Natural Disasters and Tourism Research Progress: A bibliometric Analysis

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Abstract

In recent years, natural disasters have become more frequent and severe, causing significant damage and deaths in many countries worldwide. Although several case studies have addressed how natural disasters affect tourism, there have been very limited studies that investigate the key themes and trends of natural disasters and tourism. Accordingly, this study aims to answer the following question; what are the current state and trends of scientific research on natural disasters and tourism? .To answer this question the study depends on a bibliometric approach. Secondary data consisting of363 Scopus-indexed studies were published over the period from January 2000 to March 2023 were extracted and analyzed by VOS viewer software. The findings of the study show a remarkable growth in research related to natural disasters and tourism. In terms of the number of publications and most productive institutions, Indonesia was the leading country on this topic. The IOP conference series: earth and environmental science were the top source of publications on the study topic. Furthermore, the keyword analysis reveals that tourism, climate change, natural disaster, tourist destination, disaster management, tourism development, sustainable development, tsunamis, and floods are key hotspots in research. The study concluded that future research should focus on climate change related disasters and tourism, especially the adaptation and resilience of the tourism industry towards such kind of disasters.

Keywords: natural disasters, tourism industry, bibliometric analysis, VOS viewer, Scopus.

1. Introduction

In many regions, countries, and cities, tourism plays a key role in economic development. Nevertheless, the tourism industry is vulnerable to various types of disasters that can negatively affect the industry and the economy in several ways (Naeem &Rana, 2020).

According to Ma *et al.*(2020)disasters are unexpected or progressive events that are naturally occurring or caused by humans and have severe consequences on communities that require special measures to mitigate them. United Nations (2002, p.55) indicated that a disaster is "a major disturbance of society's functioning, resulting in widespread losses of people, properties, or the environment that exceed the afflicted society's ability to cope using only its own resources". Furthermore, a disaster is defined by Rodriguez *et al.*(2009)as an event that kills at least 10 persons, affects at

least 100 persons or more, and leads to the appeal for international aid or declaration of emergency in the country. Briere and Elliott (2000) argued that a disaster is an event that causes death or serious injury, such as earthquakes, floods, volcanic eruptions, fires, tsunamis, and droughts. In this context, Wang *et al. (*2019) mentioned that the natural and social characteristics of a disaster determine how extensive, comprehensive, and far-reaching its effects.

It's important to note that the tourism industry is sensitive to disaster events in terms of supply and demand (Araña&León, 2008). Tourism has been hit by numerous crises and disasters over the past five decades, and very few destinations have been exempted from them (Beirman, 2006). Indeed, these challenges cast a dark shadow on global tourism development. Thus, many tourists start doubting the safety and security of the destinations and the tourist attractions they intend to visit (Poku&Boakye, 2019)

Inhuman history, natural disasters have been triggered by both natural changes and human actions. Despite the causes, once natural disasters strike, their impacts on human activities and business operations are immeasurable (Chen *et al.,* 2022). In comparison to other industries, tourism is more vulnerable to such disasters due to its dependency on natural resources. There is no doubt that the occurrence of natural hazards not only causes physical damage to tangible assets such as infrastructure and tourism facilities during disaster events, but it can also be difficult to restore the destination image after such events (Ma *et al.*, 2020; Stylidis *et al.*, 2014). This could result in a disruption of tourism supply and demand and accordingly cause major shocks to tourism business

management (Chen et al., 2022; Ritchie & Jiang, 2019).

Worldwide, various natural disasters heavily impacted the tourism supply in numerous tourist destinations(Wu & Shimizu, 2020), for example, in December 2004, Southeast Asia was struck by a strong earthquake and tsunami that caused the most devastating tourism disaster in history (Naeem & Rana, 2020). Furthermore, many Southeast Asian countries whose primary economic sector is tourism, such as Thailand, Maldives, Indonesia, India, Sri Lanka, Malaysia, and Bangladesh, were affected by the Indian tsunami. (Blažin*et al.*, 2014). In Sri Lanka, approximately 70% of the coastline was damaged by tsunami waves caused by a Sumatran earthquake (Gamburd& McGilvray, 2010). In the tsunami, thousands of people died after huge waves flooded beaches, destroyed infrastructure and hotels (Naeem &Rana, 2020). Moreover, in August 2008, Typhoon Morakot hit Taiwan with high winds and torrential rain, triggering many mudslides and landslides in mountainous regions. During this typhoon, several bridges, roads, and famous tourist resorts were seriously damaged throughout the island (Tsai *et al.*, 2012). In this sense, Shareef & Hoti (2005) highlighted that small islands are often vulnerable to natural disasters; they have limited resources and mainly rely on tourism as a major economic activity.

On the other hand, natural disasters might directly or indirectly result in physical and psychological damage to tourists. In this regard, Tsai *et al.*, (2016) predicted that 1.8 billion tourists might experience natural catastrophes in 2030 due to severe weather. For example, in 1999, the Taiwan earthquake resulted in decreasing international tourists by 15% from September to December (Huang & Min, 2002).

Also, in 2004, over 225,000 persons were killed due to the Indian Ocean tsunami. This tragedy was the largest disaster worldwide during the last two centuries. Accordingly, the Maldives have witnessed a significant decline in tourist arrivals (69.7%) (Park & Reisinger, 2010). Another example, in 2010, the volcanic ash cloud generated by the Iceland volcanic eruption negatively affected the European airline industry to lose up to £2.15 billion (Hall, 2010). Furthermore, in 2011 and 2016 Japan experienced two massive earthquakes followed by a nuclear disaster. This pushed the potential tourists to think that visiting Japan entails a significant danger of exposure to nuclear radiation and led to a notable decline in tourist arrivals (2.5 million) (Park & Reisinger, 2010)

Previous studies that used a bibliometric analysis to examine the existing trends of publications have focused on various topics for example; the different types of natural disasters (Barnes *et al.,*2019; Gao &Ruan,2018; Velasquez *et al*.,2022), tourism and hospitality studies (Leong *et al*.,2021; López-Bonilla & López-Bonilla,2021; Ülker *et al*.,2023), tourism destination resilience (Wang *et al*., 2022), tourism and climate change (Qiu *et al*., 2023; Scott &Gössling, 2022), tourism and sustainability (Niñerola, *et al*.,2019; Pahrudin *et al.,*2022), trends of tourism aftermath COVID-19 (Viana-Lora & Nel-lo-Andreu, 2022). However, it can be noticed that only a few studies have conducted a bibliometric analysis of natural disasters and tourism (Chen *et al*., 2022; Jiang *et al*., 2019; Pascual-Fraile *et al*., 2022). To fill the knowledge gap, this study seeks to clarify the current research trends of natural disasters and tourism. It aims to explore the direction of future studies on this topic to help researchers

and practitioners understand the research profile of this topic. To this end, the study conducted a bibliometric analysis to examine the current literature related to natural disasters and tourism to make it more accessible to academics.

Thus, the study seeks to answer a number of main questions aligned with the objective of the study:

RQ1. What is the overall evolution of the current literature in the area of natural disasters and tourism?

RQ2. What are the most frequently used keywords on natural disasters and tourism studies (January 2000-March2023)

RQ3. What are the most-cited documents and journals on natural disasters and tourism?

RQ4. What is the collaboration network between authors, institutions, and countries on natural disasters and tourism?

Indeed, the findings of this study could not only add to the current body of research on natural disasters and tourism but could also provide scholars and policymakers with relevant information about the trends and structure of this field.

2. Methodology

This study used a bibliometric analysis of scholarly articles indexed in the Scopus database related to natural disasters and the tourism industry over the globe. In fact, Bibliometric analysis is a technique for classifying relevant prior studies utilizing quantitative data from a particular database (Gomezelj, 2016). It helps in evaluating academic productivity and predicting the trend of scientific research on a specific topic (Wang et al., 2021), as well as summarizing the most relevant themes (Ellegaard & Wallin, 2015). According to Koseoglu et al. (2016), bibliometric methods are divided into three categories: review studies, relational techniques, and evaluation techniques.

For example, this analysis determines the quantity of publications and citations produced by particular academics or institutions (Lima & Bonetti, 2020; Singh et al., 2022). On the other hand, it highlights the main cooperation between authors, research institutions, and countries (Fan et al., 2020).Furthermore; it has recently been widely utilized to describe the structure and pattern of research developments in many scientific fields according to the emergence of research variables by numerous scholars from different countries. (Collins et al., 2021; Luo et al., 2022).To conduct the bibliometric analysis, this study adopts VOS viewer as statistical software to analyze natural disaster and tourism publications in a scientific manner and present the common research trends. This study used secondary data consisting of Scopus-indexed publications, as they are accessible and high-quality index

publications. Furthermore, Scopus allows for well-structured, targeted searches with high-quality results (Chavarro et al., 2018).Also, the Scopus database has numerous tools that can be used to analyze citations, count research collaborations, and export data to Microsoft Excel for further analysis and mapping (Sweileh, 2017)

In the first stage, the database has been determined, the author chose well-defined key search strings related to natural disaster and tourism (Table 1).For data collection, the author extend the keywords searching to related synonyms in order to increase the number of relevant publications.

Table 1. Search Terms used to collect data in Scopus

Tourism industry-related terms		**Natural disasters -related terms**
Tourism		Natural disasters
Travel		Natural hazards
Tourist attractions		Disaster management
Tourism development		Earthquake
Sustainable development		Hurricane
Tourism destination		Tsunami
Tourism management		Tornado
Destination image		Flood
Event management	**AND**	Drought
Resorts	**OR**	Wildfire
Hotels		Landslide
Leisure		Volcanic eruption
Adventure tourism		Cyclone
Cultural tourism		Heatwave
Ecotourism		Hailstorm
Mountain tourism		Thunderstorm
Transportation		Storm surge
Infrastructure		Coastal erosion

Source:the author

In the second stage, the author retrieved scholarly open published articles, reviewed papers, and Conference Proceedings at the last stage of publication and written in English during the period January 2000 - March 2023. All these retrieved publications were exported to an Excel sheet. At this step, a total of 1531 publications were assembled.

In the third step, the gathered data was cleaned so that all duplicated publications and those with incomplete information such as authors, year of publication, DOI numbers, and source of publications were removed.

In the last step, another data screening was conducted by using a combination of keywords through the titles and abstracts of publications, the authors' keywords and names of journals, and full reading of the

abstracts of the publication. Accordingly, all publications out of the scope of the study were excluded and a total of 363 publications were retained for further analysis. The data collection, screening, and publication inclusion are shown in Fig.1.
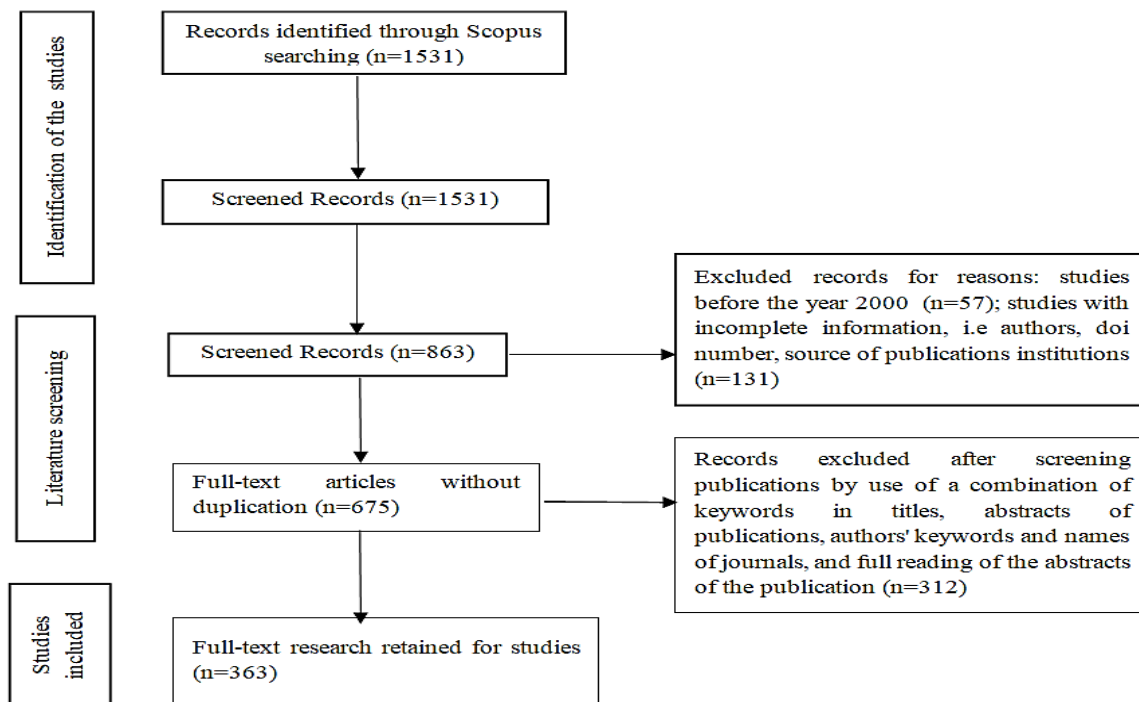

Figure 1. Identification, screening, and selection of publications
Source: the author

3. Results and discussion

3.1 Review of publications growth

This study analyzed 363 publications related to natural disasters and tourism over the globe. Fig.2shows the trend of publications on natural disasters and tourism during the period January 2000-March 2023.According to the graph, the number of publications increased significantly in 2018. This may be due to the growing number of natural disaster events which happened recently over the world (Fan et al., 2020).

Of a total of 363 publications, 71 publications were published in 2021, 56 in 2022, and 46 publications were published in 2020. Accordingly, the year 2021 recorded the highest number of publications followed by 2022 and 2020 respectively. This result aligns with Chen *et al. (*2022) who noted that recently, scholars have started to give an increasing interest in natural disasters and tourism studies. This reflects the possibility of studying and exploring this topic for its novelty.
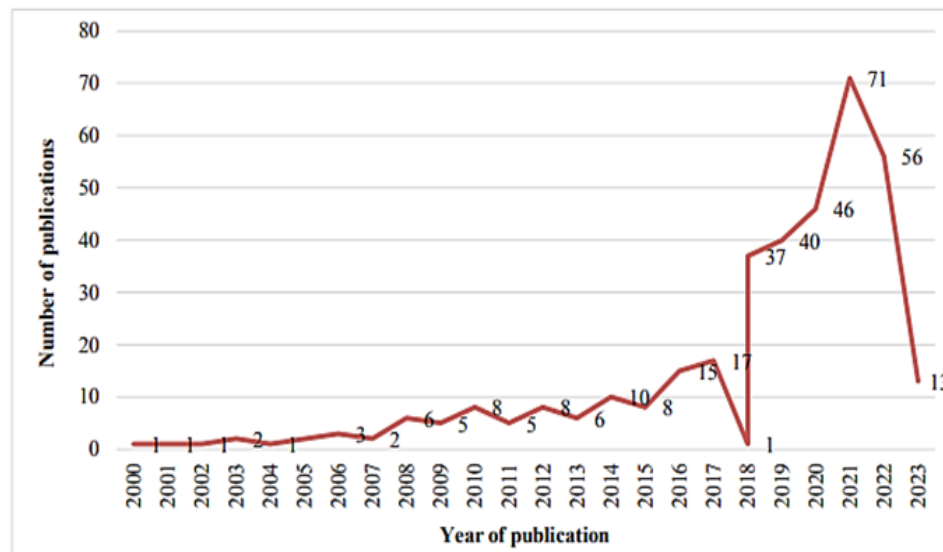

Figure 2. Annual scientific publications growth
Source: the author (depends on Scopus searching)

3.2. Keyword analysis

Keyword analysis was conducted by using VOS viewer to investigate the most relevant keywords used and accordingly highlight the hot topics and future research areas. Based on an occurrence of at least 10 times for each word, 46 words were classified into five clusters. The keyword co-occurrence analysis in Fig 3 shows that the most 10leading keywords from January 2000 to March 2023 were tourism (93)

times, climate change (59) times, natural disaster (45) Times, tourist destination (45) times, disaster management (37) times, tourism development (37) times, sustainable development (36) times, ecotourism (32) times, tsunamis (25) times and floods (22)times. Cluster 1 (red color);included 17 items and was a different type of combination with "climate change "as a leading keyword such as(adaptation, adaptive management, climate change, vulnerability, cultural heritage, urban area, drought, flooding, natural hazard, resilience, sustainability, and stakeholder), some terminologies

related to tourists such as (decision making, tourism market) and others related to tourist destinations which witnesses natural hazards events and climate change (Spain, Italy, and United states).Keywords in cluster 2 (green color) were dominated by 10 items related to "sustainable development". The main items of the cluster include (beaches, coastal zones, disaster prevention, earthquakes, economics, leisure industry, regional planning, rural areas, sustainable development, and tsunamis).

Based on the components of cluster 3 (blue color), the keyword focused on "tourism", it includes7 items (China, ecotourism, sustainable tourism, tourism, tourism development, tourism management, and

tourist destination).The fourth cluster (light green color) contains 6 items with "natural disaster" as a leading keyword (disaster management, economic impact, Indonesia, Japan, natural disaster, tsunami). Cluster 5 in purple consists of five items with a focus on "risk assessment" as a main research area (conservation, environment protection, humans, risk assessment, wildlife).

Keyword analysis reveals the specific geographic key terms such as China, Japan, Indonesia, Italy, Spain, and the United States. This implies that those key tourist destinations witnessed various natural disasters which were studied by many scholars. Thus, it is likely that these countries appeared in many case studies and therefore in keyword analysis as (Mair *et al.*, 2016; Wang & Ritchie, 2010) mentioned that earlier research on disasters and crises included case studies dominated research.

Figure 3. Keywords co-occurrence analysis of the top 10 keywords
Source: The author retrieved from VOS viewer software.

3.3. Co-authorship network analysis

A co-authorship analysis determines the underlying dynamics of collaboration among researchers in a particular research area

(Reyes-Gonzalez *et al.*, 2016).In fact, shared authorship of a paper connects authors, institutions, and countries (Jiang *et al.*, 2017).It was found that a total of 1195 authors have

written the 363 publications included in this study, which represents an average of 3.29 authors per publication. However, the co-authorship network analysis revealed that the largest set of connected items includes 17 authors of whom Muhammad Ramdhan has the most collaborative network than any other authors (16 papers) followed by Hadiwijaya Lesmana Salim, August Daulat, and Dini Purban with 9 papers for each one.

Fig.4 illustrates the co-authorship analysis which identified two clusters, consisting of 17 items representing only 1 % of the total authors. There are 13 authors (76.5%) among the selected authors who have published or co-published only one article. As a result, there are very few prominent research groups, in terms of collaborations between authors. Thus, the items in the clusters were created by the co-authors of the same articles.

Furthermore, according toFig.4, the most prolific authors usually cluster in the centers of collaboration networks. These results go in line with Jiang *et al*. (2017) who indicated that most collaboration occurs among colleagues or between them and researchers and PhD students in the same university. This confirms the importance of geographical and institutional proximity in enhancing research collaborations (Ponds *et al*,2007).
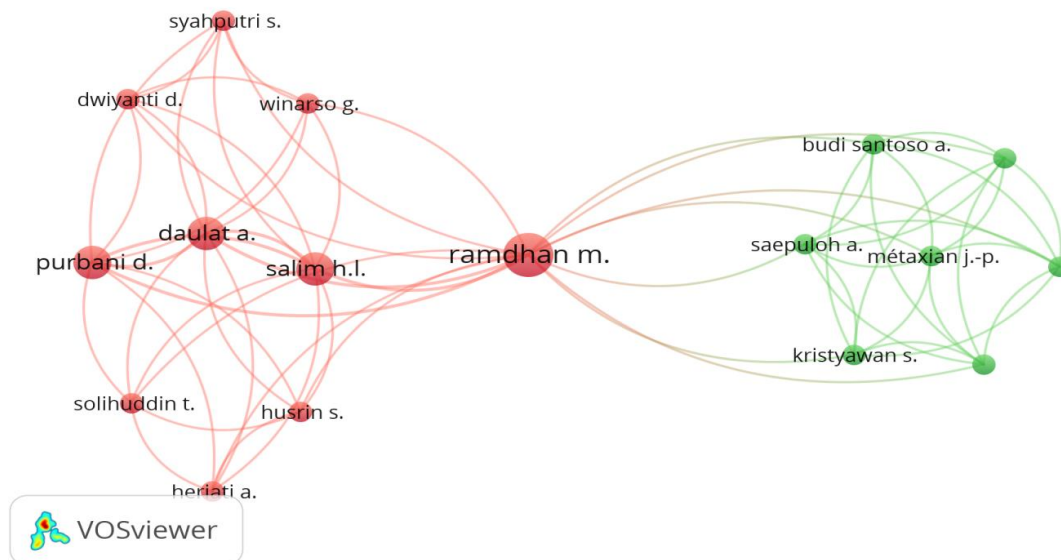
Figure 4. Co-authorship network analysis of most collaborative authors
Source: the author retrieved from VOS viewer software.

3.4. Geographical distribution of the studies per country

Geographic distribution can be used as a tool to find the most popular publications in a country (Emmer, 2018; Emmer *et al.,* 2019). The Bibliographic coupling analysis showed that 363 publications were published by 69 countries. Also,Fig.5presents the top 11 countries which have a relatively high number of publications in total (Indonesia 76 publications, United States 50 publications, United Kingdom 47 publications, Spain 26 publications, Australia 25 publications, China 25 publications, Japan 23 publications, Italy 21 publications, Netherlands 14

publications and South Africa 11 publications, Malaysia 11 publications). It can be seen that among these 11 countries, there are four countries (Indonesia, China, Japan, and Malaysia) located in Asia that published a high number of research on natural disasters and tourism.

Also, these 11 countries account for 90.63 % of the total publications. They are grouped into three Clusters; Cluster 1 (in red) includes Australia, China, Indonesia, Japan and Malaysia Cluster 2 (in green) includes Italy, Netherlands, Spain, and the United Kingdom whereas Cluster 3 (in blue) includes South Africa and the United States. Furthermore, Fig.5showsthat Indonesia ranks first in total publications followed by the United States, United Kingdom, Spain, and

China. This result is consistent with the World Risk Index (2022) which reported that Asian countries such as Indonesia and China as the hotspots of disasters risk from natural hazards. This could imply the interest of these countries in this area of study and its relationship with the tourism sector.

Although India is one of the most highly affected by natural disasters according to the World Risk Index (2022), the country analysis revealed that it is not among the top 10 countries with a high number of publications on natural disasters and tourism. In this context, Fan *et al*.(2020) argued that improving the technological and scientific level of these countries could lead them to strengthen their international cooperation, exchange research findings, and reduce the economic losses resulting from natural disasters.
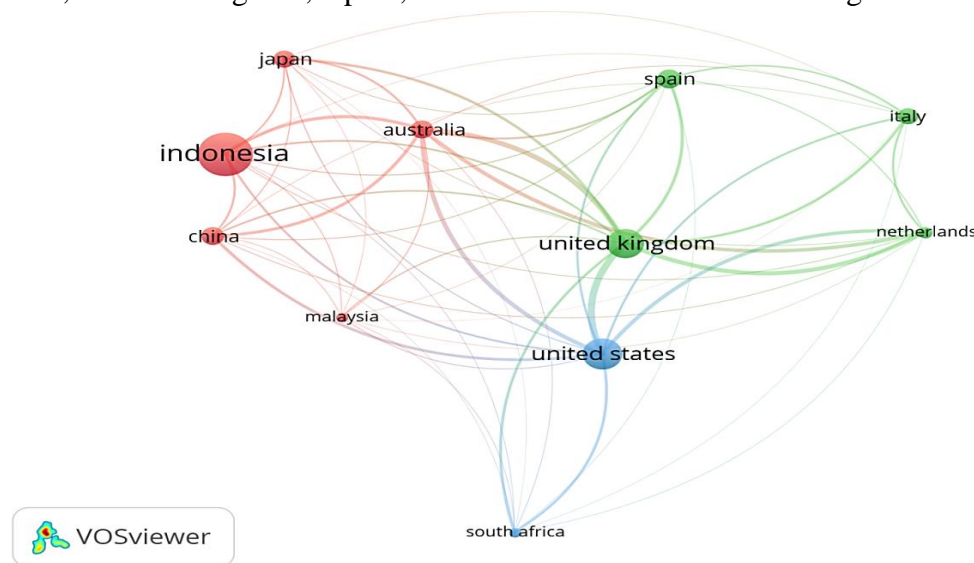

Figure 5. The most influential countries publishing researches on natural disasters and tourism
Source: the author retrieved from VOSviewer software.

3.5Countries/regions collaboration network analysis

By the use of the VOSviewer, network analysis of cooperation between countries/regions was conducted. Fig. 6 shows that 363 publications were published

through co-authorship collaborations between 69 countries. Furthermore, it reveals the largest number of connections in 23 countries/regions. Each node in this figure represents a publication number for a country/region and the links

connecting countries/regions indicate a cooperative relationship.

The figure also showed that each country accounted for at least 5 publications on natural disasters and tourism. These countries are grouped into 6 clusters, of which the United States is the most cooperative one. Cluster 1 (in red) includes Greece, Italy, Mexico, Poland, and Spain; Cluster 2 (in green); includes Canada, New Zealand, South Africa, Sweden, and the

United States Cluster 3 (in blue); Austria, Germany, Netherlands, and Switzerland, cluster 4 (in green olive); Australia, Japan, Thailand, and United Kingdom, cluster 5 in purple; China and Taiwan, cluster 6 (in light blue); Indonesia and Malaysia. Accordingly, it can be noticed that most clusters have a cross-continental collaboration (clusters one, two, three, and four) except clusters five and six where the collaboration focuses mainly on Asian countries.
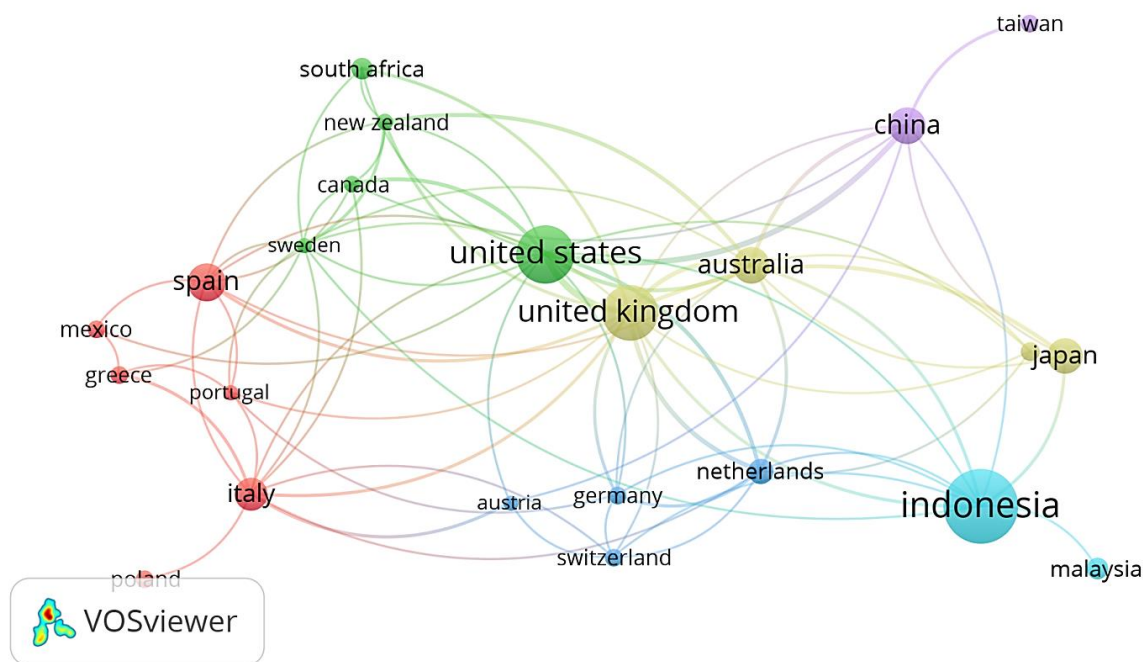
Figure6. Countries/regions collaboration network
Source: the author retrieved from VOSviewer software.

3.5.2 Most influential journals and Institutions

The main sources of natural disasters and tourism were identified to guide academics to select an appropriate journal to publish their researches. Accordingly, the top 10 most influential journals and institutions were analyzed (Table 2).

In terms of research institutions, 363 publications were published by 862

Institutions through 129 sources. The top three research institutions are *the Resilience development initiative, Bandung, Indonesia, the School of Architecture, planning and policy development, Bandung Institute of Technology (ITB), Indonesia, and the Department of Geography, tourism and hotel management, faculty of sciences, university of Novi Sad, Serbia.* The results clarified that the top ten institutions published 6.06 % of the total publications.

The top 10 sources of publication from January 2000 to March 2023 related to natural disasters and tourism are shown in Table 2. The results indicate these sources as follows; IOP conference series: earth and environmental science (70 publications), sustainability (Switzerland) (39 publications), WIT transactions on ecology and the environment (17 publications), tourism management (10 publications), geo journal of tourism and geo sites (9 publications), international journal of environmental research and public health (8 publications), Geo heritage (7 publications), current issues in tourism (6 publications), Journal of disaster research (6 publications) and international journal of sustainable development and planning (6 publications). The findings showed that the sources of the articles were mainly journals and conference proceedings which are indexed on Scopus. These sources are related to disasters, the environment, and tourism due to their connection to the study's topic. It is estimated that 178 documents have been published by the top 10 productive journals, which is equivalent to 49.03 % of all documents retrieved. The results of the journal analysis revealed that the three leading sources of publications are the IOP conference series: earth and environmental science, Sustainability (Switzerland), and WIT Transactions on Ecology and the Environment which account for 34.71% of total publications included in this study. Moreover, it can be noticed that the top 10 active journals can be classified into three main categories; firstly; journals related to environment and sustainability such as WIT transactions on ecology and the environment, secondly; journals focus on disasters such as Journal of Disaster Research and finally; journals related to tourism such as Tourism Management

Table 2. Top 10 journals and productive institutions during January 2000– March 2023

Rank	Sources of publications	TP	Institutions/organizations	TP
1	IOP conference series: earth and environmental science	70	Resilience development initiative, Bandung, 40135, Indonesia	3
2	Sustainability (Switzerland)	39	School of Architecture, planning and policy development, Bandung Institute of Technology (ITB), Bandung, 40132, Indonesia	3
3	WIT transactions on ecology and the environment	17	Department of Geography, tourism, and hotel management, faculty of Sciences, University of Novi Sad, 21000, Serbia	2
4	Tourism management	10	Department of landscape architecture & environmental planning, university of California at Berkeley, Berkeley, ca 94720, United States	2
5	Geojournal of Tourism and geosites	9	Department of forest resources conservation and Ecotourism, Faculty of Forestry, Bogor agricultural university, Indonesia	2
6	International Journal of environmental research and public health	8	University of Surrey, United Kingdom	2
7	Geoheritage	7	State key laboratory of Resources and environmental information system, institute of geographic sciences and natural resources research, Chinese Academy of Sciences, Beijing, 100101, China	2
8	Current issues in tourism	6	Institute of Economy, geography and Demography, Spanish national research council (iegd-csic), associated unit geolab, c/albasanz, 26-28, Madrid, 28037, Spain	2
9	Journal of disaster research	6	Research group of hydrography, faculty of earth sciences and Technology, institute teknologi bandung, Indonesia	2
10	International Journal of sustainable development and Planning	6	Department of Science, management and Design, universititeknologi malaysia Kuala Lumpur, Kuala Lumpur, 54100, Malaysia	2

Source: the author retrieved from VOSviewer software.

3.6. Citation analysis

The citations obtained through the Scopus database indicated that the number of times that a publication is cited by all Scopus-indexed journals. In this regard, Choudhri *et al.* (2015) explained that the number of citations a particular article receives can be used to assess its quality and influence. The results clarified that the 363 publications included in this study have 5617 citations in Scopus with an average of 15.47 citations per publication. 20.93% of the publications did not receive any citation in Scopus, 20.28 % of the publications have at least 20 citations of which 4.13% had at least a minimum of 100 citations in Scopus at the date of the data extraction. Obviously, 19.54 % of the citations of the total publications come from three specific studies which were published in 2001, 2009, and 2006. The most three cited publications from January 2000 to March 2023 are *"Katherine, washed out one day, back on Track the next: a post-mortem of a tourism disaster"* with 237 citations, '*The Impact of crisis events and macroeconomic activity on Taiwan's International inbound tourism demand'* 'with 228 citations, and *"Erosion and tourism infrastructure in the coastal zone: Problems, consequences, and management"* with 209 citations.

Fig.7shows that the first influential article authored by Faulkner &Vikulov (2001) described how an earlier developed model for tourism disaster management plans was refined by looking at the 1998 Australia Day flood at Katherin. The second one published by Wang (2009)investigated how these disasters negatively affected inbound tourism demand, and the third influential publication authored by Phillips & Jones (2006) evaluated erosion's effects on coastal tourism, coastal destination development, and the global tourism industry in general. Indeed, the research themes of the highly cited articles indicate how the literature addressed natural disasters and tourism from various perspectives.

It is evident from the citation study that the articles published before 2010 are more likely to be cited due to their longer time horizons. While most publications during the period January 2020-March 2023 didn't receive any citation in Scopus at the date of the data extraction. This result is consistent with Gong *et al.* (2018) and Zupic & Čater (2015) who mentioned that citations indicate a document's visibility and significance as a reference in academia since publications with more citations are perceived as more significant.
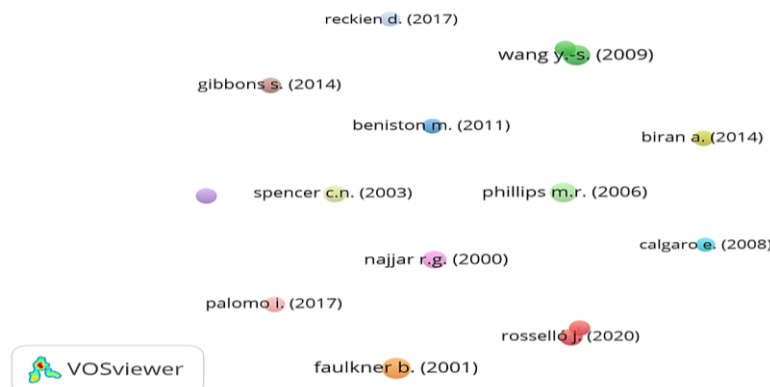

Figure 7. Map for top authors with at least 100 citations in Scopus
Source: the author retrieved from VOSviewer software.

4. Conclusion

The purpose of this study is to provide a comprehensive overview of the scientific literature indexed in Scopus from January 2000to March 2023on natural disasters and tourism through a bibliometric analysis. Ellegaard and Wallin (2015) recommended using this analysis as an important method to assess scientific output. In the current study, bibliometric analysis has helped the author to identify the main research gaps and lines, the main authors, the countries with the most publications, as well as the journals and articles that received the most citations. Furthermore, it provides answers to the research questions regarding natural disasters and tourism. To prevent bias in the information presented here, only journal articles, conference proceedings, and article reviews were examined using VOSviewer (Sunyono *et al.*, 2022). The study screened 1531 articles from the Scopus database, after which 363 articles were selected for scientific analysis.

As mentioned in the above findings, there is a steady increase in publications as well as citations, which suggests natural disasters and the tourism industry as a significant research area. The keyword analysis clarified that there are emerging trends in publications related to natural disasters and tourism. The author classified them into five themes; (1) natural disasters induced by climate change and adaptation strategies ;(2) the impacts of natural disaster on sustainable tourism development;(3) natural disaster and tourism destination management ;(4) natural disaster management and economic resilience and (5) risk management and biodiversity conservation.

Regarding the most productive countries, Indonesia is the dominating country with a total of 76 publications, followed by the United States and the United Kingdom. The most cited article is ''Katherine, washed out one day, back on track the next: a post-mortem of a tourism disaster'' and had been cited 237 times from January 2000 until March 2023.In terms of institutions, the resilience development initiative, in Bandung, Indonesia (with 3 publications) is the most productive institution. Concerning the productive authors, Muhammad Ramdhan has the most collaborative network than any other authors (with 16 papers). Concerning the influential source of publications, the IOP conference series: earth and environmental science (with a total of 70 papers/ Conference Proceeding) is the most productive source of publications. In terms of collaboration, there was a lack of collaboration between research groups. The majority of this collaboration was between the same authors in one article. Furthermore, co-occurrence analysis identified an overview of the key themes and trends in research related to natural disasters and tourism. Tourism, climate change, natural disaster, tourist destinations, disaster management tourism development, sustainable development, ecotourism, tsunamis, and floods were the research themes that appeared more frequently in recent studies.

5. Research limitations

Despite the contribution of this study to understand the context and popular concerns related to natural disasters and tourism, some limitations exist. Firstly, to collect data from the academic publications used for performing bibliometric analysis, this study depended mainly on a single database (Scopus) which may not include all relevant documents, for

example, other Journal articles and books. Thus, other databases (e.g., WoS and Google Scholar) can also be used to collect data in further studies. Indeed, using multiple databases to obtain data increases the coverage of the topic. Secondly, the literature coverage in this study focused mostly on English journals, so documents in other languages such as French, Spanish and Italian were underrepresented. Thirdly, the VOSviewer was the only tool used in this study for analysis. Nevertheless, other software (such as Bibexcel and CiteSpace II) could be used as well in future research. Fourthly, VOSviewer program has limitations when presenting static images. This paper does not allow readers to zoom in on network maps or explore links between authors or papers to gain a deeper understanding of the data and relationships. Fifthly, this study used a bibliometric analysis, which presents a broad overview of natural disasters and tourism research; however, it does not involve in-depth analysis of the research content. Finally, the findings of the study may give an overview of the current situation regarding natural disasters and tourism literature, but it may change over time.

6. Future studies

The current study retrieved and analyzed only articles published in peer-reviewed journals and conference proceedings, so, future studiesshould analyze grey literature such as government documents and reports, research reports, blogs, and press release. Such publications which are not indexed in databases could give a comprehensive overview related to policy debates and local knowledge that does not exist in the

scientific journals. In addition, future studies should use a variety of databases and qualitative analyses which could help to complement and further expand the findings of this research. To further develop this field of research, studies have to focus on possible future research directions of natural disasters and tourism. For example, climate change, earthquakes, disaster prevention, adaptation, and resilience should be the trending topics in disaster science. Moreover, future research should guide policy makers on more effective responses to prepare for natural disasters that are increasingly likely in the foreseeable future. Specifically, it is important that all countries should focus more on the disasters they suffer from and share their experiences in order to improve the technology or measures for preventing or mitigating disasters in the future

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