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Sustainable Tourism Research Progress: A Bibliometric Analysis

Abstract

In recent years, scientific research on sustainable tourism has attracted wide attention, which has fueled the concomitant need to comprehend the current state of research in sustainable tourism. In order to identify the research status of sustainable tourism and explore the direction for future research, this paper presents a comprehensive bibliometric analysis of 2,184 academic literature related to sustainable tourism. By using five bibliometric methods of citation analysis, co-analysis, co-occurrence analysis, burst detection analysis and timeline view analysis, this paper reviews and analyzes the study of sustainable tourism from three perspectives of performance analysis, collaboration networks analysis and keywords analysis. The popular issues in the current study, future research and limitations are also discussed in this paper. By systematically reviewing the academic literature on sustainable tourism, this paper deepens the understanding of relevant topics, and provides a reference for scholars to carry out research on sustainable tourism in the future.

Keywords: sustainable tourism, sustainability, tourism, tourism development, bibliometric review

1. Introduction

With the continuous development of tourism, sustainable tourism research is becoming more and more important (Higgins-Desbiolles, 2018; Xu et al., 2020). At first, sustainable tourism focused on the impact of environmental factors on sustainable development. Subsequently, the comprehensive impact of environmental factors, social factors, and economic factors on sustainable tourism has been gradually concerned (Albrecht, 2014; Coghlan, 2012; Font, 2002). However, Buckley (2012) pointed out that tourism is still "far from sustainable" due to the negative impacts of environmental and social factors such as climate change and community development. Therefore, the concept, effectiveness, and practice of sustainable tourism are still controversial in academic circles (Ruhanen et al., 2015).

In the past 30 years, many scholars have carried out abundant research on the related topics of sustainable tourism (Bramwell, 2015; Ruhanen et al., 2019; Sharpley, 2009). In addition, the *Journal of Sustainable Tourism* began to focus exclusively on issues related to sustainable tourism (Bramwell et al., 2017). At present, sustainable tourism has become an important application of sustainable development ideas in tourism (Bramwell & Lane, 2005), which is considered as the ultimate goal of tourism development policies and practices (Lu & Nepal, 2009; Ruhanen, 2013). But at the same time, due to the rapid growth of published articles on sustainable tourism, there is a concomitant need to review and summarize sustainable tourism literature (Ruhanen et al., 2015).

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Some scholars attempt to comprehend the current state of research in sustainable tourism and deliver recommendations for future research through literature reviews (Ruhanen et al., 2015; Moyle et al., 2021). Although literature reviews have provided an overview of the knowledge accumulated on sustainable tourism, each review tends to concentrate on select aspects or sectors in putting forth recommendations for future research (Marvuglia et al., 2020; Zhou et al., 2018). In order to clarify the past and present development process of sustainable tourism from massive literature data, some scholars have used bibliometrics to analyze the research status and trend of sustainable tourism (Bramwell & Lane, 2012, 2013; Moyle et al., 2021; Niñerola et al., 2019; Ruhanen et al., 2015; Yoopetch & Nimsai, 2019). Table 1 shows some prior reviews of sustainable tourism research. While these studies provide a degree of summary in sustainable tourism research, there is a need to expand further the data scope and analysis content of these studies.

Table 1
Prior reviews of sustainable tourism research

Article	Ruhanen et al. (2015)	Niñerola et al. (2019)	Yoopetch & Nimsai (2019)	Moyle et al. (2021)
Number of data	492	4,647	1,596	839
Date source	Four tourism journals	Scopus	Scopus	Four tourism journals
Timespan	1987-2012	1987-2018	1990-2018	1987-2017
Keywords	sustainable tourism; sustainable development	sustainability; sustainable tourism; ecotourism; tourism management	sustainable tourism development; tourism sustainability; tourism development	tourism; sustainability; sustainable development goals
Software	Excel	VOS Viewer	VOS Viewer	Excel
Analysis contents	theoretical and methodological approaches; subjects and contextual themes; perspectives; approaches	annual trends; citation and H-Index; journals; geographic distribution; keywords	Size, growth trajectory, and global distribution; Influential journals, authors, and documents; intellectual structure; topical foci	theory and practice; implications for practice; future research; sustainable development goals

This paper attempts to investigate and present answers to the following research questions through a bibliometric assessment of the existing research designed to explore the progress and development of sustainable tourism as a field of research.

RQ1: What are the development trends in sustainable tourism research?

RQ2: What are the cooperation relationships of sustainable tourism research?

RQ3: What is the evolution process of sustainable tourism research?

RQ4: What are the future directions of sustainable tourism research?

This study adopts some bibliometrics methods, such as performance analysis, citation analysis, network analysis, and keyword analysis, and sets the following three research objectives to determine: (1) To reveal the development trend of sustainable tourism research and the distribution of publications. (2) To explore the countries/regions, institutions, and authors that contribute the most to sustainable tourism in terms of productivity, influence, and activity. (3) To demonstrate the evolution process of sustainable tourism research, analyzes the changes of the keywords from different perspectives to illustrate the research emphasis in this field. (4) To provide a reference for future research on sustainable tourism, this paper discusses the popular issues, future research, and limitations based on the results of bibliometric analysis.

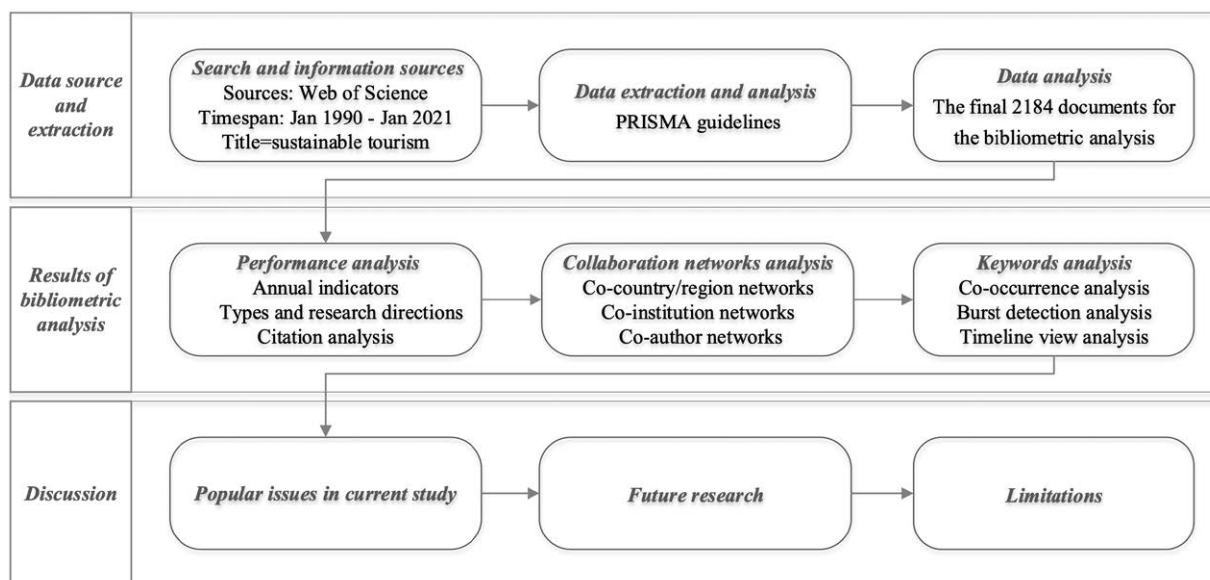
The rest of this paper is organized as follows: Section 2 introduces the information sources of literature analysis and the process of data extraction and analysis. Section 3 presents the results of performance analysis,

collaboration networks analysis, and keywords analysis in sustainable tourism. Section 4 provides some discussions on the popular issues in the current study, future research, and limitations. Section 5 illustrates the conclusions of this paper.

2. Methodology

In order to accurately provide a structured overview of the existing publications related to sustainable tourism, this section introduces how to collect reliable data and the main bibliometric methods and tools for bibliometric analysis. The research framework of the methodology in this paper is shown in Figure 1.

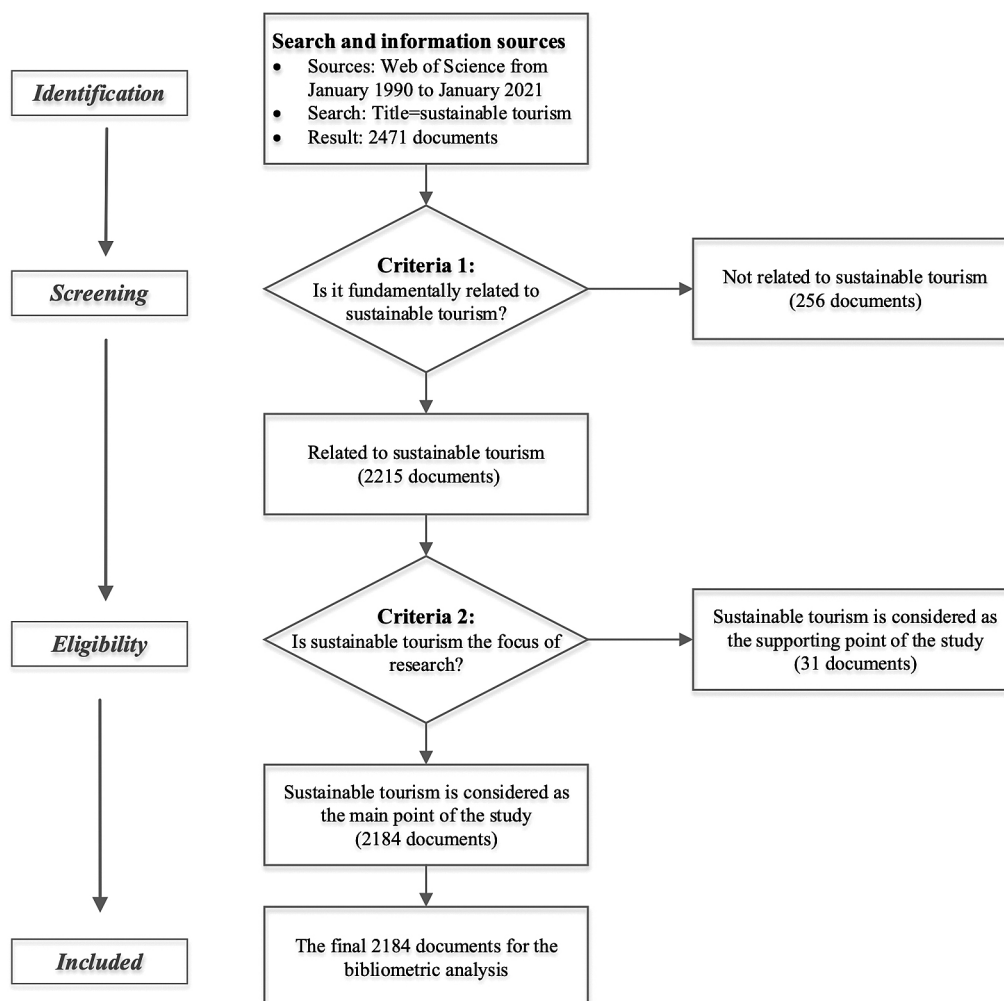
Figure 1
The research framework of the methodology



In this paper, we obtain detailed data for bibliometric analysis from the Web of Science (WoS), which provides multidisciplinary citation data and is one of the most widely used databases for bibliometric analysis (Yu et al., 2017; Zhang & Liang, 2020). The WoS search started with the title (Title = sustainable tourism), spanning from January 1990 to January 2021. We focus on the articles written in English, leaving 2,471 publications in the preliminary collection.

The preliminarily collected papers are then reviewed according to the Preferred Reporting Items for Systematic Reviews guidelines to ensure more accurate results (Moher et al., 2009). First, we eliminate 256 publications that are not related to sustainable tourism. Second, we check whether the article's emphasis is on sustainable tourism, which results in the elimination of 31 publications. Finally, we retain 2,184 publications for subsequent analysis. Figure 2 represents the detailed steps in the identification and screening of data.

Figure 2
The detailed steps in the identification and screening of data



Bibliometrics can evaluate the main characteristics of scientific activities in a field of research by applying statistical methods (Broadus, 1987; Celebi et al., 2020). The bibliometric analysis is mainly focused on two aspects: performance analysis and science mapping analysis (Aria & Cuccurullo, 2017; Wang et al., 2021). Performance analysis refers to using scientifically recognized indicators (such as the number of publications (NP), the number of citations (NC), and the average number of citations (AC)) to evaluate the productivity and the influence of literature (Hirsch, 2005; Li & Xu, 2021). Scientific mapping analysis is a visual analysis of the knowledge structure and development trend of sustainable tourism literature by using bibliometric methods and tools (Atabay & Güzeller, 2021).

This paper uses five bibliometrics methods to present the research status and development trend of sustainable tourism research. (1) Citation analysis: It can measure the similarity of references, sources, or authors by calculating citation frequency to identify the research field (Caputo et al., 2019). (2) Co-authorship analysis: It clearly shows the number of co-authored publications and collaborative relationships between different countries/regions, institutions, or authors (Higaki et al., 2020). (3) Co-occurrence analysis: This shows the number of simultaneous occurrences of two keywords in the publications, which can present the relationship

among keywords (Kamdem et al., 2019). (4) Burst detection analysis: It can combine the number of citations with time periods to reflect the emerging trends of keywords, authors, and references that are concerned by scholars (Zhou et al., 2019). (5) Timeline analysis: It can intuitively show the dynamic development trend of keywords in different time periods so as to reveal hot topics and research directions in a certain field (Yin et al., 2020).

In this paper, two bibliometric visual analysis tools, CiteSpace and Vos Viewer, are used to visualize and analyze the structure and trend of sustainable tourism literature. CiteSpace is a visual analysis software designed by Chen and has been widely used to analyze potential knowledge contained in the scientific literature (Chen, 2004). With the continuous development of CiteSpace, it can not only provide knowledge clustering and distribution for mining citation spaces but also provide co-occurrence analysis capabilities between different countries/regions, institutions and authors (Wang & Lu, 2020). VOS Viewer is a software tool for constructing and visualizing bibliometric networks (van Eck & Waltman, 2010), where VOS stands for visualization of similarities (Donthu et al., 2020). It can not only construct networks based on citations, bibliographic coupling, co-citation, or co-authorship relations but also construct co-occurrence networks based on important terms extracted from the scientific literature.

3. The results of the bibliometric analysis on sustainable tourism

This section will use the data and bibliometric methods described in Section 2 to present the results of the comprehensive bibliometric analysis in sustainable tourism research. The results show the development and characteristics of sustainable tourism research from three aspects: performance analysis, collaboration networks analysis, and keywords analysis.

3.1. Performance analysis of sustainable tourism publications

Performance analysis analyzes the development and distribution of publications in the field of sustainable tourism from three aspects: annual indicators of publications, research directions of publications, and citation analysis of publications.

3.1.1. Annual indicators of publications

Figure 3
The number of sustainable tourism publications and citations from 1990 to 2020

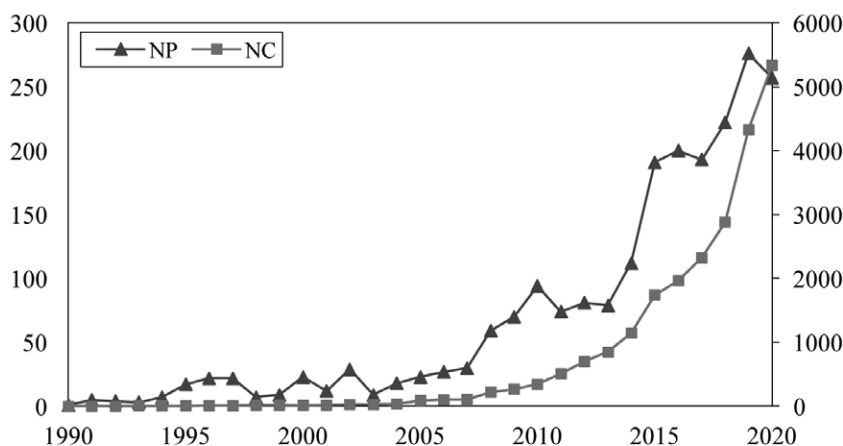


Figure 3 shows the number of sustainable tourism publications and citations from 1990 to 2020. The first document was published in the *Annals of Tourism Research* in 1990. Since 1990, scholars have gradually begun to conduct research on sustainable tourism, but the research has been in a sluggish state. Until 2008, NP began to grow substantially, and NP reached their maximum in 2019 (276 publications). The possible reason for this is that with the increasing attention of the tourism industry to sustainable development, research related to this topic has received a great deal of attention from scholars. At the same time, NC in sustainable tourism research from 1990 to 2020 is also shown in Figure 3. It can be seen that NC showed an upward trend around 2008. The reasons for this trend are two aspects: on the one hand, NP in sustainable tourism research is increasing, and on the other hand, publications in recent years may have more academic contributions.

3.1.2. Research directions of publications

Figure 4

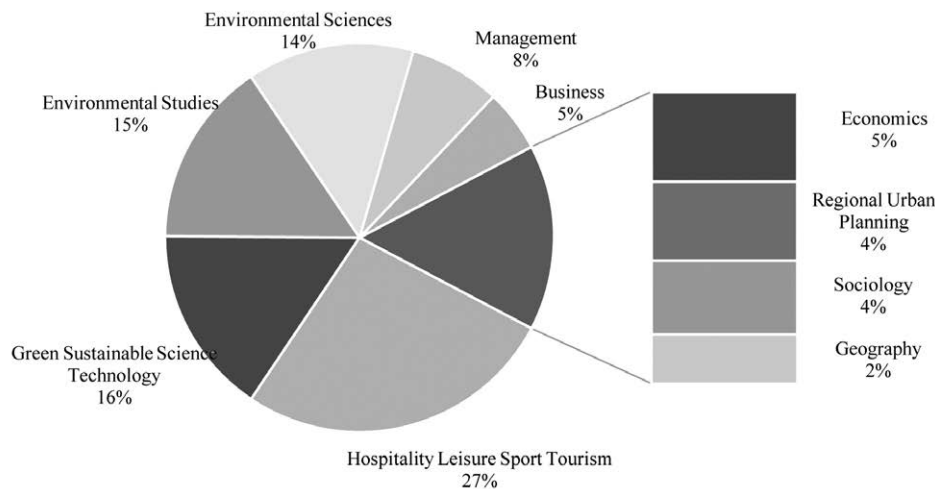


Figure 4 represents the top 10 research directions of publications in sustainable tourism research. It can be seen that the four research categories with the largest number of publications on sustainable tourism are hospitality, leisure sport tourism (27%), green sustainable science technology (16%), environmental studies (15%), and environmental sciences (14%). Compared with other categories, the four research categories have a clear advantage in proportion. The other six research categories are management (8%), business (5%), economics (5%), regional urban planning (4%), sociology (4%) and geography (2%). These indicate that sustainable tourism research has been involved in a wide range of tourism, computer science, environment, management, and business.

3.1.3. Citation analysis of publications

The number of citations can measure the quality and academic impact of publications. Citation analysis is used to compare the most influential journals, countries/regions, institutions, and authors of sustainable tourism publications. Table 2 lists the NC, NP, and AC for the top 10 highly cited journals of sustainable tourism publications. Most of these ten journals seem to be the most influential journals in the field of tourism. The most cited journal is the *Journal of Sustainable Tourism* (6,266), followed by *Tourism Management* (3,299), *Annals of Tourism Research* (1,772), *Sustainability* (1,109), and *Journal of Cleaner Production* (1,068). The NC of these five journals is more than 1000, which was much higher than the latter five journals. However, in terms of AC, the top 5 journals are *Ecological Indicators* (62.75), *Journal of Environmental Management* (49.33), *Journal of Travel Research* (41.33), *Tourism Management* (41.24), and *Annals of Tourism Research*

(33.43). It is worth noting that although the NP published in *Ecological Indicators* is the least, its academic influence is great. Meanwhile, although the NP published in *Sustainability* is high, these publications have the lowest NC among the ten journals, which indicates to some extent that the academic influence of the journal is not high.

Table 2
The top 10 highly cited journals of sustainable tourism publications

Rank	Journals	NC	NP	AC
1	Journal of Sustainable Tourism	6,266	205	30.57
2	Tourism Management	3,299	80	41.24
3	Annals of Tourism Research	1,772	53	33.43
4	Sustainability	1,109	193	5.75
5	Journal of Cleaner Production	1,068	33	32.36
6	Sustainable Development	308	18	17.11
7	Journal of Environmental Management	296	6	49.33
8	Ecological Indicators	251	4	62.75
9	Current Issues in Tourism	249	23	10.83
10	Journal of Travel Research	248	6	41.33

Table 3 shows the top 10 highly cited Countries/regions/Institutions/Authors of sustainable tourism publications. In terms of countries/regions, Australia has the most cited publications (4,200), followed by England (3,606), the USA (2,584), Canada (1,553), Spain (1,469), and New Zealand (1,246). The NC of the remaining four countries (China, Taiwan, Sweden, and Italy) is below 1,000. Obviously, Australia has made outstanding contributions to sustainable tourism research due to the development of tourism. Considering the top highly cited institutions, Griffith University in Australia ranked first with 1,284 citations, followed by the University of Queensland in Australia with 1,137 citations, and the University of Canterbury in New Zealand with 748 citations. Amongst the top 10 institutions, the top two institutions are from Australia, indicating that Australia is ahead of the rest in sustainable tourism. Except for the University of Oulu in Finland and the University of Johannesburg in South Africa, the countries where the top 10 institutions are located are in line with the influential countries. Considering the top 10 highly cited authors, Hall C Michael from New Zealand is the most influential author about sustainable tourism with 748 citations.

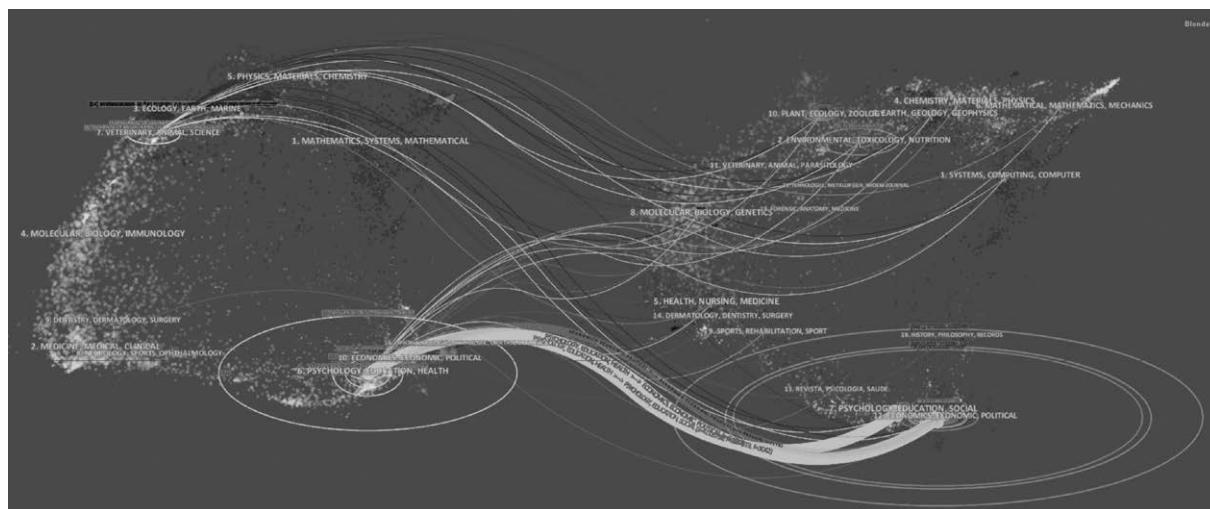
Table 3
The top 10 highly cited countries/regions/institutions/authors of sustainable tourism publications

Rank	Country/Region	NC	Institutions	NC	Authors	NC
1	Australia	4,200	Griffith University	1,284	Hall, C. Michael	748
2	England	3,606	University of Queensland	1,137	Bramwell, Bill	700
3	USA	2,584	University of Canterbury	748	Lane, Bernard	434
4	Canada	1,553	Sheffield Hallam University	650	Ruhanen, Lisa	404
5	Spain	1,469	University of Waterloo	604	Miller, Graham	375
6	New Zealand	1,246	Texas A&M University	501	Lozano-Oyola, Macarena	301
7	China	985	University of Surrey	455	Jamal, Tazim	251
8	Taiwan	906	University of Oulu	441	Javier Blancas, Francisco	240
9	Sweden	862	University of Johannesburg	364	Gonzalez, Mercedes	220
10	Italy	756	Lund University	235	Weaver, David B	216

Table 4 provides the top 10 highly cited publications related to sustainable tourism research, which contain detailed information including source, type, year, NC, AC, the number of authors (AN), the number of institutions (IN), and the number of countries/regions (CN). It can be seen from Table 4 that the top 10 highly total cited publications are all articles, and they are mainly published in three journals (*Journal of*

Sustainable Tourism, Annals of Tourism Research, and Tourism Management). Meanwhile, except for the work of (Miller et al., 2010) and (Choi & Murray, 2010), most of the other publications are studied by a single country/region, institution, and author and do not involve cooperation. This lack of cooperation may be explained by the regional nature of tourism. From the research content, these publications about sustainable tourism research are mainly focused on local food, global sustainable development, policy learning, the paradigm of sustainable tourism, community resident attitudes, tourism products, the governance of tourism, and tourism behaviors.

Figure 5
Dual-map overlay of sustainable tourism research



The dual-map overlay of journals from CiteSpace is a method to display the distribution, citation trajectory, and the center of gravity shift of papers (Chen & Leydesdorff, 2014). Figure 5 illustrates the dual-map overlay of sustainable tourism research. On the dual-map overlay, the left side shows the citing journals, and the right side shows the cited journals. The curves represent the citation links, reporting the context of the citation. Generally speaking, the left side can represent the application fields, and the right side can represent the research foundation. On the left map, the longer the vertical axis of the ellipse, the more papers in the journal. The longer the horizontal axis of the ellipse, the more authors there are. On the right map, the longer the horizontal axis, the more authors are cited; The longer the vertical axis, the higher the number of citations. At the same time, to clearly show the citation relationship between journals on the map, we use the Z-score algorithm to merge the links.

There are three main citation tracks in Figure 5. They are "Psychology, Education, Health" to "Psychology, Education, Social", "Psychology, Education, Health" to "Economics, Economic, Political" and "Economics, Economic, Political" to "Economics, Economic, Political" respectively. What's more, the citing documents mainly focus on the two disciplines of "Psychology, Education, Health" and "Economics, Economic, Political", and the cited documents mainly focus on the disciplines of "Psychology, Education, Social", "Economics, Economic, Political" and "Environmental, Toxicology, Nutrition". At the same time, the applied research on sustainable tourism has shown an interdisciplinary trend. For example, the publications from "Psychology, Education, Health" are connected to many disciplines on the right side, such as "Health Nursing, Medicine", "Molecular, Biology, Genetics", "Mathematical, Mathematics, Mechanics" and "Psychology, Education, Social". This indicates that scholars should actively absorb the theories and ideas of other disciplines to carry out sustainable tourism research.

Table 4**The top 10 highly cited publications related to sustainable tourism research**

Rank	Title	Sources	Type	Year	NC	AC	AC	IN	CN
1	Food, place and authenticity: Local food and the sustainable tourism experience (Sims, 2009)	Journal of Sustainable Tourism	Article	2009	463	35.62	1	1	1
2	Sustainable tourism: Research and reality (Buckley, 2012)	Annals of Tourism Research	Article	2012	405	40.5	1	1	1
3	Sustainable tourism as an adaptive paradigm (Hunter, 1997)	Annals of Tourism Research	Article	1997	366	14.64	1	1	1
4	Policy learning and policy failure in sustainable tourism governance: From first- and second-order to third-order change? (Hall, 2011)	Journal of Sustainable Tourism	Article	2011	365	33.18	1	1	1
5	Influence analysis of community resident support for sustainable tourism development (Lee, 2013)	Tourism Management	Article	2013	321	35.67	1	1	1
6	The development of indicators for sustainable tourism: Results of a Delphi survey of tourism researchers (Miller, 2001)	Tourism Management	Article	2001	303	14.43	1	1	1
7	Governance, the state and sustainable tourism: A political economy approach (Bramwell, 2011)	Journal of Sustainable Tourism	Article	2011	260	23.64	1	1	1
8	Sustainable tourism and the question of the commons (Briassoulis, 2002)	Annals of Tourism Research	Article	2002	228	11.4	1	1	1
9	Public understanding of sustainable tourism (Miller et al., 2010)	Annals of Tourism Research	Article	2010	216	18	5	2	2
10	Resident attitudes toward sustainable community tourism (Choi & Murray, 2010)	Journal of Sustainable Tourism	Article	2010	215	17.92	2	1	1

3.2. Collaboration networks analysis of sustainable tourism research

Collaboration networks can reflect collaborative relationships among interconnected countries/regions, institutions, and authors. This section analyzes three levels of scientific collaboration networks for publications on sustainable tourism from 1990 to 2021, namely, co-author networks, co-institution networks, and co-country/region networks.

3.2.1. The co-country/region networks

In order to analyze the current situation of sustainable tourism cooperation from a macro perspective, we have analyzed the co-country/region networks. We set the minimum number of publications for a country/region to be 10, and 47 out of 117 institutions met the threshold. Table 5 illustrates the top 10 productive and active countries/regions based on the collaboration networks in sustainable tourism. From Table 5, we can easily see that the scholars who have published more publications in this field come from China, the USA, Spain, Australia, and England. The USA cooperated most with other countries, followed by Australia, Spain, England, and Italy in terms of cooperation with other countries.

Table 5**The top 10 productive and active countries/regions in sustainable tourism**

Rank	Countries/Regions	NP	Countries/Regions	NL
1	China	296	USA	40
2	USA	168	Australia	37
3	Spain	161	Spain	32
4	Australia	157	England	31
5	England	140	Italy	26
6	Italy	114	China	25
7	Romania	102	South Africa	25
8	Canada	70	France	25
9	Indonesia	58	Canada	23
10	Malaysia	57	Germany	23

3.2.2. The co-institution networks

In order to deepen the understanding of the research results and the status of cooperation, we have analyzed the co-institution networks of publications in sustainable tourism research. We set the minimum number of publications for an institution to be 10, and 24 out of 103 institutions met the threshold. Table 6 shows the top productive and active institutions in sustainable tourism research. In terms of the NP, Griffith University in Australia ranked first, with 40 publications and 1,284 citations. It is followed by the University of Queensland in Australia, the University of Waterloo in Canada, the Bucharest University of Economic Studies in Romania, and the University of Johannesburg in South Africa. As can be seen from Table 6, the vast majority of the top active ten institutions in sustainable tourism research are also highly productive, but nearly half of the institutions' publications are still unsatisfactory. It can be guessed that the collaboration of different institutions may not contribute much to sustainable tourism research.

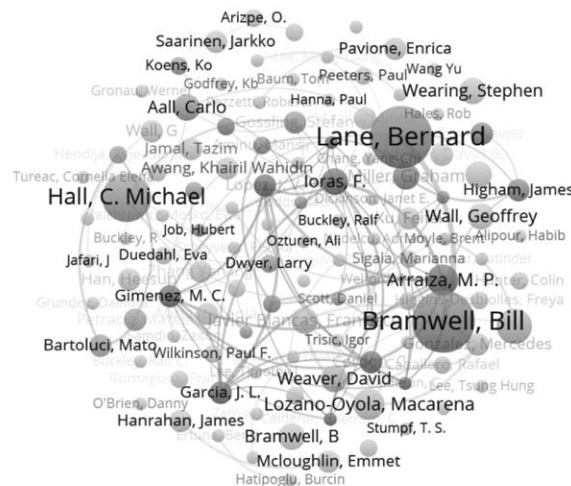
Table 6
The top 11 active and productive institutions in sustainable tourism research

Rank	Institutions	NL	NC	Institutions	NP	NC
1	University of Johannesburg	7	364	Griffith University	40	1,284
2	University of Canterbury	7	748	University of Queensland	27	1,137
3	University of Queensland	6	1,137	University of Waterloo	24	604
4	Griffith University	5	1,284	Bucharest University of Economic Studies	21	55
5	University of Waterloo	5	604	University of Johannesburg	18	364
6	University of Otago	4	155	University of Surrey	18	455
7	University of Oulu	4	441	Sheffield Hallam University	16	650
8	Lund University	4	235	University of Rijeka	15	2
9	University of Surrey	3	455	Tianjin University of Finance & Economics	15	13
10	University of Ljubljana	3	202	University of Otago	14	176
11				The Hong Kong Polytechnic University	14	155

3.2.3. The co-author networks

In order to analyze the current situation of sustainable tourism cooperation from a micro point of view, we analyze the co-author networks. From 2,184 articles, we identified 4,564 authors who contributed to sustainable tourism research. We select 115 authors for the condition that one author accomplished at least three publications. Figure 6 shows the co-author networks among the 115 authors. The nodes represent different authors, and the size of the nodes indicates how many publications there are. The lines represent the cooperative relationship between authors.

Figure 6
The co-author networks of publications in sustainable tourism research



As can be seen from Figure 6, 113 authors are divided into seven different research communities with diverse colors. In terms of co-author relationships, Arraiza M P from The Technical University of Madrid collaborates most with other authors. Meanwhile, through careful observation of the co-authorship networks, it can be found that the last four authors are all from Spain and have all accomplished publications in cooperation with Arraiza M P. What's more, except for Arraiza M P, the ranking results of the other four authors with NP and NC are not ideal. At the same time, in terms of the NP, Lane Bernard and Bramwell Bill from Sheffield Hallam University published the 14 publications articles, ranking first. However, most of the authors who rank high in NP and NC do not collaborate with other authors much. Most highly influential authors are good at writing their papers alone. To some extent, this phenomenon also reflects the regional nature of sustainable tourism research, which may not have high requirements for cooperation.

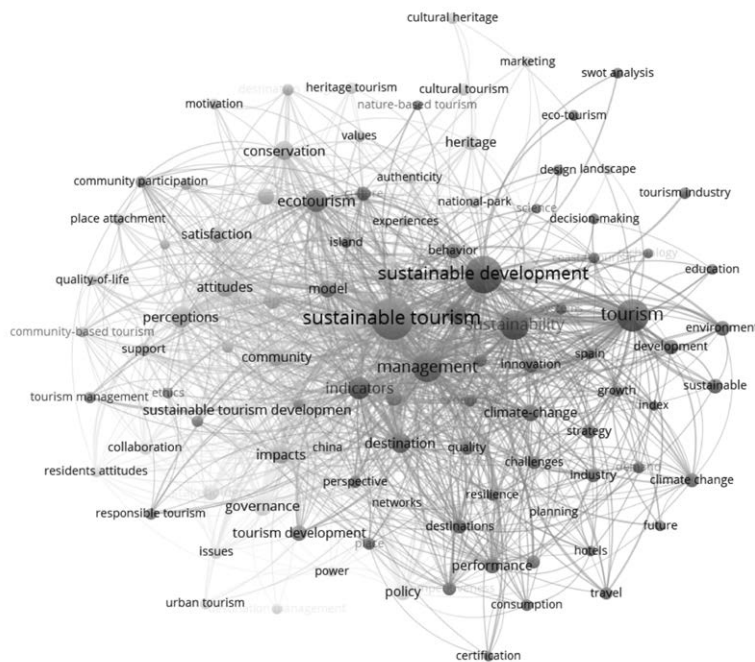
3.3. Keywords analysis of sustainable tourism publications

In this section, co-occurrence analysis, burst detection analysis, and timeline view analysis are carried out according to the keywords of sustainable tourism publications so as to reveal the topics changes further and visualize the interactions between topics.

3.3.1. Co-occurrence analysis

Co-occurrence analysis can reveal the internal correlation and microstructure of sustainable tourism research by describing the association and combination of keywords (Altarturi et al., 2020). Co-occurrence analysis in this paper is carried out by using Vos Viewer based on all keywords, including author keyword and keyword plus. Let the minimum number of occurrences of a keyword be 15, and 103 keywords meet the threshold among total of 5,580 keywords. Figure 7 illustrates the co-occurrence network of keywords concerning sustainable tourism research. In Figure 7, different nodes represent different keywords, and the links between nodes reflect the correlation between keywords. The size of the node represents the frequency of keyword occurrences, which means that the larger the node, the more frequent the keyword occurrences (Shi et al., 2020).

Figure 7
The co-occurrence network of keywords concerning sustainable tourism research



As can be seen from Figure 7, "sustainable tourism" occurs the most frequently, followed by "sustainable development", "tourism", "sustainability", "management" and "rural tourism", which indicate that publications on sustainable tourism emphasize on these keywords. It can also be seen that all the keywords are divided into six categories, which are respectively represented by red, green, dark blue, yellow, purple, and sky blue. From the perspective of co-occurrence frequency, the keywords of Cluster 3 (represented by "sustainable development") and Cluster 5 (represented by "sustainable tourism") attract the most attention from sustainable tourism researchers. The summary of the co-occurrence network reveals the intersecting situation of many research directions in sustainable tourism research.

3.3.2. Burst detection analysis

We use the burst term detection function in CiteSpace to analyze research trends and frontier changes in sustainable tourism (Zhou et al., 2018). The burst of keywords refers to a sudden increase in the number of citations for some keywords in a short period ~~of time~~ (Kenekayoro, 2020). Table 7 presents the result of the burst detection analysis of keywords in sustainable tourism research since 1990. The blue lines in the table show the time interval of one year, and the red lines show the duration of keyword bursts. In terms of burst time, the earliest keywords "Sustainable tourism" and "Eco-tourism", in which "Sustainable tourism" only lasted for one year (2006-2007) while "Eco-tourism" lasted for five years (2006-2011). This shows that sustainable tourism research has begun to attract attention since 2006. With the change of time, the burst keywords in sustainable tourism research changed. In terms of burst strength, the strength of the keyword "Sustainable development" was much higher than that of other keywords, with a value of 16.89. Meanwhile, the duration of this keyword is longer than that of other keywords. From the two aspects of burst strength and duration, it can be shown that relevant studies on "Sustainable development" have made profound contributions to sustainable tourism research. And recently, "Growth" and "Intention" have become new research hotspots in sustainable tourism, which to some extent indicates the new research focus in this field in recent years.

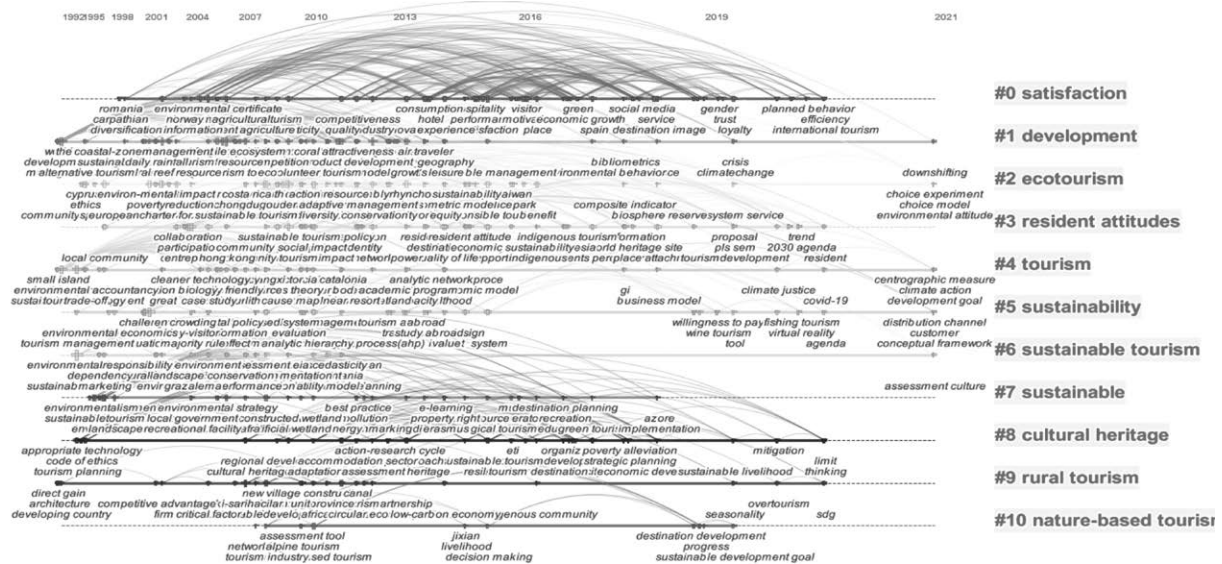
Table 7
The top 13 keywords on citation burst over time

Keywords	Strength	Begin	End	1990 - 2021
Sustainable development	16.89	2008	2014	=====
Eco-tourism	4.17	2006	2011	=====
Travel	4.63	2011	2014	=====
Ethics	3.85	2013	2016	=====
Place attachment	3.76	2018	2021	=====
Strategy	5	2009	2011	=====
Growth	4.15	2019	2021	=====
Intention	4.15	2019	2021	=====
Entrepreneurship	4.67	2018	2019	=====
Sustainable tourism	4.19	2006	2007	=====
System	3.93	2018	2019	=====
Performance	3.88	2018	2019	=====
Index	3.56	2018	2019	=====

3.3.3. Timeline view analysis

In order to better understand the origin and further development trends of sustainable tourism, we use CiteSpace to conduct a visual timeline analysis of keywords. Figure 8 illustrates the timeline view of keywords in different clusters.

Figure 8
Timeline view of keywords in different clusters



In the timeline view, the clusters are displayed horizontally along the timeline, and the label for each cluster is displayed at the end of the cluster timeline. The points on the timeline represent different keywords. The line between different points represents a symbiotic relationship between different keywords. As can be seen from Figure 8, all publication keywords are divided into 10 clusters.

Specifically, Cluster #1 (development) is the longest and oldest cluster, lasting from 1990 to 2021. It can be seen that research on "development" has always been widely favored by scholars. The focus keywords in this cluster are active until 2015, and in recent years, keywords have focused on "pro-environmental behavior", "climate change" and "downshifting". Based on our research objectives, we focus on Cluster #6 (sustainable tourism) and find that the time span of this subgroup lasted from 1994 to today. At the same time, the early keywords in this cluster are mainly focused on "self-regulation" "economic analysis", "cruise tourism", "environmental carrying capacity" "coastal area", etc. The recent keyword in this cluster is "assessment culture", which means that cultural assessment may be a research hotspot in sustainable tourism in the near future. What's more, it is worth noting that Cluster #0 (satisfaction), Cluster #3 (resident attitudes), Cluster #8 (cultural heritage), and Cluster #9 (rural tourism) do not last until 2021, but it does not mean that these clusters are not the focus of current research. Because this paper only collects the data up to January 2021, it is not enough to explain the research trend in 2021.

4. Discussion

In this paper, two literature analysis software packages, CiteSpace and VOS Viewer, are used to analyze literature related to sustainable tourism, and the results of different dimensions are obtained. Based on the results of bibliometric analysis, this section further discusses the popular issues in the current study, future research, and limitations in this paper.

4.1. Popular issues in the current study

The research on sustainable tourism has attracted the extensive attention of scholars. There are some bibliometric papers on the analysis of sustainable tourism from the aspects of theories, methods, and themes. Although

literature reviews have provided an overview of the knowledge accumulated on sustainable tourism, each review tends to concentrate on select aspects or sectors in putting forth recommendations for future research (Marvuglia et al., 2020; Zhou et al., 2018). We conducted extensive keyword analysis of sustainable tourism publications through co-occurrence analysis, burst detection analysis, and timeline view analysis, which can provide references to understand the popular issues in the current study. Some findings on sustainable tourism are obtained by analyzing the focus, bursts, and development trends of keywords. Early sustainable development research was carried out by emphasizing environmental factors, while later scholars realized that social and economic factors were also important for achieving sustainability (Echebarria et al., 2018). Therefore, sustainability is currently understood from environmental, economic, and social perspectives (Glavič & Lukman, 2007).

Research on environmental sustainability mainly focuses on keywords such as "ecotourism", "rural tourism", "environment", "conservation" and "protected areas". For example, (Leco et al., 2013) studied the attitudes and motivations of rural tourists towards the practice of environmental activities. (Lim & McAleer, 2005) analyzed the management practices and challenges of two ecotourism attractions. (Chin et al., 2018) studied communication strategies to drive rural tourism tourists toward green behavior. (Carić, 2018) presented the concept of greening tourism in order to contribute to the efficient implementation. The research on environmental sustainability provides useful ideas and management suggestions for environmental problems in sustainable tourism from the aspects of environmental activities, the protection of ecotourism attractions and the promotion of green behavior.

Research on economic sustainability mainly focuses on keywords such as "tourism development", "cultural heritage", "enterprise" and "stakeholders". For example, (D'Auria, 2009) studied the creative approaches to sustainable tourism development based on cultural heritage. (Aydin & Emeksiz, 2018) studied the relationship between the success factors of sustainable development and the economic performance of small tourism enterprises. (Pulido-Fernández et al., 2015) explored whether sustainable tourism would hinder the economic development of the tourism industry through an international empirical study. (Su et al., 2019) proposed a sustainable livelihood approach to promote economic sustainability by integrating local tea and tourism. (Poudel et al., 2016) proposed a new approach to measuring outcomes of sustainable tourism development from the perspectives of stakeholders. In the relevant research on sustainable tourism, economic sustainability is mainly analyzed from the perspective of tourism stakeholders and the integration of local resources.

Research on social sustainability mainly focuses on keywords such as "residents' attitudes", "community", "perceptions" and "governance". For example, (Giampiccoli et al., 2020) carried out research on the intersection between sustainable tourism and community tourism; (Yu et al., 2011) took the sustainable tourism attitude scale as the research object to explore the residents' attitudes towards sustainable tourism. (Rasoolimanesh & Jaafar, 2017) conceptualized the heterogeneity of residents' perceptions and explored the impact of these perceptions on residents' support for and participation in sustainable tourism development. (Nunkoo, 2017) adopted the method of political economy to study the evolution of governance of China's sustainable tourism development in the past 30 years. At present, the research on social sustainability in sustainable tourism research mainly analyzes the impact on sustainable development from three levels: country, community, and local residents.

In a word, the current research on sustainable tourism focuses on three aspects: environmental sustainability, economic sustainability, and social sustainability, which is of great significance to the theoretical model and practical application of sustainable tourism.

4.2. Future research

In recent years, the number of publications on sustainable tourism has continued to grow, indicating that the field of sustainable tourism is booming. Based on the results of performance analysis, collaboration networks analysis, and keywords analysis of sustainable tourism, this section will propose some future research in this field.

Based on the results of the citation analysis, it can be found that the applied research on sustainable tourism has shown an interdisciplinary trend. For example, the publications from "Psychology, Education, Health" are connected to many disciplines on the right side, such as "Health Nursing, Medicine", "Molecular, Biology, Genetics", "Mathematical, Mathematics, Mechanics" and "Psychology, Education, Social". In the future, scholars should actively absorb the theories and ideas of other disciplines to carry out sustainable tourism research ~~in the future~~.

Based on the results of collaboration networks analysis, it can be found that most of the institutions or authors that are influential and productive do not collaborate with other institutions or authors much. This phenomenon also reflects the regional nature of sustainable tourism research, which may not have high requirements for cooperation. In the future, scholars can pay more attention to regional advantages and make use of regional characteristics to carry out sustainable tourism research.

Based on the results of the keyword analysis, it can be seen that the relevant research on sustainable tourism has also carried out some changes in content. In its early years, the field focused on defining and understanding concepts related to sustainable tourism, such as the environment and ecotourism (Ruhanen et al., 2015). As our analysis shows, current research on sustainable tourism is beginning to lean towards climate change, business models, technical tools, and public attitudes. This is because the change in ecological climate, the business activities of tourism enterprises, the development of science and technology, and public cognition all affect the future development of sustainable tourism (Xu et al., 2020). Therefore, future research should be considered the following aspects. Firstly, sustainable tourism research should keep pace with the times. Future research can use big data (e.g., mobile device signaling, GPS, social media, and search engine data) and artificial intelligence to innovate research in the field of sustainable tourism. Secondly, future sustainable tourism research should fully understand the issues and policies related to climate change to respond to the challenges posed by climate change to sustainable tourism. Finally, sustainable tourism should continue to explore the relationship between concepts related to enterprises and individuals, such as business strategy, public awareness, social responsibility, etc.

4.3. Limitations

Although this paper has contributed to understanding the development context and popular issues in the field of sustainable tourism, there are still some limitations. First of all, this paper only uses a single database (WOS) to obtain the academic publications used for bibliometric analysis. Although the WOS database is one of the most widely used databases in academia (Cortés-Sánchez, 2019), the use of multiple databases to obtain data gives greater coverage to the topic of sustainable tourism. More databases, such as Google Scholar and Scopus, will be considered to collect data in a further study. Literature types other than academic publications may also be considered in the future. Secondly, this paper only uses a title search when searching for relevant literature on sustainable tourism, limiting the search volume. The reason why the topic keywords are not used is that many of the more than 7,000 articles returned have nothing to do with sustainable tourism. Finally, the research of this paper is based on bibliometric analysis, which reveals the panoramic view of sustainable tourism research, and involves little in-depth analysis of the content. This paper provides some basic research directions for in-depth analysis of research contents in the future.

5. Conclusions

This paper uses bibliometrics methods to review the relevant literature in the field of sustainable tourism, clarify the past and present development process of this field, and prospect the future research direction. In this paper, 2,471 articles obtained from the WOS database are screened, and finally, 2,184 articles are obtained for scientific mapping analysis. Based on the results of performance analysis, cooperation networks analysis, and keywords analysis in sustainable tourism research, this paper draws the following conclusions:

First, this paper reveals sustainable tourism research development trends by conducting a performance analysis. The annual indicators, research directions, and citation analysis in sustainable tourism research have been summarized. In addition to identifying influential and productive items (journals, countries, institutions, authors) in sustainable tourism research, this paper also presents the research foundation and application fields.

Second, this paper explores the cooperation relationships of sustainable tourism research by analyzing collaborative networks. This paper shows the cooperative relationships among countries/regions, institutions, and authors through the analysis of co-authored networks at three different levels. The collaborative network analysis reflects the regional nature of sustainable tourism research.

Third, this paper analyzes the evolution process of sustainable tourism research by proceeding with keywords analysis, which summarizes the research direction of sustainable tourism. The keywords analysis includes co-occurrence analysis, burst detection analysis, and timeline view analysis. Co-occurrence analysis reveals the internal correlation and microstructure of sustainable tourism research. Burst term detection function analyzes research trends and frontier changes in sustainable tourism. Timeline view analysis helps to understand the origin and further development trends of sustainable tourism.

Finally, this paper discusses the popular issues of current research and the prospect of future research based on the results of the bibliometric analysis on sustainable tourism. This paper puts forward five suggestions for future research from different perspectives of performance analysis, collaboration networks analysis, and keywords analysis. Besides, the limitations of this paper are also discussed in this paper.

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