

# Mapping Global Assessment of Green Technology Research: A Scientometric Analysis Based on Web of Science

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## ABSTRACT

The present study aimed to evaluate global research assessment of green technology using web of science database. Bibliometric tools were employed to explore annual growth and ratio growth rate of publication, documents type, language, relative growth rate and doubling time, author productivity, degree of collaboration, institutions, Bradford's law, keywords, country and journals etc., Hiscite, Bibexcel, Biblioshiny and Vosviewer software were utilized to process and analyse the data. The result shows that green technology contributed 5902 publications, the highest number of publications 1504 (16.72%) were published in 2022, the maximum number of 4773 (80.87%) published were article-type documents, most of the publications are published in English language 5854 (99.1%), The mean doubling time for publication is 10.07 years. Finally, the most cited references in the field of green technology research. In this paper, we analyse the Scientometric of green technology research globally. It will help researchers in future.

**Keywords:** Scientometric, Green Technology, Bradford's law, Zip's law, Clean technology, Environmental Technology, Annual Growth Rate, Bibliometric.

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**Received:** 04-04-2024;

**Revised:** 16-05-2024;

**Accepted:** 23-06-2024.

## INTRODUCTION

Green Technology (GT) is wide area of scientific research, including energy, atmosphere, science, agriculture, material science and hydrology to reduce the harmful effects of the same, manufacturers altered the production processes to produce less waste by-products. Oxford English Language dictionary defines environmentally beneficial technology, as applied to mitigating or remediating effects of human activity on the environment green technology also called "Environmental Technology" or "Clean Technology" is the application of one or more environmental science, green chemistry, environmental monitoring and electronic devices to monitor, model and conserve the natural environmental factors and atmosphere, nature effect etc.,

World Intellectual Properties Organization (WIPO) is defined as a Green Technology (GT) that includes both process and product technologies that generate low and no waste and increase resource and energy efficiency. They also cover "end-of-the-pipe" technologies for treating pollution. Green technology does not only mean individual technologies but also systems, including know-how, procedures, goods and services and equipment, as

well as organizational and managerial procedures. Green technology books defined how healthy innovation ecosystems are generating a wealth of green technology solutions. Green technologies can help people adapt to the reality of climate change.

Green technology can be broadly defined as technology that has the potential to significantly improve environmental performance relative to other technology. It is related to the term "environmentally sound technology" and is geared to protect the environment, is less polluting uses all resources in a more sustainable manner, recycles more of its wastes and products and handles residual wastes in a more acceptable manner than the technologies for which they were substituted other related terms for green technology include climate-smart, climate-friendly and low carbon technology. In the year 2022 report analysed the technology trends and practical solutions to combat climate change impact on agriculture and forestry the water sector and cities.

## REVIEW OF LITERATURE

Since there is no specific study on the Scientometric analysis of green technology literature till today, as a result, we have chosen it for analysis. Among the related studies on the subject of enquiry Akbari, M., *et al.* (2022) providing the bibliometric analysis based on green innovation is recognized as one of the main



DOI: 10.5530/jcitation.3.2.19

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factors affecting financial growth, environmental sustainability quality of life. A total number of publications were 283 articles collected from the Web of Science (WoS) database to identify and define green innovation. The VoS viewer, cite space and citNet explorer bibliometric software have been used to build the Green Innovation network. The findings indicate that the Sustainability Journal has the greatest number of studies on green innovation followed by the Journal of Cleaner Production, Business Strategy and the Environment International Journals of Environmental Research and Public Health. The co-citation network of references revealed three clusters of green innovation and performance.

Wang, X., and Gong, X. F., (2022) the article discussed mapping of research in the field of forest therapy-related issues: A bibliometric analysis for 2007-2021. A total number of publications 2545 retrieved from the Web of Science database analyzed the different scientometric parameters such as journal and countries, citations, subject's areas, evolutionary stages, etc. Adel, T.K., *et al.* (2021) in this article did green building construction is considered as an advancement towards sustainable development and providing a balance among health economics and social problems, This study reviews a scientometric analysis of some published articles on the policies, incentives and barriers to GBC from 1990 to 2019. The data was retrieved from the Web of Science database and then analyzed using Hiscite, Citespace and VoSviewers' software. This study focuses on top journals, keywords co-occurrence networks, cluster analysis, the strongest citation burst, co-citation articles, most citations per year and countries for the last three decades. Farrukh, M., and Javed, S., (2021) aimed to analyse the publication structure of academic research on green innovation between 2000 and 2019. We used the Scopus database and then they were analysed through VOS viewer software. A total number of 653 publications were indexed during the period of 2000- 2019. This study identifies the most productive countries, universities, authors, journals and most prolific publications in green innovations. Besides, the study uses VOSviewer software to visualize the mapping based on co-citation bibliographic coupling and co - occurrence of keywords.

Bhardwaj, A.K., *et al.* (2020) this studied the term green products issued commonly to describe the products that seek to protect or enhance the environment during production, use or disposal by conserving resources and minimizing the use of toxic agent pollution and waste, we used the Scopus database using different keywords to the green products. This study used bibliometric tools and various indicators to discern research progress in the field of green products over the period 1964- 2019 the VoS viewer software it applied the map the main trends. A total of 1619 publications during the study period were extracted from the Scopus database using different keywords related to green products. Pang, R., and Zhang, X. (2019) studied bibliometric analysis of a basic review of the evolutionary progress of green manufacturing this study analyses 32 years of development a general cartography of

existing research is now needed to reflect the major ideas and questions involved. We extract high-frequency keywords from the articles and calculate their co-occurrence. In the co-word matrix, six clusters are identified and visually presented by a strategic diagram and bi-dimensional multi-dimensional scaling diagrams. The six clusters cover the research subjects of green chemical materials and green manufacturing. etc. Albort Morant, G., *et al* (2017) the topic of green innovation has increasingly attained organizational relevance due to its contribution to the satisfaction of environmental needs. The study period of 1971-2015 Web of Science core collection database was used to analyze a total number of publications 618 retrieved on green innovation. This paper develops a bibliometric analysis with the aim of assessing the critical papers in the field and identifying the most substantive contributions to the literature. This study presents the following findings the chronological development of the discipline the research trends and prevalent issues in this field and the primary outcomes of green innovation.

## OBJECTIVES OF THE STUDY

In this study, the main objectives are;

- To examine the year wise distribution of publications with annual growth rate and ratio growth rate of green technology.
- To find out the document types and language wise distribution of publication.
- To study the relative growth rate and doubling time.
- To analysis the most prolific authors and degree of collaboration of green technology research publication.
- To most productive institution and most used keywords of research productivity.
- To emphasize the application of Bradford's Law; and
- To study the leading countries and most cited reference journals in Green technology research.

## METHODOLOGY

On July 12, 2023, data was retrieved from the WoS database for this study. By using the following search query, the relevant papers were retrieved from the WoS core collection. TS=(“Green Technology “OR “Environmental Technology “OR “Clean Technology”) TS=Topic. During the search, “keywords” only from 2013 to 2022 were retrieved in order to make sure recent publications would be retrieved.

The search results were about 5902 research papers in total starting from 2013. This paper analyses only 10 years of research output in the green technology research area “publication year” for the period 2013-2022. We used, Hiscite software to analyse the data and VoSviewer software was used for mapping and visualization.

The data were downloaded from the Web of Science database in plain text format. For each text file exported from Histcite software and analysed the bibliometric tools and the different types like the publication year, document types, country, etc., VoS viewers were used to map and visualise.

## ANALYSIS AND INTERPRETATION

### Year-wise distribution of Publication with AGR and RoG

A total number of 5902 published research articles were published the web of science core collection indexed database this study period chosen from 2013 to 2020 in the ten years green technology journals selected for this study is presented in Table 1 and Figure 1 Indicates the year-wise distribution of publications with annual growth rate and ratio growth rate of green technology research during the period of 2013 to 2022 The highest number of publications 1504 (16.72%) were published in the year 2022, followed by 987 (16.72%). The least number of publications were found in the year 2013 (4.26%). The average number of publications per year is 590.20. The gradual increase in the number of publications indicates the changing growth trends of research in green technology research. the annual growth rate of publications on green technology research during the period from 2013 to 2022, It was found that the highest annual growth rate is 52.38 recorded in the year 2022, followed by 38.81 annual growth rate during the year 2021 and the lowest number of annual growth rate zero recorded in 2013, The overall annual growth rate is 204.94 and ratio growth rate is 11.0 showed in Table 1.

### Publication types

In this regard, a total number of 15 types of documents were identified from the 5902 published bibliographic research articles. Table 2 shows how green technology research publications were distributed document-wise over the course of ten years. The maximum number of 4773 (80.87%) published were article-type

documents, followed by review types of documents with 833 (13.7%) publications and followed by article proceedings papers were published 83 (1.4%) the remaining data like article early access, editorial material, meeting abstract, review early access, book review, which comes next of the document wise distribution of publications as shown in Table 2.

### Language wise distribution of Publication

In this regard, a total number of 14 languages were identified from the 5902 published bibliographic research articles. Table 3, it can be found that among the various published languages, most of the publications are published in English language 5854 (99.1%), then it is followed by Chinese 12 (0.2%), Portuguese and Spanish 8 (0.1%) respectively and then continued by German language is 7 (0.1%) publications and then continued by French, Italian, Japanese, Polish language are 2 (0%) publications and Croatian, Korean, Slovak, Turkish, et., The average citation per paper is 55.52. It is visible that the English language is predominantly used and published in green technology research.

### Relative Growth Rate and Doubling Time

Table 4 and Figure 2 present data on the relative growth rate and doubling time for total research output in green technology research. It could be noted that the mean value of the relative growth rate for the study period 2013 to 2022 is 1.87 and 1.29 respectively. The whole data study period records the mean relative growth rate as 1.58. The mean doubling time for publication is 10.07 years. This has been highlighted by the relative growth of the rate for publications which is more than doubling time.

### Authors Productivity

In this regard, a total number of 20410 authors contributed 5902 published bibliographic research articles. Ten 10 authors were identified as shown in Table 5. Based on the number of publications the most prolific author is Li Y has 33 (0.5%) publications. Next

**Table 1: Year - wise publication with AGR and RoG.**

Publication Year (PY)	Total Papers (TP)	Annual Growth Rate (AGR)	Ratio Growth Rate (RoG)
2013	252	0	0
2014	269	6.74	1.06
2015	318	18.21	1.18
2016	381	19.81	1.19
2017	403	5.77	1.05
2018	464	15.13	1.15
2019	613	32.11	1.32
2020	711	15.98	1.15
2021	987	38.81	1.38
2022	1504	52.38	1.52
Total	5902	204.94	11.0

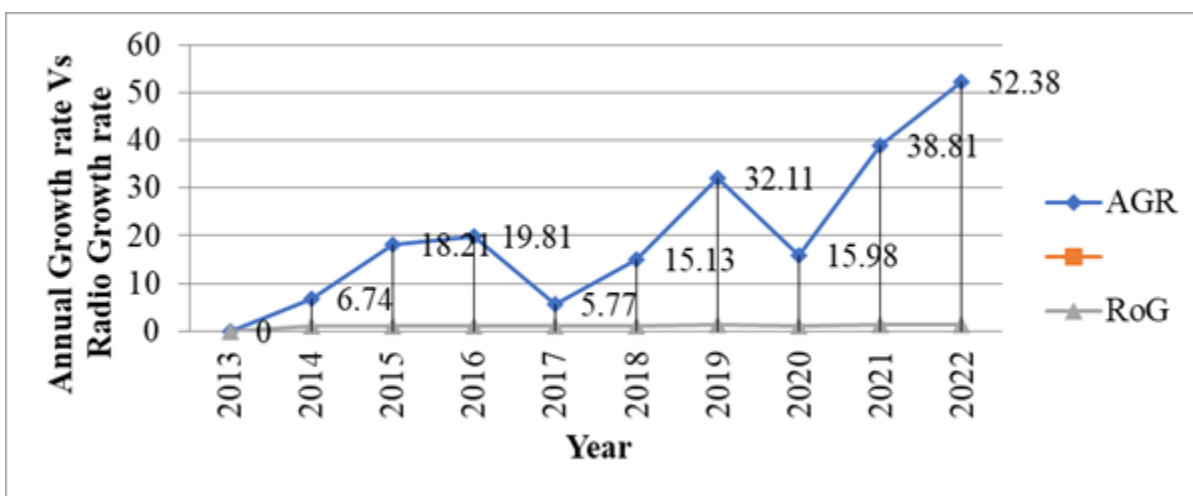


Figure 1: Year wise distribution of publication with AGR and RoG.

Table 2: Document wise distribution of Publication.

Sl. No.	Document Types (DT)	Total Publication (TP)	Cumulative Total Publication (CTP)	%	Cumulative %
1.	Article	4773	4773	80.87	80.87
2.	Review	833	5606	13.7	94.57
3.	Article proceedings paper	83	5689	1.4	95.97
4.	Article early access	78	5767	1.3	97.27
5.	Editorial material	76	5843	1.3	98.57
6.	Meeting abstract	17	5860	0.3	98.87
7.	Review early access	14	5874	0.2	99.07
8.	Book review	7	5881	0.1	99.17
9.	Article book chapter	6	5887	0.1	99.27
10.	Correction	5	5892	0.1	99.37
11.	News Item	4	5896	0.1	99.47
12.	Letter	2	5898	0.0	100
13.	Review book chapter	2	5900	0.0	100
14.	Article retracted publication	1	5901	0.0	100
15.	Item Withdrawal	1	5902	0.0	100
	Total	5902		100	

level the most prolific author is Liu Y 31 (0.5%) publications, which is followed by Wang Y and Zhang Y 26 (0.4%) publications respectively and also Wang L and Zhang J 20 (0.3%) publications, the least prolific author is Li X who has 19 productivity, However, the result would be quite different if the listing done by Total Global Citation received by Zhang J (975) Publications, The Total local citation score is Chen X is 45 publications.

### Degree of Collaboration

Single and Multiple authors are the major finding of the study was that the green technology research output domain is

highly collaborative as the analysis of data resulted in multiple authorships of the paper is used to measure the extent of the research collaboration. According to Subramanyam, the formula is used to analysis the data (Table 6).

$$DC = \frac{Nm}{(Nm + Ns)}$$

Where,

Nm=No. of multi authored research papers,

Ns=No. of single authored papers.

**Table 3: Language wise distribution of Publication.**

Sl. No.	Language	Total Publication (TP)	Total Citation	Average Citation per Paper (ACPP)
1.	English	5854	167114	28.54
2.	Chinese	12	70	5.83
3.	Portuguese	8	55	6.87
4.	Spanish	8	16	2.0
5.	German	7	2	0.28
6.	French	2	5	2.5
7.	Italian	2	1	0.5
8.	Japanese	2	3	1.5
9.	Polish	2	7	3.5
10.	Croatian	1	0	0.0
11.	Korean	1	2	2.0
12.	Slovak	1	1	1
13.	Turkish	1	1	1
14.	Unspecified	1	0	0
	Total	5902	167277	55.52

**Table 4: Relative growth rate and doubling time in green technology research.**

Year	No. of Publication	Cumulative No. of Publication	W1	W2	RGR (W2 -W1)	Mean R (a)	Dt /0.693	Mean Dt (a)
2013	252	252	0.00	5.52	0.00	1.87	0.00	6.63
2014	269	521	5.52	6.25	0.73		0.94	
2015	318	839	6.25	6.73	0.48		1.44	
2016	381	1220	6.73	7.10	0.37		1.87	
2017	403	1623	7.1	7.39	0.29		2.38	
2018	464	2087	7.39	7.64	0.25	1.29	2.77	13.51
2019	613	2700	7.64	7.90	0.26		2.66	
2020	711	3411	7.9	8.13	0.23		3.01	
2021	987	4398	8.13	8.38	0.25		2.77	
2022	1504	5902	8.38	8.68	0.3		2.30	
Mean						1.58		10.07

Subramanian's, formula used. It is expressed as

$$\begin{aligned}
 DC &= \frac{Nm}{(Nm + Ns)} \\
 &= \frac{5561}{(341 + 5561)} \\
 &= \frac{5561}{5902} \\
 &= 0.94
 \end{aligned}$$

The degree of collaboration is determined using this formula based on this study, the result of degree of collaboration DC=0.94, i.e., 94% is of articles published in a collaborated manner among the global research.

### Most Productive institution

Table 7 above show the top ten institution' contribution and collaboration of networks in the field of green technology which depicts that out of the top ten institutions which are ranked based on total articles published one country namely China have six institutions and Malaysia from three counties name and Saudi Arabia country one name. The highest number of articles was produced in the Chinese Academy of Science with 101 (1.7%) Publications in first rank followed by Jiangsu University with 60 (1%) publications in the second rank, as a third rank institution, King Saudi University produced by 50 (0.85). University of Chinese Academy of Science and University Putra Malaysia, each institution produced 41 (0.7%) Publications, seventh rank, Hunan University and Shanghai Jiao Tong University each

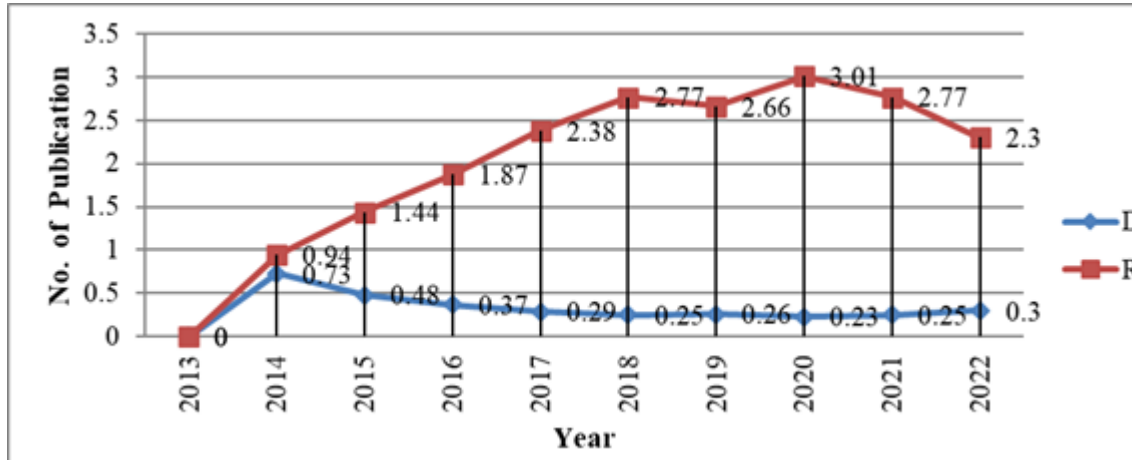


Figure 2: Relative growth rate of doubling time.

Table 5: Author Productivity based on Publication.

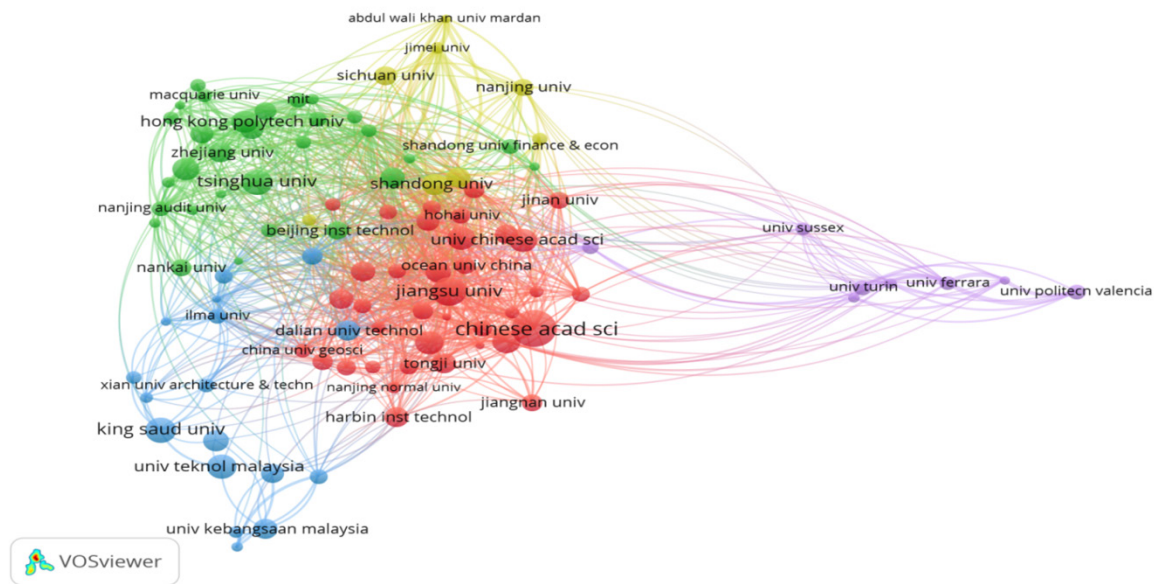
Sl. No.	Author	Total Publications	%	TLCS	TGCS	TLCR	TLCsb	TLCse
1.	Li Y	33	0.5	8	906	12	2	
2.	Liu Y	31	0.5	6	661	21	1	
3.	Wang Y	26	0.4	11	581	18	2	
4.	Zhang Y	26	0.4	8	523	14	0	
5.	Li J	25	0.4	5	698	26	0	
6.	Wang J	22	0.4	3	885	11	1	
7.	Chen X	21	0.3	45	732	30	10	14
8.	Wang L	20	0.3	2	770	12	0	
9.	Zhang J	20	0.3	23	975	20	6	
10.	Li X	19	0.3	3	287	9	0	

Table 6: Single Author Vs Multi Author and Degree of Collaboration.

Year	Single Authors (Ns)		Multiple Author (Nm)		Total Citation	Degree of Collaboration
	NP	%	NP	%		
2013	36	10.55	216	3.88	252	0.85
2014	33	9.67	236	4.24	269	0.87
2015	32	9.38	286	5.14	318	0.89
2016	28	8.21	353	6.34	381	0.92
2017	33	9.67	370	6.65	403	0.91
2018	24	7.03	440	7.91	464	0.94
2019	33	9.67	580	10.42	613	0.94
2020	33	9.67	678	12.19	711	0.95
2021	40	11.73	947	17.02	987	0.95
2022	49	14.36	1455	26.16	1504	0.96
Total	341	100	5561	100	5902	0.94

**Table 7: The top 10 most productive institutions.**

Name of Institution	Total Publication	%	Total Citation	ACCP	Country	Rank
Chinese Academy of Science.	101	1.7	4761	47.13	China	1
Jiangsu University.	60	1	2161	36.01	China	2
King Saudi University.	50	0.8	1367	27.34	Saudi Arabia	3
Tsinghu University.	49	0.8	1785	36.42	China	4
University Teknikal Malaysia.	46	0.8	1823	39.63	Malaysia	5
University Malaya.	43	0.7	1637	38.06	Malaysia	6
University of Chinese Academy of Science.	41	0.7	1880	45.85	China	7
University Putra Malaysia.	41	0.7	1640	40.00	Malaysia	7
Hunan University.	39	0.6	1211	31.05	China	8
Shanghai Jiao Tong University.	39	0.6	1555	39.87	China	8



**Figure 3:** Overlay Visualization (Co- occurrence of Institution).

institution produced by same 39 90.6%) publications eighth rank. The highest number of citations and Average Citation per Paper (ACPP) was produced by the Chinese Academy of Science institution with 4761 (47.13) and the least number of citations and average number per paper was produced by Hunan University and King Saudi University Institution with 1211 (27.34) (Figure 3).

**Application of Bradford’s Law**

Table 8 found that 29 journals covered more than one-third of the total articles published. The next 210 journals covered another one-third of the articles and the remaining 1084 journals the last one-third of the published articles. According to Bradford’s distribution, the relationship between the zone is 1: n: n<sup>2</sup>, while the relationship between each zone of the present study is 29: 210:1084, thus it does not fit into Bradford’s distribution.

**Most Productive Keywords**

In this regard, one of the crucial parameters is the keywords as they determine and emphasise the fundamental subject of the study area. “Co-occurrence” was selected as the “analysis type” for the evaluation and “all keywords” was chosen as the “analysis unit” A total of 26361 keywords, 2105 meet the threshold keywords were kept. Table 9 presents a list of the top 10 words that appear most frequently in published literature on the topic. Performance, impact, Green technology, CO2 emissions, innovation and China are the six keywords that come up the most frequently in the context of this area of research. Figure 4 presents the network visualisation map of keywords, illustrating their connections, co-occurrences and density in a manner that is proportionate to the frequency with which they appear. The size of a keyword circle in figure reflects how frequently it appears in articles, while the placement of the circle that are significantly larger than the

**Table 8: Ranking of journals according to Bradford’s Law.**

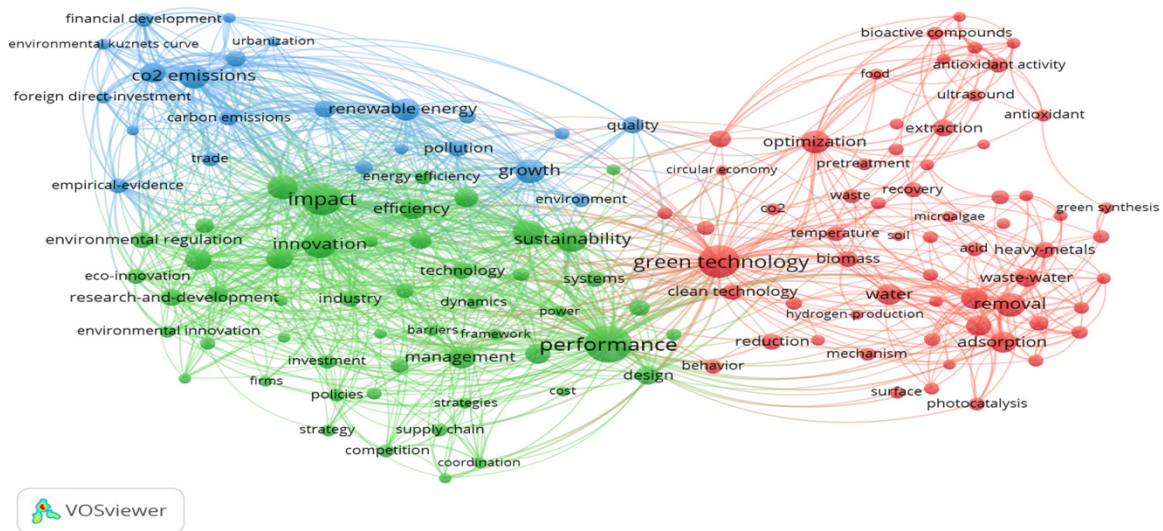
	No. of Journals	No. of Articles	Total No. of Articles	Cumulative No. of Articles
First Zone	1	387	387	387
	1	255	255	642
	1	238	238	880
	1	82	82	962
	1	78	78	1040
	1	71	71	1111
	1	65	65	1176
	1	63	63	1239
	1	61	61	1300
	1	60	60	1360
	2	43	86	1446
	1	42	42	1488
	1	40	40	1528
	1	37	37	1565
	2	36	72	1637
	2	35	70	1707
	1	34	34	1741
	2	33	66	1807
	1	32	32	1839
	1	31	31	1870
	1	30	30	1900
	2	29	58	1958
	2(29)	28	56	2014(32597)
	Second Zone	1	27	27
3		26	78	2119
2		25	50	2169
1		24	24	2193
1		23	23	2216
2		22	44	2260
2		21	42	2302
2		20	40	2342
2		19	38	2380
3		18	54	2434
4		17	68	2502
6		16	96	2598
8		15	120	2718
7		14	98	2816
4		13	52	2868
12		12	144	3012
10		11	110	3122
12		10	120	3242
13		9	117	3359



	No. of Journals	No. of Articles	Total No. of Articles	Cumulative No. of Articles
Third Zone	14	8	112	3471
	19	7	133	3604
	32	6	192	3796
	50(210)	5	250	4046(63610)
	82	4	328	4374
	119	3	357	4731
	288	2	576	5307
	595(1084)	1	595	5902(20314)
	1271		5902	

**Table 9: 10 of the most often used terms in green technology research.**

Sl. No.	Keywords	Occurrences	Total link Strength
1	Performance	613	2910
2	Impact	452	2482
3	Green technology	491	2029
4	Co2 emissions	267	1916
5	Innovation	300	1660
6	China	271	1523
7	Economic growth	186	1530
8	Growth	255	1304
9	Energy	274	1302
10	Removal	268	1271



**Figure 4: Keyword analysis (Network visualisation).**

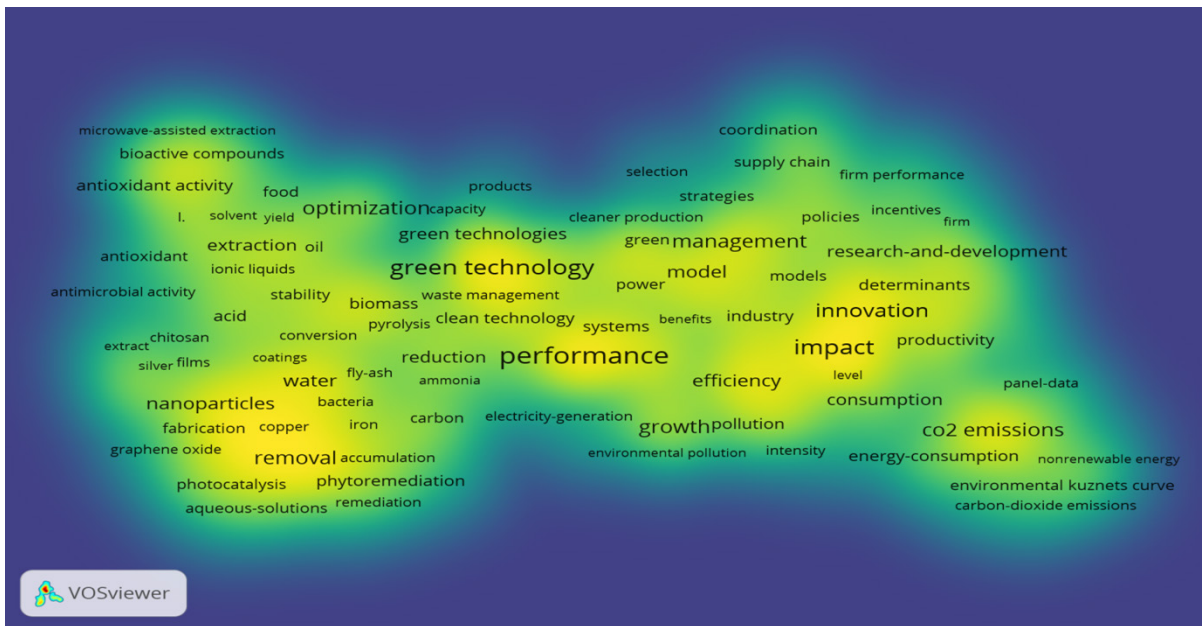


Figure 5: Keyword analysis (density visualisation).

Table 10: The leading countries based on published documents in the current study topic.

Sl. No.	Name of Country	Total Publications	Total citations Received	Total link Strength
1.	China	1906	54925	4632
2.	USA	672	24595	1737
3.	England	302	10432	994
4.	Pakistan	201	5535	957
5.	Malaysia	300	11568	862
6.	India	620	14990	842
7.	Italy	299	7353	819
8.	Canada	222	7861	776
9.	Australia	225	8082	684
10.	France	183	6751	599

others, which suggests that these keywords are very important to the study of green technology. The graph draws attention to word clusters in a way that demonstrates the frequency with which they occur together in a range of publications. the network visualisation there are three colours that each indicate a different cluster: green, red and blue. Figure 5 presents the density visualization intensity of the colours yellow and green listed from highest to lowest, performance has more yellow markers, which indicates that it has a higher density concentration, because of this revelation, prospective authors will have a better chance of selecting keywords that facilitate access to research on a certain subject.

### The Leading Countries

The contribution of several countries to green technology research is already substantial, yet there is room for improvement. The

network map is created to facilitate access to green technology countries. Countries were chosen as the type of analysis is “citation” and the unit of analysis is “countries” A total of 15 documents per country was set and 10 countries satisfied this threshold. Table 10 has produced a minimum of 15 documents in the current topic of research, Peoples of China, USA England, Pakistan, Malaysia, and India provided the most number of papers, 1906, 672, 302, 201,300 and 620 respectively. Moreover China, USA, England, Pakistan, Malaysia and earned the most citations, with China obtaining 54925, the USA, receiving 24595, England 10432, Pakistan 201, Malaysia 300, citations and India 14990 citations, respectively. Figure 6 presents a depiction of the scientific mapping as well as an illustration of the density of international connections made through citations. The density visualisation map in Figure 7 illustrates that the more engaging countries have a higher density.

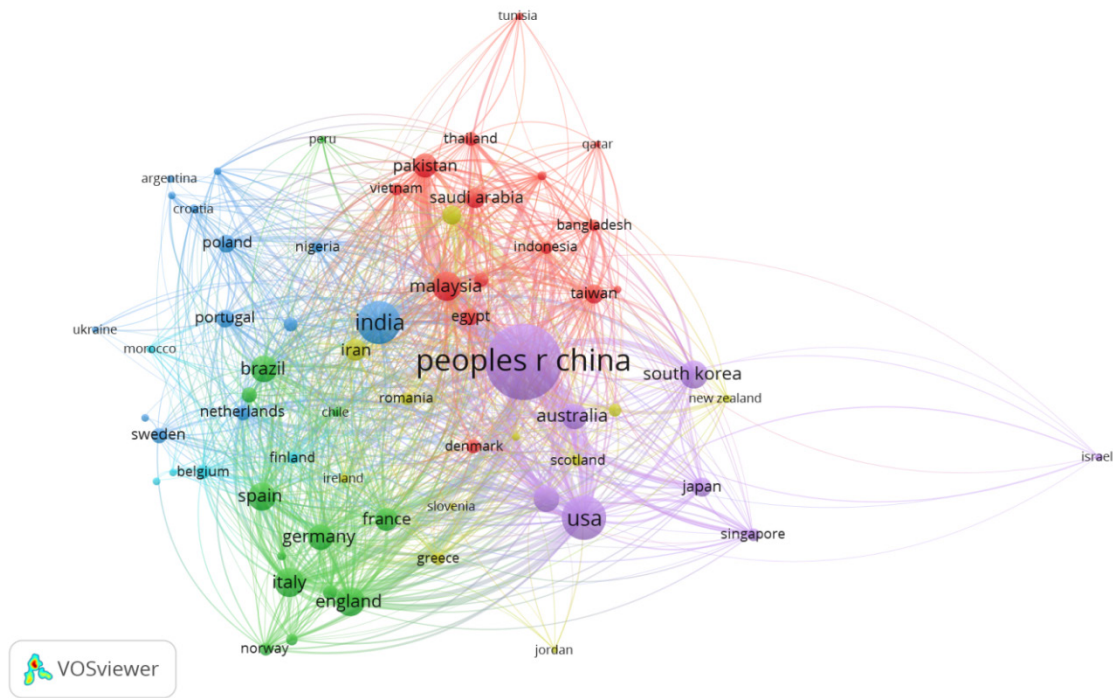


Figure 6: Network visualization of countries having a minimum of 15 publications in the relevant study field until 2022.

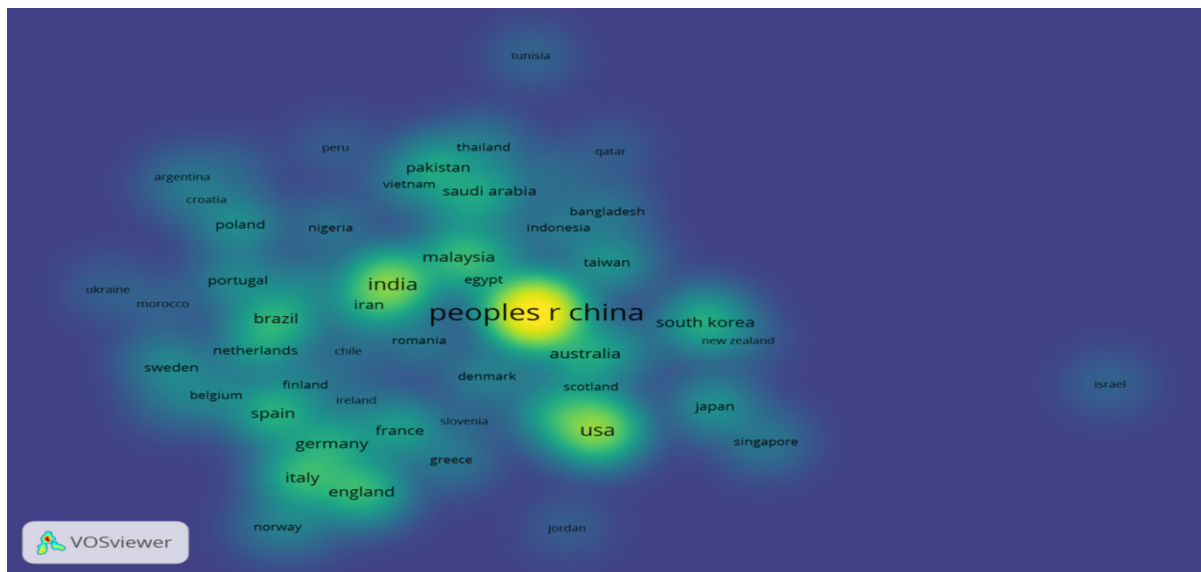


Figure 7: Density visualization of countries having a minimum of 15 publications in the relevant study field until 2022.

### Most Cited Reference Journals

Table 11 depicts the top 10 most cited references on Green technology research output during the study period. The top 10 cited reference lead to Porter Me, 1995, Econ Perspect, V9, P 97 doi 10.1257/jep.9.4.97 is 220 (3.6%), citations followed by Acemoglu D, 2012, Am M Econ Rev, V102, P131, Doi 10.1257/

aer.102.1.131 is 126 (2.1%) citation. V102, P131, DOI 10.1257/aer.102.1.131 is 126 (2.1%) citations.

### Findings

The findings of the present study are as follows: Global publication trends in green technology research are increasing year by year. Annual growth rate is 204.94 and ratio growth rate is

**Table 11: The top 10 most cited reference journals.**

Sl. No.	Cited References	Year	DOI Number	Total publication	%
1.	Porter Me, Journal of Econ Perspect, V9, P97,	1995	10.1257/jep.9.4.97	220	3.6
2.	Acemoglu D, Am Econ Rev, V102, P131,	2012	10.1257/aer.102.1.131	126	2.1
3.	Krass D, Prod Oper Manag, V22, P1035,	2013	10.1111/poms.12023	90	1.5
4.	Pesaran MH, J Appl Economist, V22, P265,	2007	10.1002/jae.951	86	1.4
5.	Brunnermeier SB, J Environ Econ Manag, V45, P278,	2003	10.1016/S0095-0696(02)00058-X	85	1.4
6.	Rennings K, Ecol Econ, V32, P319,	2000	10.1016/S0921-8009(99)00112-3	80	1.3
7.	Jaffe AB, Rev Econ Econ Stat, V79, P610,	1997	10.1162/003465397557196	79	1.3
8.	Grossman Gm, Q J Econ, V110, P353,	1995	10.2307/2118443	7.5	1.2
9.	Horbach J, Res Policy, V37, P163,	2008	10.1016/j.respol.2007.08.006	71	1.2
10.	Johnstone N, Environ Resource Econ, V45, P133,	2010	10.1007/s10640-009-9309-1	6.9	1.1

11.0. Most of the authors preferred to write their research article in English Language is 5854. The maximum number of 4773 (80.87%) published were article type of Documents. The most prolific author is Li Y has 33 (0.5%) published green technology research. Mean relative growth rate is 1.58. Mean doubling time of publications is 10.07 years. Degree of collaboration is 0.94. The Chinese Academy of Science had the highest number of articles produced Institution with 101(1.7%) Publication and Average Citation per Paper (ACPP) with 4761(47.13). Twenty-nine journals covered more than one-third of the total articles, next 210 Journals covered more than one-third of articles and 1084 journals the last one-third, this does not fit in Bradford's law is 29: 210:1084, thus it does not fit into Bradford's distribution. Highly used keyword in the discipline is "Green" "Technology" and "Environmental" "Keywords. Zipf's law is valid in Green technology research literature. Most cited reference lead to Porter me, 1995, J Econ Perspect, V9, P97, DOI 10.1257/jep.9.4.97 is 220 (3.6%).

## CONCLUSION

In this study, Green technology research output during the period of 2013 to 2022. It was found that the green technology research since 2013 began least productivity during the study period year the research productivity going to peak, the environmental technology or green technology or clean technology become a safe environment effect produce the green technology encompasses a wide area of scientific research, including energy, atmospheric

science, agriculture, material science and hydrology to reduce the harmful effect of the same, manufactures altered the production process to produce fewer waste by-products. In addition, the future of green technology has less effect on atmosphere the productivity also increasing. In future, we find the something new ideas.

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**Cite this article:** Ravi S, Devi PA, Palaniappan M. Mapping Global Assessment of Green Technology Research: A Scientometric Analysis Based on Web of Science. *Journal of Data Science, Informetrics, and Citation Studies*. 2024;3(2):170-82.