Application of Bibliometric Analysis in the Study of Climate Change and Sustainable Development Practices

Type of article- Review article

Abstract

Climate change is a global issue and it needs the attention of everyone for which the United Nations has covered this under Sustainable Development Goals (SDGs13). In this context, this paperattempts to make a bibliometric analysis to get an overview of research works conducted in the field of climate change and sustainable development practices. A total of 889 articlesfrom the Dimension database have been considered for the studyand they have been analysed with the help of Biblioshiny and VOS viewer software. Various bibliometric components like thematic evolution, keyword co-occurrence map, top authors etc. have been discussed in the study. We found that the concerned field is an important research area as the number of documents is showing an increasing trend. So, more studies are expected in future. This paper will help future researchers in choosing the right area of work in the concerned field.

Keywords: climate change, sustainable development, bibliometric study, themes

Introduction

Climate change is one of the important concerns nowadays. We come across various horrible news every day regarding climate change and its impact on society. It is anticipated that climate change brought on by growing greenhouse gas emissions will result in rising temperatures and shifting rainfall patterns in the next century that would, among other things, have a considerable impact on human livelihoods(Schipper & Pelling, 2006).So, attention should be given to this. Sustainable Development Goal (SDG 13) deals with this issue.

Governments and organisations are implementing a variety of policies and laws in many economies to reduce issues like global warming(Liao, 2020). Proactive environmental policies are intended to reduce costs and protect the environment, which spurs innovation(Mishra & Yadav, 2021). There are obvious connections between social media and shifting public perceptions, with the prospect that public opinion will influence political decision-making(Mavrodieva et al., 2019). Climate change also affects health. Reduced health effects of climate change require crossand inter-sectoral adaptation measures(Bowen et al., 2012).Built environment interventions need to go beyond just ecological sustainability to

promote healthy lifestyles for both people and the environment. Education also plays an important role in ensuring sustainable practices (Di Biase et al., 2022)

The problem of climate change cannot be solved by government policy only. Various stakeholders like business firms, the public and various organisations should contribute their part and they should adopt sustainable practices. For a business, the core components of sustainable practice and proactive environmental initiatives are the use of proper materials, eliminating waste, and creating goods using environmentally friendly concepts(Singh et al., 2020). Similarly, the general public should ensure that their habits and activities affect the environment in the least possible way. Although it is possible to lower climate risks for relatively less cost, there is still some ambiguity over how applying climate change adaptation strategies will have certain broader development impacts(Halsnas & Trarup, 2009). Information and communication technology (ICT) based education on climate change is great endeavour to acquaint the students with sustainable practices (Makrakis et al., 2012).

In this context, this paper presents a bibliometric analysisto get an overview of the concerned area of research that will help the researcher to know the current status of research as well as themes to be explored more in future. Bibliometric analysis is a scientific and computer-assisted review methodology that covers all the publications related to a given topic or field and can identify core research or authors, as well as their relationship (Han et al., 2020). Academic publication is studied using bibliometrics, which makes use of statistics to identify patterns in publishing and to identify connections between published works(Ninkov et al., 2022).This study attempts to explore the top authors, top productive countries, and emerging themes in the field of climate change and sustainable development practices. The paper flows as introduction, methodology in the next section, results and interpretations in section 3 and conclusion and future research direction in section 4.

Methodology

In this study, VOSviewer and Biblioshiny software packages have been used as bibliometric analysis tools for summarising and visualising results. The data have been collected from the Dimension database. Our search criteria were '"climate change" AND "sustainable development" AND "practice"'. Only chapters and articles are considered in this study. We considered the time period from 1991 to2023 (March). We also selected only those journals which are in UGC Journal List Group II or UGC Journal List Group I. After applying all these criteria, we got 889 publications which are utilised in this study for further analysis.It

isshown in Fig. 1 as a flowchart.We have used VOSviewer software for keyword co-occurrence analysis and Biblioshiny for all other analyses in this study.

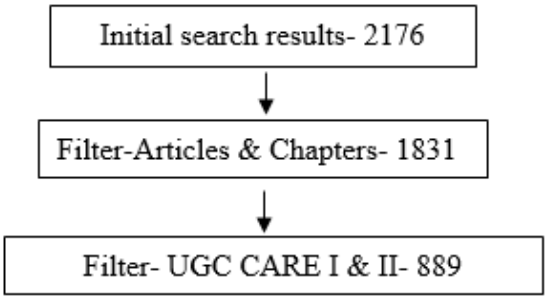

Fig. 1:Flowchart of documents selection criteria

Source: Compiled by authors

Results and Interpretation

Annual trend of publications

An analysis of annual publication by year may reveal the rate and pattern of advancement in a given scientific field. A continuous increasing trend in total year-wise publication has been observed over the previous three decades (Fig. 2). From 1991 to 2007, there was no discernible research activity contributing to the subject, but since then, there has been a rapid rise in publications. The year 2022 has the highest number with 177 publications. So, we can infer that this topic is an important one for current and future studies.

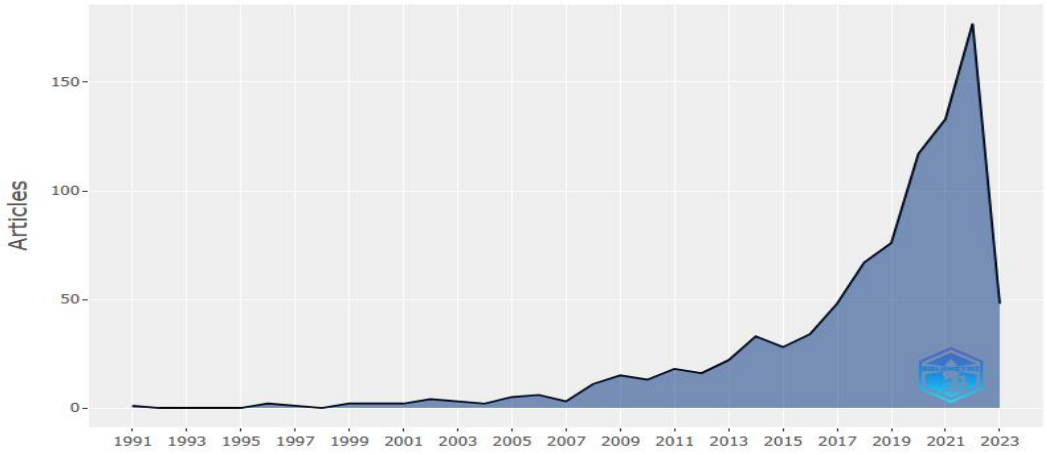

Fig. 2: Annual trend of publications

Source: Compiled by authors from Biblioshiny

Country scientific production

Table 1 depicts the top 10 most productive countries that contribute to the publications in the selected field. It is based the authors' affiliation. The United Kingdom holds the top rank with 199 publications, followed by China (195), Australia (130), and India (105).

Table 1: The top 10 most productive countries

Name of the country	Total number of publications
United Kingdom	199
China	195
Australia	130
India	105
Germany	83
Italy	73
Canada	57
Sweden	57
Nederland	56
France	47

Source: Compiled by authors from Biblioshiny

Using colour indices, Fig. 3shows the contribution of many significant nations to global publications. Here, the deep blue colour denotes high contribution, whereas the grey colour denotes non-contributing nations. As shown in table 1, United Kingdom is the top contributor with 199 publications.

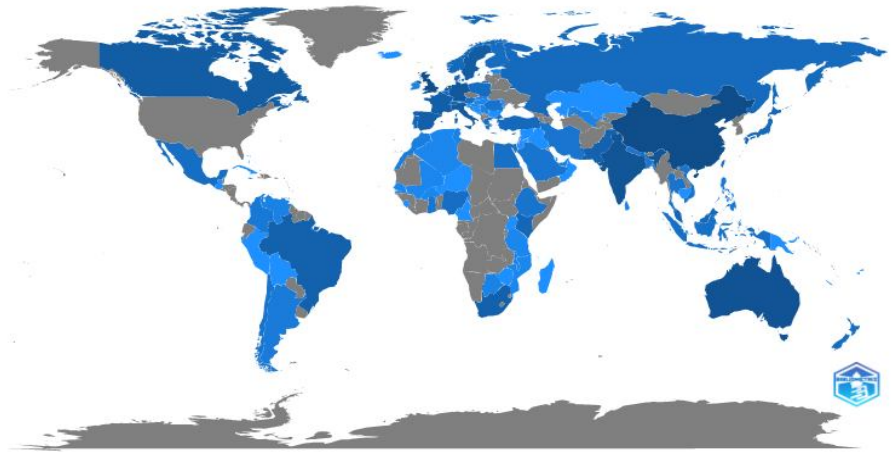

Fig. 3. Global contribution to the publications

Source: Compiled by authors from Biblioshiny

Most relevant sources

Fig. 4 shows the top 20 journals according to the highest volume of publications. *Sustainability* (IF = 3.89) is the journal with the most papers in this field (79). With 20 publications, the *Journal of Cleaner Production* (IF = 11.07) comes in second. *Environmental* Development and Sustainability (IF = 4.08) and *Environmental Science and Pollution Research* (IF = 5.19) are tied for third place with 13 publications each.

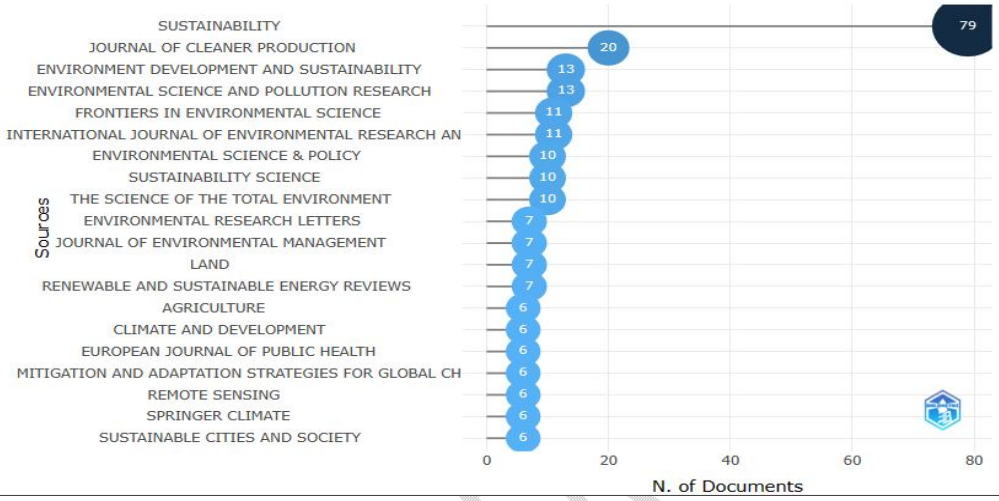

Fig. 4: Top 20 journals incorporate with number of publications

Source: Compiled by authors from Biblioshiny

Most cited documents

The top fiveglobally cited documents are shown in Figure 5. The author of the most frequently cited article in this field is G. Rebitzer. The article was published in the Environmental International journal in 2004 and got the first position with a maximum of 1257 citations. This paper is about life cycle assessment and its role in sustainability. The second-most cited article was published by S. D. Keesstra in 2016, which received 971 citations. Third rank is held by G. Seyfang, with 619 citations published in 2012. The research article by Z. Jiang ranks fourth with 564 citations published in 2014. Whereas L. Schipper's article published in 2006 ranks fifth with 469 citations.

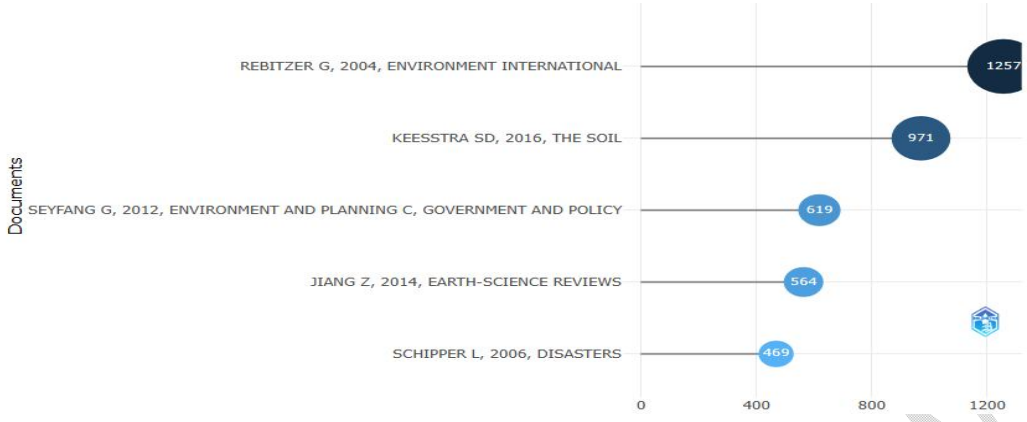

Fig. 5: Most cited dociuments

Source: Compiled by authors from Biblioshiny

Authors' contribution analysis

The contributions of the world's eminent authors in the selected field are shown in Figure 6. The horizontal lines in the figure show how long the author has contributed to publications, the size of the dots shows how many publications there are, and the depth of the blue colour shows how many citations the author has received. In this analysis, we found that the though C. Wamser is the author with highest number of publications, the author who participated for the longest amount of time (from 2009 to 2022) during the research period is J. Richardson. With the most citations, R. Lal is the author who marks the hihest impact in this field follwed by followed by E. Wollenberg.

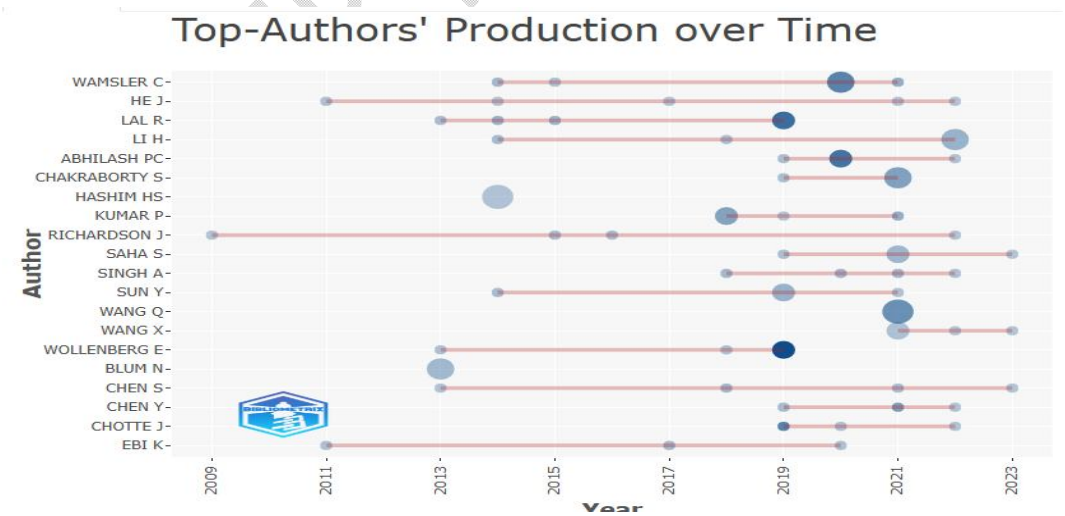

Fig. 6. Top authors' production over time

Source: Compiled from Biblioshiny

Keyword co-occurrence analysis

Since the keywords condense the essence of an article, we can capture the main directions and hotspots in the concern field. Figure 7 illustrates the networks of all keywords extracted from the resultant searched articles. Whole keywords are classified into four clusters and depicted by four different colours (red, green, blue, and yellow). Sustainable development goal (yellow cluster) is the most frequently used keyword among all keywords. Other significant keywords from the yellow cluster are health, water, pollution, poverty, climate action, etc. From red cluster, problem, planning, science, education, society, etc. are frequently used keywords. Region, agriculture, measure, pollution, agriculture, etc. are frequently used keywords in the green cluster. Frequently used keywords from the blue cluster are energy, production, reduction, industry, etc.

Thematic evolution

Fig.8 shows the evolution of themes over the study period. We have divided the total period into 3 time slices. In the first slice i.e., 1991-2015, climate, international, sustainability, challenges and management are the major themes that have evolved to similar themes with some new terms like production, practices and conservation in the second time slice (2016-2019). The latest time slice (2020-2023) includes also basic themes like climate, sustainability, and practices with newer terms like green, assessment and potential. Here the size of rectangular boxes denotes the number of occurrences. So, it can be inferred that climate, sustainability and practices are themes that are mainly focused at present. There are also new themes like green and potential which can be focused with the basic themes in future research.

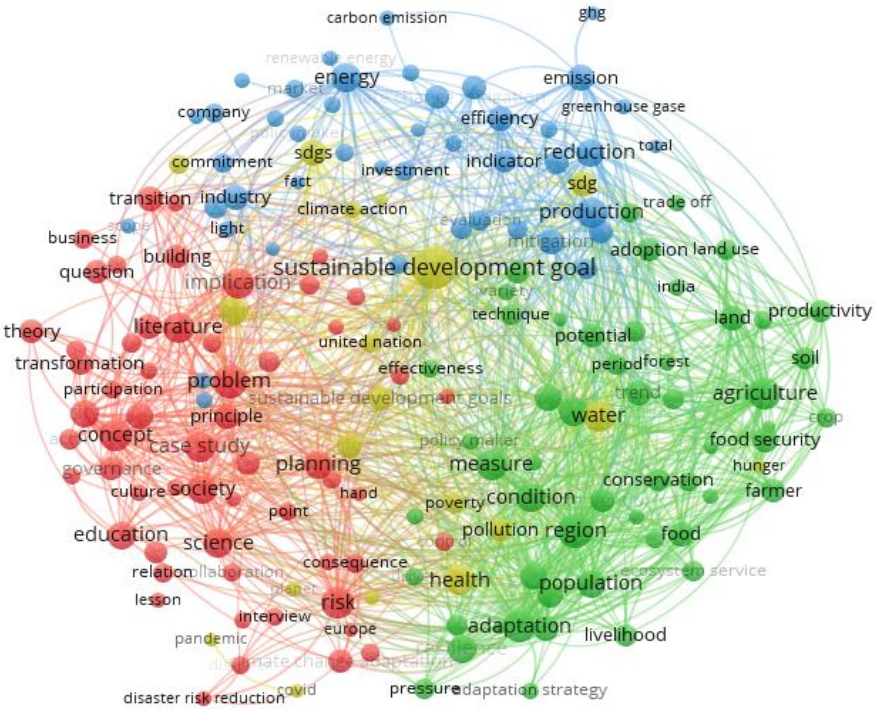

Fig. 7. Keyword co-occurrence network

Source: Compiled from VOSviewer

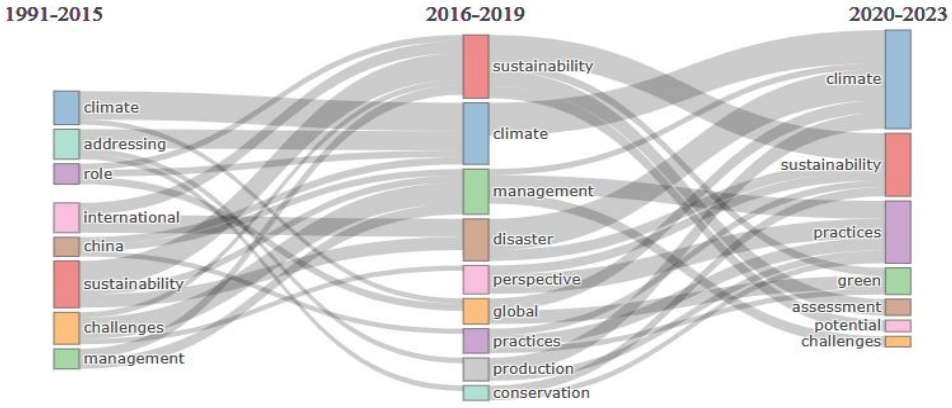

Fig. 8: Thematic evolution

Source: Compiled from Biblioshiny

Conclusion and Future Research Direction

Climate change is one of the most pressing global challenges of our time, and sustainable development practices have a crucial role to play in addressing this issue. In the context of climate change, sustainable development practices include reducing greenhouse gas emissions, increasing the use of renewable energy sources, promoting energy efficiency, and developing more sustainable transportation systems. These practices are essential for mitigating the impacts of climate change and ensuring a sustainable future for all. By adopting sustainable development practices, we can work towards a cleaner, healthier, and more equitable world for ourselves and future generations.

There have been many research studies in the context of climate change and sustainable development practice but still there is a need to study more. Previous studies have explored the impact of education (Di Biase et al., 2022; Makrakis et al., 2012), cultural practice (Duxbury et al., 2017), green construction (Porfiriev et al., 2017), perception and risk (Lai et al., 2021) and others. Jamaliah et al. (2021) emphasised that future research should explore more on barriers to climate change adaptation. Similarly, Boda et al. (2021) opined that future research should focus on developing a proper metrics to measure the loss and damage from climate change.

From the various bibliometric indicators used in this study, we get overall idea about the concerned field. An increasing trend has been observed for the publication trend which implies that more studies should be undertaken in this field. We discovered top authors, top countries, top cited documents, and important themes that should be considered for initiating new studies in the field. The themes discovered through the keyword co-occurrence analysis and thematic evolution should be given more importance in future research in this field.

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