

## Sustainable development in sport as a research field: a bibliometric analysis

IWONA ESCHER

Department of Organizational Behavior and Marketing, Nicolaus Copernicus University in Toruń, POLAND

Published online: October 30, 2020

(Accepted for publication: October 22, 2020)

DOI:10.7752/jpes.2020.s5381

### Abstract:

The growing concern about sustainable development among researchers and practitioners who deal with sports results in the increase of publications in which the terms ‘sustainable development’ (or ‘sustainability’) and ‘sport’ appear together. Over time, there are also more and more thematic areas where these terms are combined; also the new terms derived from them emerge. One of these terms is ‘sustainable development in sport’ indicated by Lis and Tomanek (2020) as an emerging field in sport management research area. The main aim of the paper is to present the state of the art in this particular research field as well as evaluate it from the perspective of the all-encompassing scientific literature where the terms ‘sustainable development’ (or ‘sustainability’) and ‘sport’ coexist. To achieve this aim, the bibliometric analysis supported by literature review was conducted. The analysis was performed with the use of VOSviewer software. The paper contributes both to theory and practice. Along with investigating the existence of the term ‘sustainable development in sport’ in scientific literature, it also sheds light on the diversity of thematic areas in which the concept of sustainable development (and sustainability) is combined with sports issues. Additionally, it presents the difficulties of conducting bibliometric analysis within such a research field due to the variety of conceptual and grammatical constructions in which terms ‘sustainable development’ and ‘sustainability’ are combined with ‘sport’. It also discusses limitations related to the use of Scopus and Web of Sciences databases together with VOSviewer software for such an analysis. Practical implications refer to the ways in which sport and sustainable development goals may be combined. The paper may also offer guidance for scientific researchers in their future research, including bibliometric analysis related to the paper’s topic. For this purpose, the research procedure applied by the author was intentionally described in detail in the article, which both ensures its transparency and enables its replication. The repetition of the analysis may form the basis for identifying changes in the intellectual structure of the research field that have occurred since the article was published.

**Key Words:** sport, sustainable development, sustainability, bibliometric analysis, VOSviewer

### Introduction

Although the origins of the concept of sustainable development (SD) date back to the nineteenth-century (Caradonna, 2014), it has been in the last two decades that the attention to this topic has grown significantly among researchers and practitioners. Based on its definition proposed in 1987 in the “Our common future” report by the World Commission for Environment and Development (*Report...*, 1987), sustainable development can be defined as “*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*” (p. 41). To achieve it, the concept requires the integration of three key dimensions (seemingly contradictory): economic (long-term economic growth that will be shared by all nations and communities), environmental (protection of the natural environment and managing natural resources in such a way as to allow preserving at least some of them for future generations), and social (permanent improvement of the quality of life of present and future generations) (Hopwood et al., 2005; Alhaddi, 2015).

The growing concern about SD, as well as sustainability (which could be understood as the overall outcome of the sustainable development where the economic, environmental and social factors are balanced in equal harmony), results in the increase of scientific production which represents numerous and fundamentally different scientific disciplines. As the concept is multifaceted in nature, the ways how it is implemented in practice or described in the literature are very diverse, and depend on the specificity of a particular research or practice area. The attention to this topic has also grown significantly in scientific discourse in the field of sport and physical activity. Alongside abundant literature on sport and also on SD (or sustainability), there are more and more publications in which the terms ‘sustainable development’ (or ‘sustainability’) and ‘sport’ appear together. In fact, sport and physical activity contribute in various ways to achieving the ‘sustainable development’ goals, due to their various forms of implementation by individuals, societies, non- and for-profit organizations, as well as multiple effects which they bring at the individual (i.e. human development), meso and macro levels. Consequently, sport is considered a driver of SD (Masdeu Yelamos et al., 2019) or an essential enabler of SD (*International ...*, 2015; *Transforming...*, 2015; González-Serrano et al., 2020).

As the interest of the academia in the fields related to sport in conjunction with sustainable development (or sustainability) grows, consequently the number of authors employing bibliometric methods to study the structure of this research area and its evolution is increasing (e.g. Jiménez-García et al., 2020; González-Serrano et al., 2020; Lis & Tomanek, 2020; López-Bonilla et al., 2020). Nevertheless, it is worth noting that most of such analytical publications concern specific, very narrow issues. Although they mention ‘sustainable development’ (or ‘sustainability’) and ‘sport’, but they do it in general terms; rather as a background for a more specific topic than as the primary focus of the analysis. The growing number of such publications with narrowly-defined research area confirms how multifaceted the understanding of SD in the context of sport is. On the other hand, it makes it more and more difficult to obtain a more general picture of the coexistence of the terms ‘sport’ and ‘sustainable development’ (or ‘sustainability’) in the scientific literature.

As of August 26, 2020, just 214 of relevant publications in Scopus database were found, that is publications dealing with the interface between ‘sustainable development’ (or ‘sustainability’), ‘sport’ and ‘bibliometric analysis’ / ‘thematic mapping’ / ‘bibliographic analysis’ / ‘systematic review’ / ‘Web of Sciences’ / ‘Scopus’ in titles, abstracts and keywords. Of these, only in a few does the bibliometric analysis concern the interface between relatively broad terms, such as for example ‘sustainability’ and ‘sports tourism’ (e.g. González-Serrano et al., 2020), or ‘sustainability’ and ‘golf tourism’ (e.g. López-Bonilla et al., 2020). Although they do not analyze exactly the same research field as studied in the present article, their appearance confirms the growing interest of academia in analyzing the intersections between ‘sport’ and ‘sustainable development’ (or ‘sustainability’) in scientific literature. For example, based on bibliometric analysis, Jiménez-García et al. (2020) identified the significant increase in concern with the field of ‘sustainability’ and ‘sports tourism’, especially during last four-year period of their study (2016-2019) which contributed almost 51% of the total literature production in the field by then. As the authors conclude, “*this production boom in the field can be directly connected with the increased visibility of the theme of sustainable development worldwide, resulting from the 2015 United Nations SDGs [the publication by the UN of the 17 Sustainable Development Goals]*” (p. 9). Despite this increase, a specific fragmentation of different thematic areas with little relations between one other was observed by the authors. As they argued, these relations are not yet well-established and not consolidated enough, which proves the relative novelty of the research area. The growing attention of academics to a similar field was also indicated by Lis and Tomanek (2020) when conducting thematic mapping of the sport management research area. Among emerging topics enumerated by the authors, there was issue named ‘sustainable development in sport’. It was an ‘umbrella label’ proposed for several keywords listed by the authors, such as: sustainability, sport for development and sport-for-development, which occurred with high frequency in the most recent publications (2016 and later).

In actual fact, the results of Lis and Tomanek’s analysis (2020) were an inspiration for the aim of this article and in consequence for designing the study procedure. First of all, their results produce the following question (*Q1.1*): Does the phrase ‘sustainable development in sport’ (exactly as used by the authors) exist in scientific literature, and if yes, what is the state of the art in this particular research field? Taking into account the semantic closeness of the word ‘sustainability’ to the term ‘sustainable development’, it also seems interesting to examine whether a similar phrase ‘sustainability in sport’ covers the same scientific production (*Q1.2*). Additionally, a few other questions seem worth posing. For the record, Lis and Tomanek (2020) focused on a specific research field (sport management), and as a result ‘sustainable development in sport’ appeared in their analysis as a new emerging field. On the other hand, in the last several years a significant increase of the researchers’ interest in interconnection between the terms ‘sustainable development’ (or ‘sustainability’) and sports issues has been identified. Taking it into account, it also seems interesting to evaluate Lis and Tomanek’s results from the perspective encompassing all scientific literature where the terms ‘sustainable development’ (or ‘sustainability’) and ‘sport’ coexist. In other words, it is intriguing to find out whether the same conclusions (assigning an emerging character to the described research field) could be formulated if the bibliometric analysis was undertaken on a higher level of generalization (*Q2*), i.e. without using such a precisely defined term as done by Lis and Tomanek and without confining generic terms ‘sustainable development’, ‘sustainability’ and ‘sport’ to specific, narrow thematic areas, as it is done by many academics. Based on this question, more detailed ones could be proposed as follows:

- *Q2.1*. What is the volume of scientific production in the research area that combines ‘sustainable development’ (or ‘sustainability’) and ‘sport’?
- *Q2.2*. What are the main topics studied within this field of research?

The article aims to give answers to the above-mentioned research questions. Simultaneously, the article is a kind of direct answer to Lis and Tomanek’s (2020) suggestions for other scholars to explore the emerging topics indicated by them in their bibliometric analysis, as well as a response to a more general suggestion for academia to conduct future research based on published results. In order to achieve these aims, the bibliometric analysis was conducted. The analysis was performed with the use of VOSviewer, a free science mapping software tool to analyze and visualize scientific structures of research fields (www.vosviewer.com; Van Eck & Waltman, 2020). The results of the bibliometric analysis were supported by an in-depth review of the most relevant literature within a given topic.

## Material & methods

The bibliometric analysis (followed by review of the selected literature) was performed in two main stages, in accordance with the above-proposed research questions and their sequence. The two-stage procedure is reflected in the structure of the next empirical section of the article. The analysis was performed based on the bibliometric data retrieved from Web of Science Core Collection (WoS) and/or Scopus, as they are the two most comprehensive, and most widely recognized international databases collecting scientific publications with the most significant impact.

At two subsequent stages (stage 1 that refers to *Q1.1.* and *Q1.2.*, and stage 2 that refers to *Q2.1.* and *Q2.2.*), a particular phrase ('sustainable development in sport' / 'sustainability in sport') and the interface between particular terms ('sustainable development' / 'sustainability' and 'sport\*') were searched for respectively in the titles of the publications, their abstracts and keywords.

At the first stage, the data was retrieved both from Scopus and WoS separately, and later added together and compared. When a publication was registered in both databases, the duplicate was removed. In turn, at the second stage, the bibliometric data was retrieved only from Scopus. The main reasons for choosing Scopus were as follows: (i) in comparison to WoS, Scopus provided richer output (with the use of similar search criteria); (ii) the data retrieved from WoS duplicated Scopus output to a relatively large extent; (iii) files with the data retrieved from both databases could not be combined in a single input file for VOSviewer which was used to conduct the keywords co-occurrence analysis. The high-frequency keywords co-occurrence analysis is an example of co-word analysis (Guo et al., 2017) and was used at the second stage of the research procedure to analyze the research status and identify leading topics within the research field.

At both stages of the research procedure publications irrelevant to the topic under study were deleted before the analysis. The eligibility assessment was done by reading the titles, keywords, and abstracts of the retrieved publications. The document was considered ineligible if SD (or sustainability) and sport were not the primary focus of the document – they were only mentioned in general terms, in the background of the prime discourse. Additionally, the publication was excluded if its title did not indicate high relevance to the topic, and at the same time there was no abstract or full version of the publication to evaluate it.

At both stages bibliometric data referring to subsequent research questions was retrieved as concurrently as possible (between August 2020 and September 2020), so as to ensure that the obtained results could be, as far as possible, compared since they related to the same time period. For comparison purposes, the search was restricted by language (to publications written only in English), but not by the time of the publication (all years up to the date of search, excluding publications with 2021 as an anticipated year of publication), and not by the type of documents (excluding only irrelevant ones, such as editorial materials, letters, conference reviews, short surveys, notes, errata, meeting abstracts, etc.). The language restriction supported the use of VOSviewer, as the natural language processing algorithms provided by the program do not support other languages (Van Eck & Waltman, 2020).

In the next section the details of the employed procedure are purposely left in order to ensure its transparency as well as enable its replication by other researchers in their future studies.

## Results

*'Sustainable development in sport' and 'sustainability in sport' as a research field (Q1.1. and Q1.2.)*

First, a report was generated from Scopus and WoS bases for the term 'sustainable development in sport' proposed by Lis and Tomanek (2020). The following search criteria were used: [TITLE-ABS-KEY("sustainable development in sport")] for Scopus, and [TI=("sustainable development in sport") OR AB=("sustainable development in sport") OR AK=("sustainable development in sport")] for WoS. In total (as of September 16, 2020), only two publications were retrieved (one more, which was repeated in both databases was written in Spanish). Among those two, one is a book chapter from 2016 (Edizel & Ward, 2016) on large-scale sports events, which are – on one hand – an attractive tool for cities in the context of their urban development and renewal, but on the other hand, they are a source of public concerns about their rising costs and their impact on environmental issues. The term 'sustainable development in sport' appears there when referring to the crucial role of the International Olympic Committee in "promoting sustainable development in sport", defined in the Olympic Charter (1996). The second publication is the above-mentioned article by Lis and Tomanek issued in 2020, where the search string is used literally as the above-mentioned 'umbrella label' for one of the thematic clusters indicated in the area of sport management research. The third one (Valle et al., 2011), which theoretically should be excluded from the analysis as written in Spanish, comes from 2011 and focuses on the environmental impact of sport activities undertaken in nature and provides sustainable guidelines for their realization. The search string is used here in the context of "sustainable development in sport events". It is the document, which out of these three has the highest number of citations (10) to the date. Interestingly, it is followed by Lis and Tomanek's publication, which received all its first citations (4) in the last days of August 2020.

This relatively small number of citations may be partly explained by the comparative recency of the mentioned publications. On the other hand, even just a general overview of the references provided in them is enough to notice that in fact the coexistence of the terms 'sport' and 'sustainable development' in the scientific

literature is significantly more prevalent than in 2011, when the article written in Spanish was published. It allows us to expect that although the search string ‘sustainable development in sport’ has not yet appeared word-for-word very often in the scientific discourse, the scientific literature where the term ‘sport’ appears in conjunction with ‘sustainable development’ is much more abundant than presented here. Moreover, the results of the bibliometric analysis presented in the second part of this section confirm such a supposition.

Interestingly, analogous procedure conducted for a related phrase ‘sustainability in sport’ resulted in a richer list of publications. In total, 16 publications were retrieved (as of September 16, 2020). There were no publications written in a language other than English. In Scopus [TITLE-ABS-KEY("sustainability in sport")] 13 publications meeting the eligibility criteria were found, of which 12 were articles and 1 a book chapter. They are distributed over 9 subject areas, as defined by Scopus, mainly under: Business, Management and Accounting (7 publications), Social Sciences (6), Energy (5) or Environmental Science (5) (subject area categorization is not exclusive, which means that a document may belong to a single area or to several areas simultaneously). In WoS [TI="sustainability in sport" OR AB="sustainability in sport" OR AK="sustainability in sport"] 8 publications were found, but only one of them was not a duplicate of Scopus outputs.

None of the publications retrieved from either Scopus and WoS was a duplicate of those found in the previous search for the phrase ‘sustainable development in sport’. The retrieved documents (in total from two databases) come from the period 2008-2020, with the majority issued between 2016 and 2020 (11; 78.6%). This is a period with the greatest growth in scientific production in the field so far, after the 2011-2015 period when no publication with the analyzed phrase in title, keywords or abstract was indexed in either of the analyzed databases. The retrieved publications discuss the concept of ‘sustainability in sport’ in very different contexts. Among them is, for example, an article where the term ‘sustainability in sport’ is used when describing “social sustainability in sport at the individual level” in context of bullying and harassment in sport (Vveinhardt et al., 2019). Another article discusses determinant attributes that enable “financial sustainability in sport non-governmental organizations” (Córdova Paredes et al., 2019), and yet another one describes the development, testing, and validation of a survey instrument designed to enhance “sustainability in the sports industry” (Lavallee et al., 2020). All the publications received in total 140 citations, of which almost 92.9% (130) are generated by 5 publications (cf. Table 1).

**Table 1.** Most cited papers with the term ‘sustainability in sport’ in title, abstract or keywords

Title and authors	Source	Cited by
State-of-the-art Green HRM System: Sustainability in the sports center in Malaysia using a multi-methods approach and opportunities for future research (Gholami et al., 2016)	Journal of Cleaner Production	41
Environmental sustainability in sport facility management: A Delphi study (Mallen et al., 2010)	European Sport Management Quarterly	27
Challenges and strategies of building and sustaining inter-organizational partnerships in sport for development and peace (Welty Peachey et al., 2018)	Sport Management Review	24
Conceptualising sustainability in sports development (Lindsey, 2008)	Leisure Studies	22
The green waves of environmental sustainability in sport (McCullough et al., 2016)	Sport in Society	16

Source: Prepared by the author based on Scopus and WoS data (September 16, 2020).

The most cited article (Gholami et al., 2016) focuses on social issues – it discusses how to develop the ability, motivation and opportunity of human resources to embed “sustainability in sports centers” through the alignment of Green HRM Practices. The second article (Mallen et al., 2010) discusses “environmental sustainability in sport facilities”, including best practices, challenges, trends and competencies in the sport facility management industry, as well as the guidelines for sport management education. The third article (Welty Peachey et al., 2018) discusses challenges faced by sport for development and peace (SDP) organizations when forming and sustaining inter-organizational partnerships, as well as strategies employed to overcome these challenges. The search string appears here in the context of “sustainability in sport for development and peace”. In the fourth article (Lindsey, 2008) the emphasis is put on the theoretical fundamentals of “sustainability in sports development”, and more specifically – sports development programmes, with proposed frameworks that can be used to examine and understand it in this context. The fifth article (McCullough et al., 2016) concerns environmental sustainability efforts made by organizations within the sport industry. The searched term is inscribed there within “environmental sustainability in sport”.

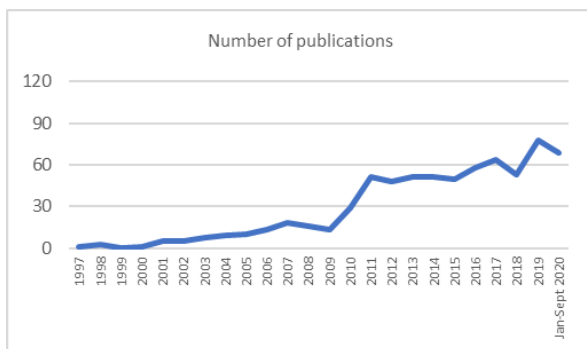
*Relationship between ‘sustainable development’, ‘sustainability’ and ‘sport’ in existing literature (Q2.1. and Q2.2.)*

A relatively small number of publications found to this day for the two above-described terms ‘sustainable development in sport’ and ‘sustainability in sport’ could imply their novelty in scientific research. Considering the purpose of this article, one more bibliometric analysis was conducted in order to verify the extent to which

this kind of statement is legitimate. Unlike the previous analysis, in this stage the search was not restricted by such strict wording of the search phrases. Instead, the interface between the very generic terms ‘sustainable development’, ‘sustainability’ and ‘sport’ was searched for.

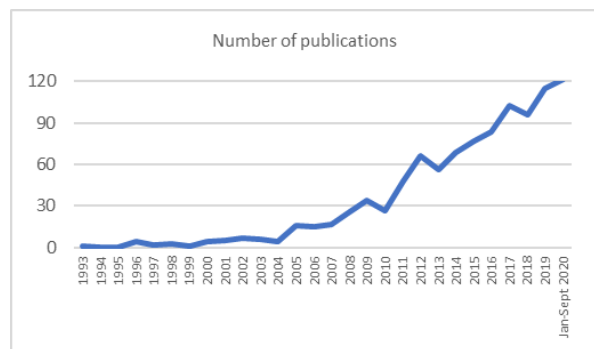
The Scopus database was used first. In the initial phase, 774 publications were found where the pair of terms ‘sustainable development’ and ‘sport\*’ appears in titles, abstracts or keywords [TITLE-ABS-KEY("sustainable development") AND TITLE-ABS-KEY("sport\*")]. After excluding irrelevant types of documents and also publications written in languages other than English, 704 publications were left (as of September 16, 2020). The oldest (relevant) output comes from 1997 (Bramwell, 1997). This article discusses the effects of the sport mega-event (the 1991 World Student Games) within a SD perspective. The majority of retrieved publications was issued between 2010-2020 (602; 85.5%). 2019 is the year with the highest number of publications so far (cf. Figure 1). Nevertheless, 2020 is not over, which stipulates that the number of publications for this year will exceed the results from 2019. Articles (48%) and conference papers (41.8%) are the two dominant types of retrieved outputs. All the publications in the research sample are distributed over 22 subject areas, as defined by Scopus. The majority of them are categorized under: Engineering (32.9%), Environmental Science (28.6%), Social Sciences (24.4%), Business, Management and Accounting (16.2%).

Even more plentiful scientific output was found in Scopus for the pair of terms ‘sustainability’ and ‘sport\*’ [TITLE-ABS-KEY("sustainability") AND TITLE-ABS-KEY("sport\*")]. After similar exclusion as above-described, 1008 publications were left. The oldest relevant publication comes from 1993 (Galvani, 1993). The article discusses the limits for further growth which were established by the public governing bodies of Cortina d’Ampezzo (one of the most important mountain resorts in Italy, famous for its winter sports opportunities) for the protection of their mountain environment. All the publications in the research sample are distributed over 26 subject areas. The majority of them are categorized under: Social Sciences (36.1%), Business, Management and Accounting (25.4%), Environmental Science (23.3%), Engineering (14.8%) and Medicine (14.6%). The articles (73.9%) and conferences papers (10.9%) are two dominant types of documents retrieved. The majority of retrieved publications was issued between 2010-2020 (863; 85.6%). 2020 is the year with the highest number of publications so far (122), even though it is not over yet and the COVID-19 pandemic is still ongoing, causing possible postponement of research and publishing processes (cf. Figure 2).



**Figure 1.** Scientific productivity ('sustainable development' and 'sport\*')

Source: Own study based on data retrieved from Scopus (September 16, 2020).



**Figure 2.** Scientific productivity ('sustainability' and 'sport\*')

As demonstrated, the two above-discussed search strings deliver different output (in terms of the number of publications, annual production and distribution under specific subject areas). Nevertheless, it is important to note that the search criteria were limited only to the titles, abstracts or keywords of the publications. Additionally, many authors employ simultaneously these two terms ('sustainable development' and 'sustainability') in the same publication, which means that the higher frequency of the intersection between 'sport\*' and 'sustainability' in titles, abstracts or keywords does not exclude the intersection of the terms 'sport\*' and 'sustainable development\*' in the main body of the same publications.

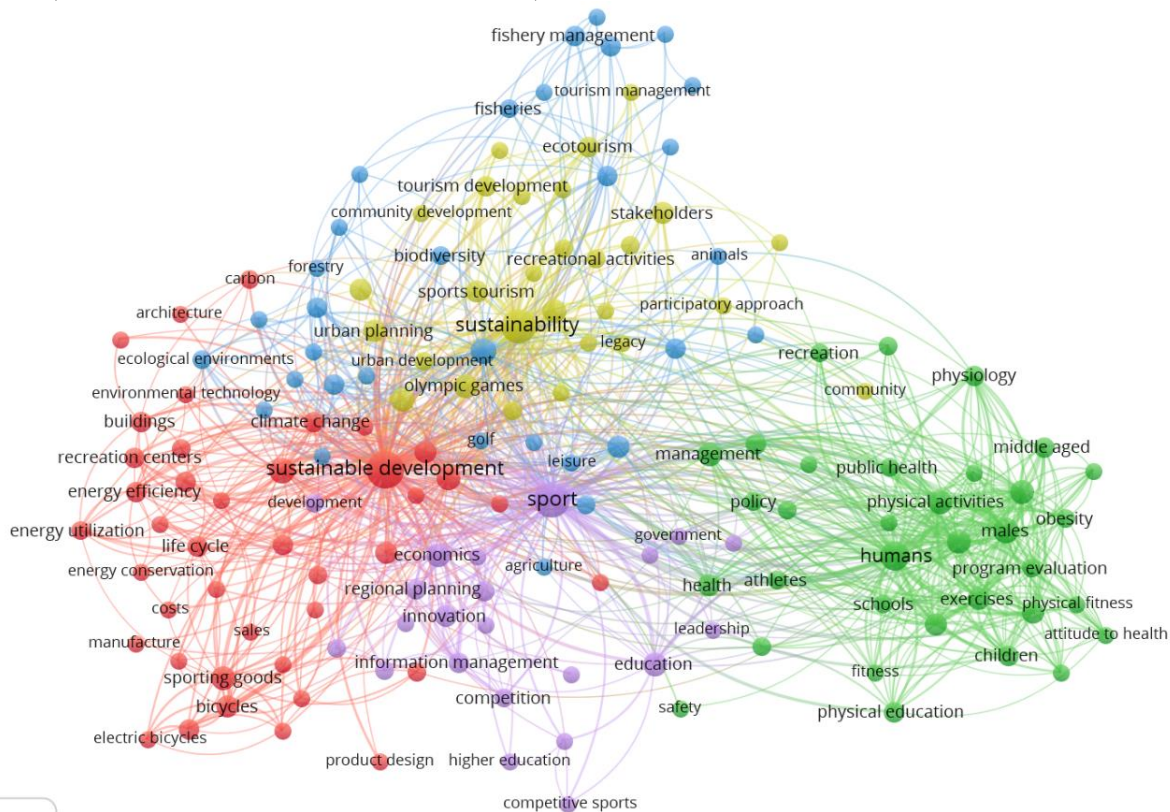
Taking it into account, it seemed justified to compare the two above-mentioned reports retrieved from Scopus (704+1008=1712). After comparing them and excluding duplicates, there were in total 1513 publications where the term 'sustainable development' or 'sustainability' in conjunction with the term 'sport\*' is used in title, abstract or keywords. In this respect it is worth mentioning that only in 196 of these publications the terms 'sustainable development' and 'sustainability' do not appear together in the mentioned parts of the retrieved documents which confirms their frequent coexistence in the literature on the studied field. Similar output (after removing ineligible publications) was received when all three terms were applied in one search query [TITLE-ABS-KEY ("sustainability" OR "sustainable development") AND TITLE-ABS-KEY ("sport\*")]. Logically, the publications retrieved in the first stage of research procedure for two investigated phrases were a subset of that last search output.

For comparison, the application of similar search criteria in WoS database for the term 'sustainable development' resulted in 398 relevant scientific outputs [TI=("sustainable development" AND "sport\*") OR AB=("sustainable development" AND "sport\*") OR AK=("sustainable development " AND "sport\*")]. A similar



search query defined for the term ‘sustainability’ resulted in 537 scientific outputs [TI=("sustainability" AND "sport\*") OR AB=("sustainability" AND "sport\*") OR AK=("sustainability" AND "sport\*")]. After comparing and excluding duplicates, there were in total 899 publications where the term ‘sustainable development’ or ‘sustainability’ in conjunction with the term ‘sport\*’ is used in title, abstract or keywords. As can be noticed, WoS provided fewer documents for analysis, compared to Scopus outputs. Similar to Scopus data, most of the publications were issued between 2010-2020 (739; 82.2%), and 2019 is the year with the highest number of publications so far (115). The publications are classified under 124 WoS categories. Among them, the most represented are: Hospitality Leisure Sport Tourism (23.5%), Environmental Sciences (14.5%), Education & Educational Research (14.2%), Sport Sciences (13.2%), Management (11.3%), Environmental Studies (11.2%), Green Sustainable Science Technology (10.3%). Not unlike the Scopus outputs, articles (58.4%) and conference papers (38.3%) are two dominant types of retrieved documents.

As mentioned in Material & methods section, the second stage of analysis was conducted only on the basis of data obtained from Scopus. That section also presented the main reasons that supported such a decision. Scopus data was an input for the keywords co-occurrence analysis conducted with the use of VOSviewer. The unit of analysis was ‘all keywords’, which includes both ‘author keywords’ and ‘index keywords’. Before the analysis was performed, the terms with fewer than 10 occurrences were excluded (by default). Additionally, a number of general terms with a low relevance to the topic (e.g. ‘article’, ‘comparative study’, ‘interview’, ‘literature review’, ‘study’, ‘methodology’, ‘questionnaire’, etc.) were eliminated manually with the use of a purposely created thesaurus file. The thesaurus file was also used to homogenize some terms. It included, among others, unified grammatical forms for the keywords written in plural and singular (e.g. child – children, adult – adults); it also merged different variants of a term (e.g. sport events, sports events, sport event), synonyms (e.g. Olympic Games and Olympics) or abbreviated terms with full terms. After data cleaning, there were in total 9357 keywords indicated in the research sample, including 7167 terms with only one occurrence. The number of 10 occurrences was achieved by 157 keywords. Among them, the terms with the greatest total link strength (regarded as the weight attribute of the item) are: sustainable development (total link strength 1800), sport (1691), sustainability (971), and humans (960). They are also the keywords with the highest number of occurrences. On the map created in VOSviewer (cf. Figure 3) they are shown more prominently than items with a lower weight. The sizes of the circles assigned to them are larger than for the circles of other terms which means that these keywords appear in more publications than other terms. As an item (in this case – a keyword) with a higher weight is regarded as more important than an item with a lower weight, these terms can be also considered the most important in the created co-occurrence network and as leading thematic areas in the research field (Guo et al., 2017; Van Eck & Waltman, 2020).



**Figure 3.** Co-occurrence network of keywords in the research field (VOSviewer parameters used for analysis and visualization: min. cluster size=5, min. strength=1)

Source: Own study based on data retrieved from Scopus (16 September 2020).

As seen in Figure 3, those four keywords consequently also play the predominant role in thematic clusters created by VOSviewer. Three of them take more central position on the map, and the fourth (green one – cluster no. 2) is relatively far away from them. The distance between the items as well as the thickness of the links provide important information as they indicate the level of the relatedness between the items. The closer two keywords are located to each other and the thicker the lines between them, the more frequent co-occurrence (the number of documents in which they appear together) (Garrigos-Simon et al., 2018; Van Eck & Waltman, 2020).

By assuming the minimum 5-item cluster size, the VOSviewer designated one more (blue) cluster, with the term ‘environmental protection’ to come to the fore. It is worth noting, however, that this keyword has a significantly lower number of occurrences than the central keywords in the other four thematic clusters. Also the terms that belong to this cluster are relatively less concentrated. On the other hand, many of them are on the map in relative proximity of other four clusters (especially two of them – no. 1 and no. 4) which suggests their relative closeness to each other, i.e. the coexistence with the keywords from other clusters in the same publications.

In the vicinity of five above-mentioned high-frequency keywords there are also many other terms (topics) that receive a lot of researchers’ attention. The main among these terms (with a minimum of 20 occurrences) qualified to each thematic cluster are presented in Table 2.

**Table 2.** Key topic areas in each of thematic cluster

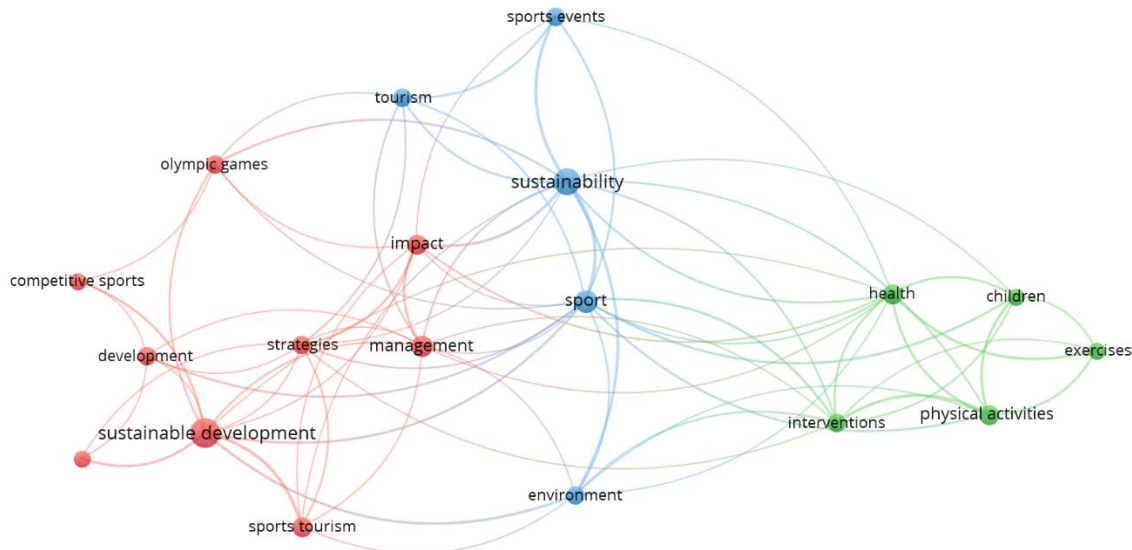
<b>Thematic cluster with central keyword</b>	<b>Main keywords (number of occurrences)</b>
Cluster no. 1 (red) <b>Sustainable development</b> (in total: 41 keywords)	sustainable development (501), planning (89), environmental impact (50), sporting goods (47), environmental sustainability (42), bicycles (41), decision making (36), climate change (31), energy efficiency (30), stadiums (28), life cycle (24), recreation centers (24), electric vehicles (22), economic and social effects (22), buildings (22), energy utilization (20)
Cluster no. 2 (green) <b>Humans</b> (in total: 34 keywords)	humans (156), males (68), adults (63), physical activities (59), females (57), management (47), exercise (44), health promotion (40), health (38), adolescent (33), children (29), physical education (29), quality of life (27), physiology (25), middle aged (22)
Cluster no. 3 (blue) <b>Environmental protection</b> (in total: 32 keywords)	environmental protection (76), environment (43), ecology (32), conservation (27), environmental management (25), fishery management (25), sports fishing (24), conservation of natural resources (23)
Cluster no. 4 (yellow) <b>Sustainability</b> (in total: 28 keywords)	sustainability (328), Olympics Games (54), tourism (49), sports events (47), stakeholders (37), sports tourism (36), urban planning (35), sports facilities (34), tourism development (31), ecotourism (25), recreational activities (20)
Cluster no. 5 (purple) <b>Sport</b> (in total: 22 keywords)	sport (424), economics (56), education (56), innovation (33), information management (31), marketing (23), regional planning (22), competition (20), sports industry (20)

Source: Own study based on data retrieved from Scopus and analyzed with VOSviewer (16 September 2020).

For comparison, in WoS output, after analogical data cleaning, there were significantly fewer keywords indicated (2035). Among them, 1713 keywords occurred only once in the retrieved data. The number of 10 occurrences was achieved only by 19 keywords. Logically, a network created both for occurrences and total link strength has a much lower number of keywords (cf. Figure 4).

In such a network, the keywords with the greatest total link strength are: sustainability (47), sport (42), sustainable development (33). They are also the keywords with the highest number of occurrences: sustainable development (72), sustainability (53), sport (33). Nevertheless, these values are significantly lower than those obtained with Scopus output. In consequence, the predominance (and thus importance) of these three keywords among others is not so evident on the map; the individual terms are rather distant; there are less co-occurrence links between them and these links (represented by lines) are thin. This indicates relatively low degree of relatedness among them.

Comparing with Scopus outputs, there are also fewer thematic clusters (three), and they are created by smaller number of items with lower link numbers and their strength. Among these three, two clusters seem to be relatively similar to those extracted with Scopus outputs – the terms which they contain are grouped around ‘sustainable development’ (red cluster) and the aspects related to ‘the humans’ (green cluster). Nevertheless, there are also major differences. For example, the most numerous cluster (red) includes only 9 items, among which only two terms exceed the threshold of 20 occurrences, and the blue cluster includes two keywords (‘sustainability’ and ‘sport’) which in case of Scopus results were located in two separate thematic areas.



**Figure 4.** Co-occurrence network of keywords in the research field (VOSviewer parameters used for analysis and visualization: min. cluster size=5, min. strength=1)

Source: Own study based on data retrieved from WoS (16 September 2020).

## Discussion

Together with the growing concern about SD among practitioners, there is also a significant increase of scientific production (especially in the last 10 years) and a growing variety of thematic topics that appear in the intersections between the terms ‘sustainable development’ (or ‘sustainability’) and ‘sport’. As all these terms are generic and transversal, their intersection is discussed in the literature from many different perspectives and different levels of generalization. Additionally, there is a great number of terms that appear within the analyzed intersection (cf. Table 2), and also a multitude of different combinations in which these three general concepts are combined in the scientific discourse.

The phrase ‘sustainable development in sport’ (and also ‘sustainability in sport’), which is the main focus of this article seems to be only one of many possible grammatical constructions that are used when combining the discussed terms. Additionally, there is not only one single context in which these two investigated phrases are employed by authors. There either is not one-single perspective (positive/negative) from which the relation between SD, sustainability and sport is presented with the use of these phrases. Both phrases have not yet been widely applied in the scientific literature, which may suggest that they are still at the beginning of their development in terms of scientific production. On the other hand, as demonstrated in the article, there is already a relatively ample literature where the terms ‘sustainable development’ (or ‘sustainability’) and ‘sport’ appear together in many other similar configurations. It indicates that even if the investigated phrases have not been present in many publications so far, in actual fact they could have already been in use by numerous authors for many years. In consequence, it seems reasonable to state that their relative recentness in scientific literature is equal to the recentness of many other textual entities where the terms ‘sustainable development’ (or ‘sustainability’) and ‘sport’ are used together. In other words, the investigated phrases can be considered a new research field as long as the combination of ‘sustainable development’ (or ‘sustainability’) with sport issues is still considered a novelty in the literature. Simultaneously, it does not exclude the possibility to consider ‘sustainable development in sport’ and also ‘sustainability in sport’ as emerging fields in the future in other or more specific narrow thematic areas relating to some particular components of these generic constructs, as is the case with Lis and Tomanek’s study (2020).

A relatively high fragmentation of the research area and the existence of many similar phrases may lead to difficulties in distinguishing ‘sustainable development in sport’ (and also ‘sustainability in sport’) from others, e.g. ‘sport for sustainable development’ or ‘sport for sustainability’, even if they may result in a different direction of studies and publications. It means that should one attempt to use these terms as distinctly different from many others existing in the literature, their more precise operationalization is needed. So far, any unambiguous definitions of these terms, allowing them to be treated as separate concepts, have not been proposed.

In addition to the main subject of the paper, interesting conclusions can be drawn from the use of Scopus and WoS databases for bibliometric analysis. As demonstrated in Results section, the application of search strings resulted in a different output, hence the conclusions drawn on their bases vary to a greater or lesser extent. The content of one database does not fully duplicate the content of the other database; the way of constructing query strings and the available analysis criteria are not fully equivalent. Moreover, the output files cannot easily be used together by VOSviewer in one go. As a result, although the analysis of the publications



indexed in Scopus and WoS leads to the similar general conclusions about the structure of the research field, the dissimilarities in the detailed conclusions are noticeable (cf. Figure 3 and Figure 4).

Taking into account the multitude of thematic and grammatical configurations in which the terms analyzed in this article may be used together and the above-mentioned problems resulting from the use of two partially incompatible databases, it is not surprising that the bibliometric analysis of the discussed research field is complex and time-consuming. On the other hand, only a very detailed and in-depth analysis may allow for a reliable assessment of the scientific productivity in this field. The article presents only a general picture of the studied issues, leaving more complex in-depth analytical work, including systematic literature review, for further research. Also other limitations of the above-presented results should be mentioned. First, it is important to underline that the data retrieved from Scopus and WoS do not include all the publications in the field of the study. Additionally, for comparison purposes, the search was restricted by language (only publications written in English were analyzed) and the search string was limited only to the titles of publications, their abstracts and keywords.

As the field of study has great potential for continued growth, it can be expected that the results presented in this article will shortly need to be updated, providing more answers on the changes in the scientific productivity and thematic structure of this research field. With the purpose of enabling other authors to replicate the conducted analysis in the future, the details of research procedure applied by the author were intentionally left in the article.

### Conclusions

There is a relatively rich literature where the terms ‘sustainable development’ (or ‘sustainability’) and ‘sport’ appear together. Particularly, for the last 10 years scientific production in this research area has been growing significantly. Taking into account the relative recency of the field, insufficient time has elapsed for the consolidation of the thematic areas and for proposing an unambiguous interpretation for the many terms and phrases used in research and publications on this topic. In consequence, it seems to be too early to conclude whether some of these terms such as ‘sustainable development in sport’ (which was analyzed in this article) are isolated, specific or emerging. To achieve that conclusion, the terms would need to be precisely defined and then consistently used by authors.

**Conflict of Interest** – The author declares that there is no conflict of interest.

### Acknowledgment

The article was prepared within the project entitled “Positive social change in an organization as a factor of a company engagement in sustainable development” funded by the National Science Centre, Poland, on the decision number DEC-2017/25/B/HS4/01113.

### References

- Alhaddi, H. (2015). Triple Bottom Line and Sustainability: A Literature Review. *Business and Management Studies*, 1(2), 6-10.
- Bramwell, B. (1997). A sport mega-event as a sustainable tourism development strategy. *Tourism Recreation Research*, 22(2), 13-19.
- Caradonna, J. L. (2014). *Sustainability: A history*. Oxford: Oxford University Press.
- Córdova Paredes, M.J., Calabuig Moreno, F., & Dos Santos, M.A. (2019). Key determinants on non-governmental organization's financial sustainability: A case study that examines 2018 FIFA foundation social festival selected participants. *Sustainability*, 11(5), 1-19.
- Edizel, O., & Ward, R. (2016). Sustainability and mega-event legacy In Viehoff V., & Poynter G. *Mega-event Cities: Urban Legacies of Global Sports Events*. New York: Routledge.
- Galvani, A. (1993). Mountain tourism in Cortina d'Ampezzo sustainability and saturation. *Tourism Recreation Research*, 18(1), 27-32.
- Garrigos-Simon, F.J., Narangajavana-Kaosiri, Y., & Lengua-Lengua, I. (2018). Tourism and Sustainability: A Bibliometric and Visualization Analysis. *Sustainability*, 10(6), 1-23.
- Gholami, H., Rezaei, G., Saman, M.Z.M., Sharif, S., & Zakuan, N. (2016). State-of-the-art Green HRM System: Sustainability in the sports center in Malaysia using a multi-methods approach and opportunities for future research. *Journal of Cleaner Production*, 124, 142-163.
- González-Serrano, M. H., Añó Sanz, V., & González-García, R. J. (2020). Sustainable Sport Entrepreneurship and Innovation: A Bibliometric Analysis of This Emerging Field of Research. *Sustainability*, 12(12), 1-26.
- Guo, D., Chen, H., Long, R., Lu, H., & Long, Q. (2017). A Co-Word Analysis of Organizational Constraints for Maintaining Sustainability. *Sustainability*, 9(10), 1-19.
- Hopwood, B., Mellor, M., & O'Brien, G. (2005). Sustainable Development: Mapping Different Approaches, *Sustainable Development*, 13, 38-52.
- International Charter of Physical Education, Physical Activity and Sport*. (2015). UNESCO. Available online: <http://www.unesco.org/> (accessed on 24 August 2020).

- Jiménez-García, M., Ruiz-Chico, J., Peña-Sánchez, A.R., & López-Sánchez, J.A. (2020). A Bibliometric Analysis of Sports Tourism and Sustainability (2002–2019). *Sustainability*, 12(7), 1-18.
- Lavallee, D., Lowder, J., & Lowder, J. (2020). Clear Data as a New Data Typology to Enhance Sustainability in Sport. *Sustainability*, 12(11), 1-7.
- Lindsey, I. (2008). Conceptualising sustainability in sports development. *Leisure Studies*, 27(3), 279-294.
- Lis, A., & Tomanek, M. (2020). Sport management: thematic mapping of the research field. *Journal of Physical Education and Sport*, 20(2), 1201-1208.
- López-Bonilla, L., del Carmen Reyes-Rodríguez, M., & López-Bonilla, J. (2020). Golf Tourism and Sustainability: Content Analysis and Directions For Future Research. *Sustainability*, 12(9), 1-18.
- Mallen, C., Adams, L., Stevens, J., & Thompson, L. (2010). Environmental Sustainability in Sport Facility Management: A Delphi Study. *European Sport Management Quarterly*, 10(3), 367-389.
- Masdeu Yelamos, G., Carty, C., & Clardy, A. (2019). Sport: driver of sustainable development, promoter of human rights, and vehicle for health and well-being for all. *Sport, Business and Management*, 9(4), 315-327.
- McCullough, B.P., Pfahl, M.E., & Nguyen, S.N. (2016). The green waves of environmental sustainability in sport. *Sport in Society*, 19(7), 1040-1065.
- Olympic Charter* (1996). International Olympic Committee. Available online: <https://stillmed.olympic.org> (accessed on 31 of August 2020)
- Report of the World Commission on Environment and Development: Our Common Future* (1987). UN. Available online: <http://www.un-documents.net/our-common-future.pdf> (accessed on 23 of August 2020)
- Transforming our World: The 2030 Agenda for Sustainable Development*. (2015). UN. Available online: <http://www.un.org/> (accessed on 31 of August 2020)
- Van Eck, N.J., & Waltman, L. (2020). *VOSviewer Manual. Manual for VOSviewer version 1.6.15*. Leiden: Universiteit Leiden.
- Valle, P.L., Baena-Extremera, A., & Granero-Gallegos, A. (2011). Buenas prácticas para un desarrollo sostenible en los eventos deportivos en el medio natural (Good practices for sustainable development in sport events in a natural environment). *Interciencia*, 36(7), 531-537.
- VOSviewer website*. <https://www.vosviewer.com>
- Vveinhardt, J., Fominiene, V.B., & Andriukaitiene, R. (2019). "Omerta" in organized sport: Bullying and harassment as determinants of threats of social sustainability at the individual level. *Sustainability*, 11(9), 1-31.
- Welty Peachey, J., Cohen, A., Shin, N., & Fusaro, B. (2018). Challenges and strategies of building and sustaining inter-organizational partnerships in sport for development and peace. *Sport Management Review*, 21(2), 160-175.