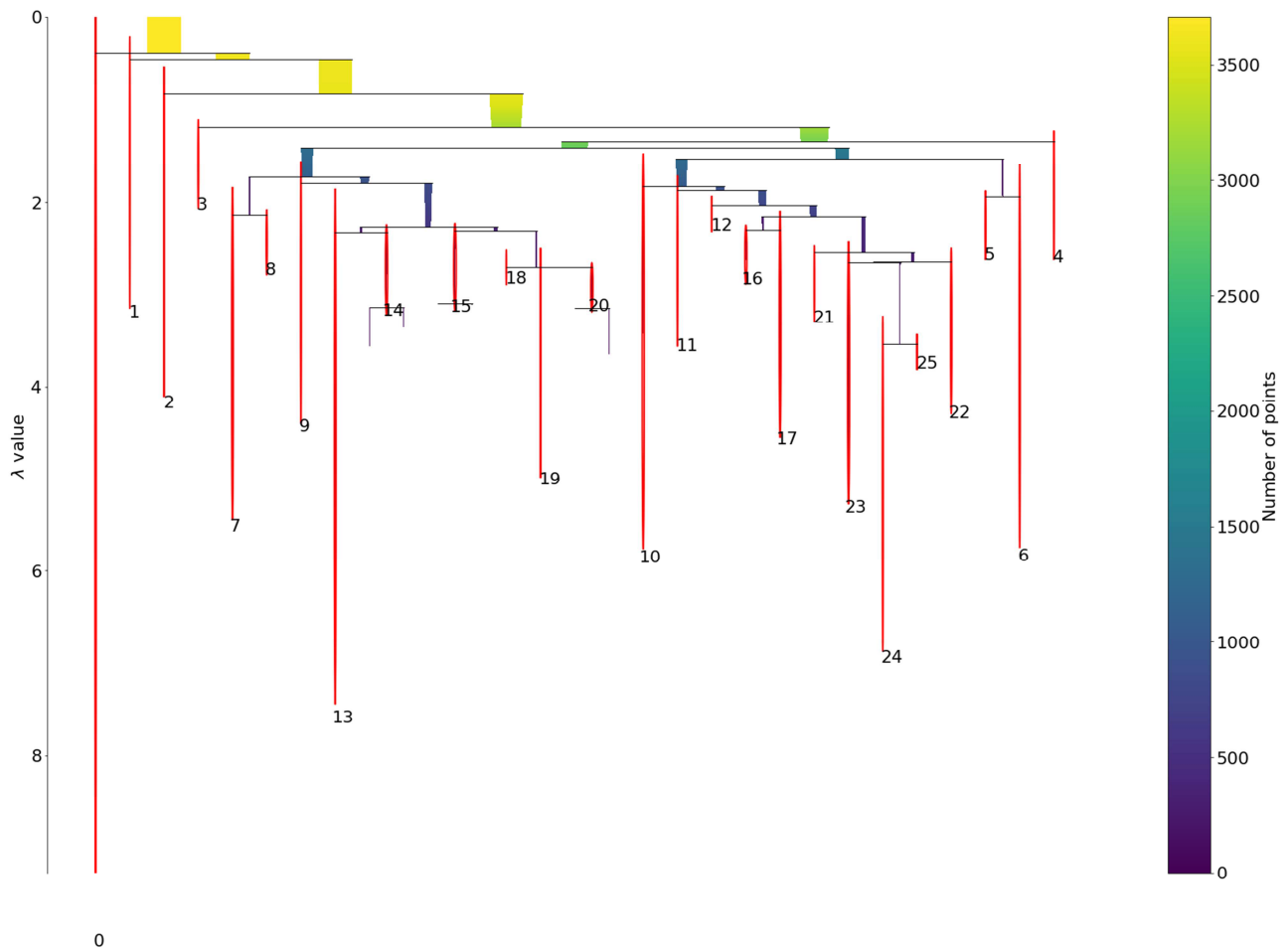

Figure 5. Topics identified and visualized by condensed clustering tree (hDBSCAN clustering algorithm).

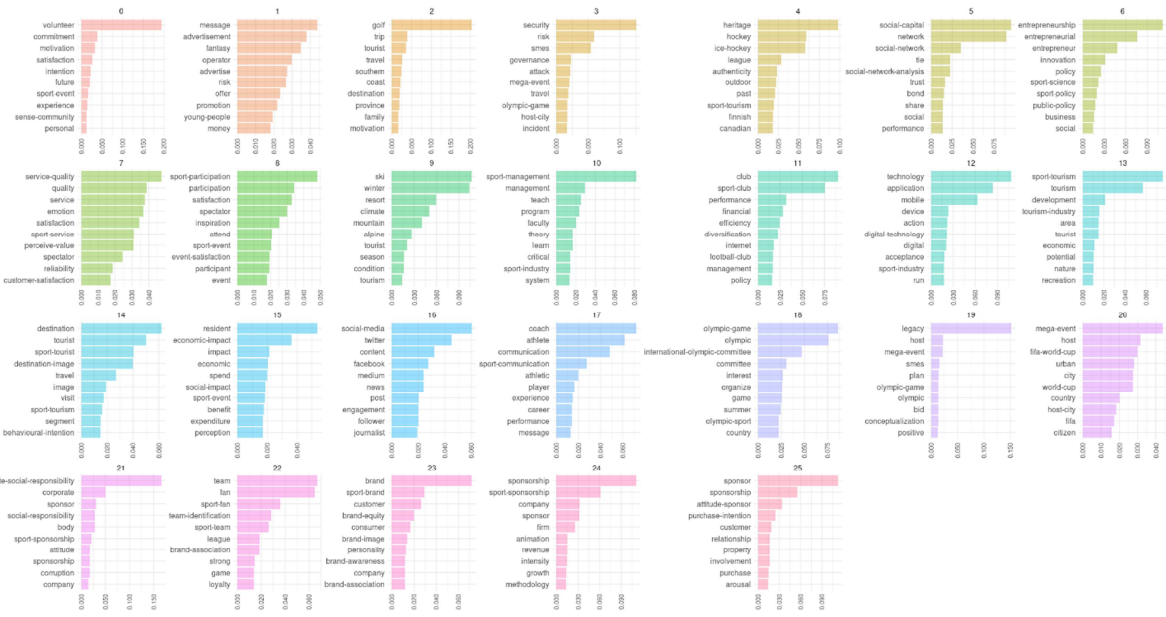Figure 6. Topics visualized by reducing to 2-dimensional UMAP.

Figure 7. Top 10 terms to describe topics according to c-TF-IDF scores

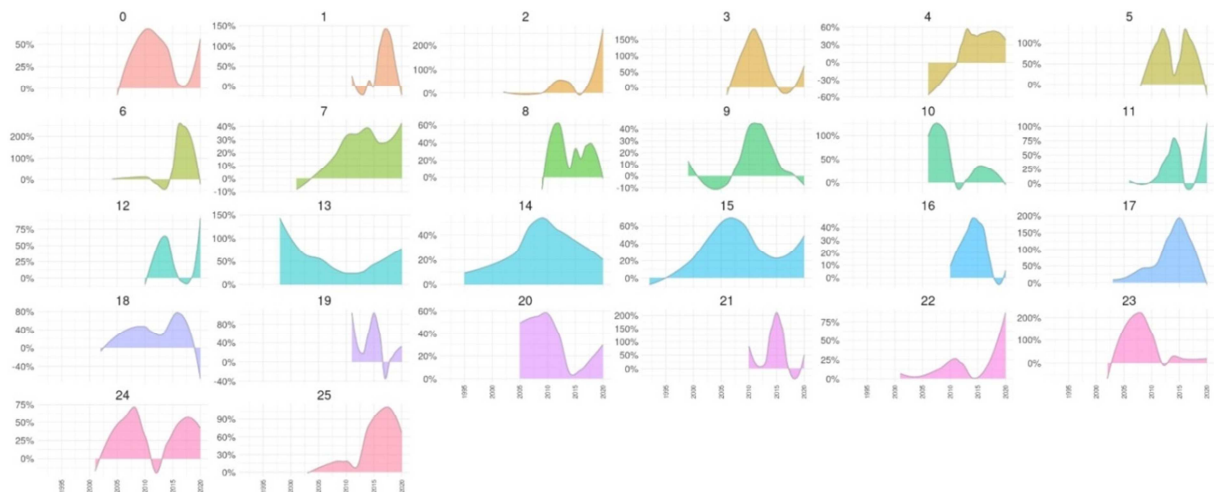Figure 8. Top 10 countries to describe topics.

Figure 9. Chronological evolution of each topic.

Table 2.
Summary of clusters.

Topic	dateL	dateH	date.median	TPC	TAuC	MAuPC	MPAuC	CI	TPC.CI	TAuC.CI	MAuPC.CI	MPAuC.CI	MCoC	MAfidC	MCiAuC	SWI
0	2001	2021	2015	72	140	1.94	0.514	2.89	63	135	2.14	0.467	1.47	1.94	15.62	4.400
1	2000	2020	2018	33	68	2.06	0.485	3.38	32	67	2.09	0.478	1.12	2.30	12.09	0.764
2	2000	2021	2014	29	59	2.03	0.492	2.70	20	52	2.60	0.385	1.28	1.79	9.90	11.410
3	2003	2021	2013	43	65	1.51	0.662	2.52	27	58	2.15	0.466	1.14	1.52	12.95	25.309
4	2005	2021	2017	36	54	1.50	0.667	2.91	23	44	1.91	0.523	1.43	1.71	13.06	1.377
5	2002	2021	2017	48	109	2.27	0.440	3.00	35	98	2.80	0.357	1.21	1.69	14.42	7.056
6	2001	2021	2018	58	108	1.86	0.537	3.37	38	98	2.58	0.388	1.26	1.74	12.40	0.937
7	1999	2021	2016	91	250	2.75	0.364	3.58	84	245	2.92	0.343	1.43	2.24	15.49	1.455
8	2007	2021	2018	58	136	2.34	0.426	3.20	56	134	2.39	0.418	1.36	2.00	15.48	3.343
9	1988	2021	2013	47	87	1.85	0.540	2.88	26	69	2.65	0.377	1.27	1.47	12.83	10.390
10	2002	2021	2016	113	249	2.20	0.454	2.93	81	224	2.77	0.362	1.18	1.61	8.55	12.114
11	2004	2021	2018	41	99	2.41	0.414	2.94	36	93	2.58	0.387	1.29	1.61	9.00	6.976
12	2009	2021	2016	26	57	2.19	0.456	3.06	17	48	2.82	0.354	1.31	1.62	6.19	3.206
13	1997	2021	2016	94	212	2.26	0.443	2.94	66	187	2.83	0.353	1.20	1.64	11.04	11.565
14	1988	2021	2016	124	281	2.27	0.441	3.02	107	268	2.50	0.399	1.39	1.89	19.11	6.719
15	1988	2021	2015	138	312	2.26	0.442	3.04	112	291	2.60	0.385	1.45	1.91	29.75	8.207
16	2007	2021	2017	113	224	1.98	0.504	3.08	73	193	2.64	0.378	1.20	1.72	10.05	7.276
17	2001	2021	2017	98	213	2.17	0.460	2.89	74	190	2.57	0.389	1.22	1.77	5.83	7.750
18	1998	2020	2013	25	43	1.72	0.581	2.92	12	31	2.58	0.387	1.16	1.56	10.24	2.433
19	2010	2021	2016	41	84	2.05	0.488	2.88	32	78	2.44	0.410	1.39	1.71	17.00	3.189
20	2004	2021	2015	117	215	1.84	0.544	2.86	66	170	2.58	0.388	1.28	1.63	15.95	12.395
21	2008	2020	2016	34	85	2.50	0.400	3.32	28	79	2.82	0.354	1.71	2.06	10.24	2.232
22	1999	2021	2018	70	170	2.43	0.412	2.95	61	159	2.61	0.384	1.38	1.91	13.24	6.239
23	1996	2021	2016	113	262	2.32	0.431	2.94	86	240	2.79	0.358	1.32	1.76	7.25	14.141
24	1998	2021	2015	49	114	2.33	0.430	2.93	43	109	2.53	0.394	1.41	1.86	13.96	6.758
25	1997	2021	2016	34	86	2.53	0.395	3.00	28	81	2.89	0.346	1.32	1.85	19.00	5.792

Note: dateL: Lower date range; dateH: Higher date range; date.median: Median of date; TPC: Total documents per cluster; TAuC; Total (distinct) authors per cluster; MAuPC: Average (distinct) authors per document and cluster; MPAuC: Average documents per (distinct) author and cluster; CI: Collaboration index; TPC.CI: Total documents per cluster among co-authored documents; TAuC.CI: Total (distinct) authors per cluster among co-authored documents; MAuPC.CI: Average (distinct) authors per document and cluster among co-authored documents; MPAuC.CI: Average documents per (distinct) author and cluster among co-authored document; MCoC: Average countries per cluster; MAfidC: Average institutions per cluster; MCiAuC: Average citations per (distinct) author and cluster; SWI: Small-world-index.

Meta-topics

In Figure 6, twenty-five topics are closely related to one another. In addition, these topics have been grouped into seven macro-themes within the sports management field according to their semantic validity, *i.e.*, (A) major sports events, (B) sports tourism and social impact, (C) brand management and sponsorship, (D) satisfaction and perceived quality in sports services and events, (E) sports communication, gambling and coaching behavior, (F) sports entrepreneurship, innovation, and sports club management and (G) sports management theories or research methodologies. Some of these identified areas are similar to those proposed by Lis and Tomanek (2020), but others differ. According to Cunningham et al. (2021) it can be seen how this field of study has moved away from the physical activity sciences of sport to examine social science theories in order to better understand sport organizations, those who work in them, and improve sport management at all levels. In particular:

▪ Meta-topic A refers to major sports events. It comprises four thematic clusters above this cluster (Clusters 0, 3, 18, 19 and 20). It is the fourth largest macrothematic cluster. The first documents in meta-topic A were published in 1998 and have received 1,385 citations. The countries with the most research in this area are the United States of America, Australia, and Canada.

Topics ranging from volunteers to security, organization, and citizen support for volunteers to their legacy are studied. The oldest and least attention-grabbing topic is the organization of the Olympic Games (Cluster 18, most documents published in 2013), whose number of documents published has declined since 2015. However, the impact of major sports events (topic 20) has been growing in recent years. Contrary, some years ago, Ciomaga (2013) highlighted the economics of sports and sports events, and the impact of sports events as the less influential trends.

However, the first document published about the legacy of major sports events (topic 19) has generated the most interest (first document published in 2010). Since 2017, this theme has grown significantly. This relevance

may be due to the importance of the sustainability of sporting events in recent years (González-Serrano et al., 2021). The recruitment and retention of sports volunteers (topic 0) and the security of sports events (topic 3) are subthemes within this cluster that have increased in the last five years. This may be because volunteers are an essential component of sport event management, and their involvement produces a number of long-lasting and sustainable positive effects and contributes to the ultimate success of the event (Kim et al., 2019). In the case of sporting event security, it may be because with 9/11, security at sporting mega-events has become increasingly important, although this is an area where numerous scholars have called for more academic attention (Lee Ludvigsen, 2018).

▪ Meta-topic B (with 468 documents) refers to sports tourism and the social impact of sports. It comprises six thematic clusters (Clusters 2, 4, 9, 13, 14, and 15) that have received 2,462 citations. Most of the documents were published between 2015 and 2016. The oldest published document was in 1988. The countries with the most research on this subject are the United States of America, the United Kingdom, and Spain.

Golf (Cluster 2) and winter events (Cluster 9) attract the most attention and have notably grown in recent years. Likewise, sports events (topic 4) show stable growth, while sports tourism management shows steady growth (topic 13). According to Jiménez-García et al. (2020) sports tourism has emerged as a relatively recent typology, but it is one that has shown significant growth in recent times. Furthermore, sports tourism, sustainability, and nostalgia tourism have increased in recent years. Therefore, it is a compact major theme of study, and its future seems to lie in the sustainability of sports tourism (Jiménez-García et al., 2020). Research on sports management focused on sustainability -which helps achieve the 2030 Agenda and the Sustainable Development Goals (SDG)- seems vital. Lis and Tomanek (2020) highlighted the SDG as an emerging issue within sports management. Sports and physical activities can contribute to achieving these objectives due to their different forms of application (individuals, societies, profit, and nonprofit organizations) and their multiple effects at the individual-, meso-, and macro-levels (Escher, 2020).

In contrast, the perception of the local impacts of sports events (topic 14) and the images of sports tourism destinations (topic 15) are themes that have declined sharply since 2008. This is in line with the findings of the bibliometric analysis of Ciomaga (2013). In particular, topic 15 has decreased at a slower rate.

▪ Meta-topic C is related to brand management and sponsorship and comprises five thematic clusters (21, 22, 23, 24, and 25). Meta-topic C has received a total of 1,370 citations and has become the third-largest macro-thematic cluster. The countries with the most research on this theme are the USA, UK, and Australia. Within Meta-topic C, one of the largest and oldest clusters is branding and self-image (Cluster 23), whose growth has been stable

since 2012.

Moreover, there are two smaller clusters, *i.e.*, social responsibility (topic 21) and attitude toward sponsor and purchase intentions (Cluster 25), whose most significant scientific research occurred in 2016. One of the ways in which sports organizations have tried to differentiate themselves and create stronger bonds with their current and potential customers is through corporate social responsibility initiatives (McCullough & Trail, 2022). Furthermore, although topic 21 experienced a decrease in published documents, it grew in the previous year. Topic 25 grew until 2010. However, since 2018, there has been a decrease in publications. In this regard, the sponsorship firm (topic 24) has not been interested since 2018. Consumer motivation in sports marketing has been one of the most influential areas (Ciomaga, 2013; Gholampour et al., 2019).

Cluster 22, related to fan identification with teams, brand association, and loyalty, should be specifically discussed. Cluster 22 has attracted the most attention in recent years, having the highest scientific output in 2018. One possible explanation is that sports sponsorship is vital to the promotional mix in marketing communication plans for brand strategies and practices (Pan & Phua, 2020; Fernández Souto et al., 2019).

▪ Meta-topic D is related to satisfaction and quality in sports services and events, consisting of two clusters (7 and 8) and 149 items. These documents have received a total of 735 citations. It is the fifth-largest topic. The countries with the most research on this topic are Spain, the USA, and Canada. Spectator and participant satisfaction with sports events (Cluster 8) is a new research topic whose first document was published in 2017. However, it seems to be gradually losing focus. In contrast, measuring service quality and customer emotions have gained attention recently (topic 7). The satisfaction of sports services and events seems to focus on the consumer, which is consistent with Lis and Tomanek (2020). These authors highlighted fan satisfaction as an emerging area of research. Perhaps the study of new technologies' irruption in these areas represents a future area of study within these meta-topics.

▪ Meta-topic E relates to sports communication, gambling, and sports coaches' behavior and comprises five clusters (1, 5, 12, 16, and 17) and a total of 318 documents and 1,019 citations. It is the fourth-largest macro-theme. The countries with the most research on this theme are the USA, UK, and Australia. It is a new macro-thematic study, as the first document was published in 2000. Specifically, the topic related to communication (Cluster 1) is the oldest research topic. Although it experienced strong growth from 2015 to 2018, interest in this topic has recently declined. However, academics are interested in how social media can improve communication with spectators and sports consumers (López-Carril et al, 2019). This finding aligns with Lish and Tomanek (2020), who recognized the use of new information technologies,

including social media, among the emerging themes in scientific research. In this regard, the relationship between the sports firm (Cluster 5) and the behavior of the sports coaches (Cluster 17) has become less important throughout the last five years.

In contrast, one of the newest topics is the application of digital technologies via mobile devices in the sports industry, having its first document published in 2009. This topic has experienced strong growth over the last three years. It is the newest topic of study in the field of sports management. The social media topic has also captured the attention of sports management researchers in the last two years, although its growth has not been as noticeable. This finding is in line with López-Carril et al. (2020), who showed that the articles published in social media are growing over the last few years. Moreover, in this context, Ströbel et al. (2021) indicate that the digitalization of the sports industry is still an emerging phenomenon for which more research is needed.

- Meta-topic F refers to sports entrepreneurship, innovation, and management of sports club management (Clusters 6 and 11). It is a new area of study with its first document published in 2001, and it comprises 99 articles. These articles have received a total of 409 citations. It is the smallest macro-theme. Spain, followed by the USA, the UK, and Australia, are the countries that have the most research on this topic. However, it seems to be an emerging area of study and attracts the interest of researchers. Specifically, scientific research on sports entrepreneurship (Cluster 6) increased exponentially between 2015 and 2018 and is currently declining or not experiencing such noticeable growth. These findings align with those of the study by González-Serrano et al. (2020).

Lastly, the topic of how to manage sports clubs (non-profit organizations) to maximize social, economic, and sports results (Cluster 11) is gaining attention (Hammerschmidt et al., 2021). López-Carril et al. (2019) also highlighted the importance of sports entrepreneurship in responding to the current needs of the sports sector.

- Meta-topic G relates to sports management theories, research methodologies, and education (Cluster 10). It comprises 114 documents. Meta-topic G has received a total of 346 citations. It is the second smallest major theme. It seems to be a newer theme, with its first document published in 2002. It grew the most in 2008; in 2010, it declined, and since 2012, its growth rate has decreased.

The development of methodologies and theories seems necessary to advance sports management research. However, as it is a newer and growing field of study, theories from other research fields have started to be borrowed; therefore, there is still a need to develop new ideas specific to sports management. According to Stenling and Fahlen (2022), when building a sport-specific theory "from scratch," one must try to capture the unique charac-

teristics of the theoretical arguments. In addition, according to these same authors, one should keep abreast of theoretical developments outside the field and take great care in explaining how modifications of borrowed theories explain sport better than the original theories. In terms of research methodologies, Cunningham et al. (2021) shows that sport management researchers have adopted new research methods, with much growth occurring especially in qualitative research. Although Shaw and Hoeber (2016) have pointed out the value of adopting innovative qualitative methods to gain new knowledge, other authors point out the need to use mixed research methods (Zhang et al. 2016).

Furthermore, the relationship between educational and sports management approaches has become essential for scientific research (Belfiore et al., 2019). In recent years, several studies have been conducted about the introduction of entrepreneurship within this field of study (González-Serrano et al., 2021) and different social media (Lebel et al., 2015; López-Carril et al., 2020). All this is to improve the employability of sports management students. The most represented countries in this cluster are the USA, China, Australia, and Canada.

Of these macro-themes (or meta-topics), major sports events, tourism, and social impact are the oldest themes in this field of study of sports management. However, they have not attracted significant attention from academics in recent years. These results also align with those found by Ciomaga (2013), who noted that the minor influential trends were the economics of sports and sports events and their impact. In contrast, smaller-scale events are attracting the attention of sports policy. Specifically, volunteering at sports events and golf event studies attracts high interest from academics in sports management.

There are three more novel or emerging research areas: sports communication, entrepreneurship and innovation, and theories and education in sports management. These last macro-themes, which seem to be a trend, may result from the growth and globality of sports management (Belfiore et al., 2019). Furthermore, information technologies and social media (Del Rio et al. 2017; Lis & Tomanek, 2020) and sports entrepreneurship (López-Carril et al., 2019) were emerging themes that captured scholars' attention within the field. Therefore, competitiveness must be maintained by improving communication, using innovation and entrepreneurship when managing, and improving the training of future sports managers. New theories specifically within sports management must be developed, and growing research is thus required to contribute to their growth and consolidation in meta-topics E, F, and G.

Lastly, a summary of the meta-topics is presented in Table 3. The number of documents, the first year of publication, the most cited papers, and the evolution of each cluster in recent years are also displayed.

Table 3.
Summary of meta-topics: number of documents, cluster numbers, first publication year, and most represented articles.

	Meta-topics	First publication year	N° of citations	N° of documents	Cluster numbers	Most cited article	Topics	Current state (Last year's growth rate changes)
A	Major sports events	1998	4501	298	0	Coyne, & Coyne (2001)	Recruitment and retention of volunteers in golf tournaments	High growth
					3	Giulianotti & Klauser (2010)	Security in major sports events	Small growth
					18	Madden (2002)	Economic impact of the Olympic Games	Large decline
					19	Preuss (2015)	Legacy of major sports events	Small growth
					20	Müller (2015)	Major events syndrome	Small growth
B	Sports tourism and social impact	1998	8874	468	2	Markwick (2000)	Golf tourism development and sustainability	High growth
					4	Ramshaw & Gammon (2005)	Nostalgia sports tourism	Stable growth
					9	Scott, McBoyle & Minogue (2007)	Ski tourism and climate change	Large decline
					13	Higham & Hinch (2002)	Changing seasonal sports and tourism	Stable growth
					14	Kaplanidou & Vogt (2007)	The influence of sports event and destination images on sports tourist's behavior	Small decline
					15	Kim & Petrick (2005)	Residents' perceptions on impacts of the 2002 World Cup	Stable growth
C	Sports brand and sponsorship	1996	3424	300	21	Plewa & Quester (2011)	Sports sponsorship and corporate social responsibility	Small growth
					22	Gibson, Willming & Holdnak (2003)	Tourism behaviors of sports fans	High growth
					23	Filo, Funk & Alexandris (2008)	Sports brand trust and loyalty	Stable growth
					24	Clark, Cornwell & Pruitt (2009)	Title sports events announcements and finance	Small decline
					25	Roy & Cornwell (2004)	Consumers' knowledge on sports sponsorships response	Small decline
D	Satisfaction and quality in sports services and events	1999	2308	149	7	Carman (1990)	Assessment of the SERVQUAL battery	Stable growth
					8	Theodorakis, Kaplanidou & Karabaxoglou (2015)	Influence of sports events participants' perceptions of service quality on happiness and satisfaction	Large decline
E	Sports communication, gambling and coaches behavior	2000	2959	318	1	Lamont, Hing & Gainsbury (2011)	Sports Gambling	Large decline
					5	Wäsche, Dickson, Woll & Brandes (2017)	Social network analysis in sports research	Large decline
					12	Mahan (2011)	Digital social media and sports consumer preferences	Large growth
					16	Steinfeldt, Foltz, Kaladow, Carlson, Pagano, Benton, & Steinfeldt (2010)	Racism attitudes in sportss online forums	Small growth
					17	Jones, Jones, Williams-Burnett & Ratten (2017).	Sports coaches behavior	Large decline
F	Sports entrepreneurship, innovation, and sports clubs management	2001	1088	99	6	Ratten (2010)	Development of the sports entrepreneurship theory	Large decline
					11	Miragaia, Brito & Ferreira (2016)	Role of stakeholders in the efficiency of nonprofit sports clubs	Large growth
G	Sports management theories, research methodologies, and education	2002	966	113	10	Sotiriadou, Brouwers & Le (2014)	Sports management theories, methodologies and education	Small decline

Conclusions and recommendations

This study aims to present the current state of sports management research and subsequently propose future research avenues. In contrast to other conventional bibliometric analyses, our approach has enabled the analysis of a larger corpus of documents and, thus, the creation of a global and broad view of sports management. Although

sports management is vast and diverse, our clusters are closely linked. Moreover, it is a research field that has grown considerably over the last 50 years. It is also highly collaborative and has shown a sustainable trend. Therefore, to contribute to the development of this research field, the findings of this article may be of interest to sports management academics and practitioners.

Branding and sports sponsorship, followed by satisfaction and quality in sports services and events, are the oldest meta-topics. Within the first macro-theme, fan identification with sports, brand association, and fan loyalty has attracted the most attention from academics in recent years. Similarly, according to the second meta-topic, spectator satisfaction becomes a key topic among academics. Sports management research focuses more on its consumers, *i.e.*, spectators and fans of sports events. Discovering how to improve sports consumers' experiences, satisfaction, and loyalty, mainly sports events, seems thus to be a growing trend. There are well-established topics, mainly about major sports events and sports tourism and their social impact. However, others, such as branding and sports sponsorship, are emerging. Perhaps the study of new technologies' irruption in these areas represents a future area of study within these meta-topics.

Communication in sports, sports entrepreneurship, innovation and policy in sports clubs, and sports management education are the newest meta-topics within this field of study, with topics beginning to emerge in the early 20th century. Furthermore, the application of technology in sports management is capturing the attention of researchers in this research field. Regarding sports innovation and entrepreneurship, both individual and organizational entrepreneurship (mainly in sports clubs) and its relation to economic performance and efficiency in sports policy-making have become more prevalent. However, more research, especially empirical research, is needed to discover the antecedents of sport intrapreneurship and entrepreneurship behaviour (individual and organizational) and its impact on society. In addition, sport entrepreneurship research through the lens of sustainability should also be considered in the future.

Lastly, sports management education and sports management theories, highly centralized and interrelated topics, are the newest and attract several researchers' attention. These topics seem to be closely related to improving students' employability in the sports sector, in which entrepreneurship, social media, and new technologies are of great interest. More empirical research is needed on what methodologies should be applied in the sport managements subjects to enhance the employability of these students. In addition, the importance of developing more specific theories within sports management is highlighted. Specific sport management theories are needed to advance in this research field. Moreover, research on sports management focused on sustainability -which helps achieve the 2030 Agenda and the Sustainable Development Goals (SDG)- seems vital. Nevertheless, research in this area is nearly nonexistent. Hence, this paper contributes to the sports management literature by providing new knowledge about current and future changes in this research field via a new approach to trend detection.

Limitations and future research

Several limitations should be considered when interpreting our results. First, despite a large number of abstracts, depending on the proposed query, there is always a risk that the abstracts analyzed will be incomplete, inaccessible, and unrepresentative. Second, future research should assess whether the topics and meta-topics have remained stable and their different interannual (or other time intervals) rankings of the relevance of each term in each theme. Third, future research should compare results with those obtained by different topic modelling approaches or bibliometric analysis methodologies. Fourth, only the Scopus database was used, so future studies should perform the same search with other databases (eg., Web of Sciences). Following Sánchez-Franco and Calvo-Mora (2022), our research removes and normalizes noise from the text. Specifically, punctuation, capitalization, digits, and extra whitespaces are discarded in step (1), standard abbreviations and acronyms are normalized in step (2), a list of stop words (i.e., noninformative words) are removed to filter out overly standard terms irrelevant to the research problem in step (3), spelling is checked in step (4), the terms are lemmatized in step (5), and several characters such as ampersands are removed or replaced by regular letters in step (6). Authors' names and publications' names with different variations are also normalized. Lastly, our process omits terms shorter than three characters, and the most frequent word n-grams (extracted from author keywords) are used in combination with unigrams.

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