



**SCIENTOMETRIC ANALYSIS OF RESEARCH PUBLICATIONS ON  
SUSTAINABLE LIBRARY**

**K.Thishanth Kumar**

Research Scholar, Madurai Kamaraj University, Madurai

**Dr.G.Amudha**

Librarian, VHNSN College, Virudhunagar

**Abstract**

Sustainable Library' is a modern library that uses environmentally friendly building materials, maximizes the use of natural resources, reduces waste, maximizes the use of renewable resources, and conducts its operations in a more cost effective and efficient manner. This study aimed to quantify the number of contributions made by scientists working in the field of Sustainable Libraries and disseminated through the Web of Science database between 2013 and 2022. Data were tabulated using MS Excel and analyzed using programmes like Bibexcel and Vos viewer. The findings showed that 1926 papers were published between 2013 and 2022, with 278 (14.43%) of those publications coming in 2021. The distribution of the research by language revealed that 1912 (99.27%) of the papers were written in the English Language, which is the most often used scholarly language. Compared to single – authors publications, the trends in multi-authored papers have dramatically increased (96.21%), outpacing them by 3.79%. the biggest number of papers (921) were contributed by the group, and the degree of collaboration (0.96) is notable.

**Keywords:** Sustainable Library; Scientometrics; Degree of Collaboration; Relative Growth; Doubling Time.

**1.1 Introduction**

Scientific calculus is used to organize, categories, and quantitatively evaluate the publication patterns of all macro and micro communications as well as their authors. The measuring of scientific output and the influence of research on public policy is known as scientometrics. To recognize the advancement of knowledge and research trends. To gauge how comprehensive secondary magazines are. To determine authorship and its tendencies in texts on different science topics.

The term bibliometrics was coined by Pritchard<sup>1</sup> in 1969 upon observing that the previously used phrase, “statistical bibliography”, was clumsy and lacked clarity. He defined Bibliometrics as the “application of mathematical and statistical methods to books and other media of communication”. Potter<sup>2</sup> (1981) defines bibliometrics as the “study and

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Pritchard, Alan, 'Statistical Bibliography Or Bibliometrics?', Journal Of Documentation, 25(4) Dec <sup>1</sup> 1969, 348-349.

[Http://Independent.Academia.Edu/Alanpritchard/Papers/602982/Statistical\\_Bibliography\\_Or\\_Bibliometrics](http://Independent.Academia.Edu/Alanpritchard/Papers/602982/Statistical_Bibliography_Or_Bibliometrics)

<sup>2</sup> Potter, W.G. (1981a). Introduction. Library Trends, 30, 5-7

measurement of the publication patterns of all forms of written communication and their authors". A number of researchers have defined bibliometrics in relation to their field of study or according to its incorporation in different disciplines. The major definitions of bibliometrics include

- The use of mathematical and statistical methods in order to study the use of materials and services within a library, or to analyze the historical development of a specific body of literature, particularly its authorship, publication, and use (Reitz, 2002). According to the author, bibliometric analyses can be applied to library usage and to study the growth of literature by the number of authors, publications and usage. The former description of bibliometrics is termed Librametry, which Rao & Neelameghan (1992:243) define as the "quantitative methods applied to library management and services".
- The application of mathematical and statistical methods to the study of the use made of books and other media within and between library systems (Prytherch in Diodato, 1994).
- The application of mathematical and statistical methods to the measurement of quantitative and qualitative changes in collections of books and media (Ungern-Sternberg, 1995,<sup>3</sup>).
- The application of quantitative methods to the study of information resources (Wallace, 1989:10)<sup>4</sup>.
- A study that uses statistical and mathematical methods to analyze the literature of a discipline as it is patterned in its bibliographies (Standerfer, 1998).<sup>5</sup>

## **1.2 Sustainable Library**

A library which seeks to minimize its adverse environmental impacts and increase the quality of the environment in houses and apartments by choosing different its location, using natural building materials, biodegradable products, conserving resources like water, the idea of a "green library" is still in its infancy. 'Green Library' and 'Sustainability' are topics with a limited amount of material, but it is growing. In recent years, numerous publications geared towards international librarians have covered a lot of the connected subjects of green libraries and sustainability.

In India, Sustainable libraries are called as green libraries, are gaining momentum as they embrace environmentally responsible practices to minimize their impact on the environment. These libraries focus on reducing energy consumption, promoting waste reduction and

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Von Ungern-Sternberg, S. (1995). Applications In Teaching Bibliometrics. Retrieved From <sup>3</sup>  
[Http://Archive.Ifla.Org/lv/lfla61/61-Ungs.Htm](http://Archive.Ifla.Org/lv/lfla61/61-Ungs.Htm)

Wallace, D. P. (1989). Bibliometrics And Citation Analysis. In: Principles And Applications Of <sup>4</sup>  
Information Science For Library Professionals. Chicago: American Library Association, 10-26.

Standerfer, A. (1998). Bradford's Law. Retrieved March 18th, 2002, From The University Of Illinois, <sup>5</sup>  
Graduate School Of Library And Information Science Website:  
[Http://Alexia.Lis.Uiuc.Edu/~Standrfr/Bradford.Html](http://Alexia.Lis.Uiuc.Edu/~Standrfr/Bradford.Html)

recycling, integrating green building techniques, and incorporating environmental sustainability into library programming.

### **1.2.2. Green Library Management**

The library administration can check the user services, the library management to see what can be planned; a checklist is an easy way to identify what the library can do on an institutional level. A good checklist is a tool to identify the green potential for further steps to achieve a convincing green image. The aim of the library is to be part of an overall strategy. Create your own “eco-action plan” according to the aims of the whole organization. The impact for the library is to participate in wider programmes and thus be part of a green profile for the entire institution. There are various projects are under taken by various ministry of government of India to redirect the mode of change to a green India and also big companies in private sectors both nationally and internationally. The some aspect of a building's architecture makes its green architecture. The libraries have specific challenges to overall green building movement. The main goal of green building is to develop and use sustainable energy – efficient resources in construction, maintenance and over all life of the structure.

Some examples of Sustainable Libraries:

**Anna Centenary Library, Chennai:** The library is well equipping with modern technology and proper use light, air and wood. It is reputed green libraries in India which is gold rating by LEED(Leadership in Energy and Environmental Design).

**Delhi University Library, Delhi:** A green library initiative with a focus on natural cooling and pleasant reading spaces.

**Calcutta University Library, Kolkata:** A library that incorporates large, open reading areas and thick walls to create natural cooling.

**Karnataka University Library, Dharwad:** Another notable example of a green library in India.

**NIT Silchar Library:** A library under construction designed according to LEED certification standards for green libraries.

**Perma Karpo Library, Ladakh:** Features solar panels and a green area with a white lotus garden.

### **2.1. Review of Literature**

Sujit Bhattacharya and Jayanthi A Pushkaran (2012) <sup>6</sup>applied bibliometric and innovation indicators to underscore to what extent India is making an assertion in nanoscience and nanotechnology. They found that India has made significant progress in nanotechnology research. It is now the seventh most active country publishing in this field. Significant upward trends are on account of increasing activity of institutions, increase in number of institutions involved in publishing, wider set of journals used for publication and increasing collaborations. Research is exhibiting more interdisciplinary characteristics (reflection through journals) and activity within different subfields of nanotechnology. India's global share and contribution among highly cited papers are increasing. Publication analysis underscores the

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<sup>6</sup> Sujit Bhattacharya And Jayanthi A Pushkaran (2012). Nanotechnology Research And Innovation In India: Drawing Insights From Bibliometric Indicators. Csir-Nistads Strategy Paper On Nanotechnology, No. li - July 2012, Nistads, India.

role of collaboration. Collaboration is instrumental in increasing output, helping in publishing in high impact factor journals and in papers attracting citations.

The Australian Academy of Science (2009)<sup>7</sup> studied the trend of Nanotechnology research in Australia by collecting data from Web of Science using different nanotechnology related terms as query strings. It was found that Nanotechnology research is strong across a variety of sub-disciplines and is continuing to grow at a rapid rate (6 to 7% increase in publications per year). Much of the research being undertaken and published by Australian nanotechnology researchers is at the basic and/or applied level of development, which is to be expected given the strong role of universities in Australia’s innovation sector. It was also found that Australian nanotechnology research is increasingly and solidly integrated with the international community.

Alan L. Porter and Jan Youtie(2009)<sup>8</sup> realized that, understanding the multidisciplinary nature of nanoscience and nanotechnology, and their relationships with other areas of research, is important for science policy, funding, research management and effective knowledge transfer. They found that nanopapers have been published in 151 of the 175 subject categories in the SCI in the period January–July 2008, with 52 subject categories containing 100 or more of these papers. These results affirm the multidisciplinary nature of research into nanoscience and nanotechnology, although the integration scores make it clear that much non-nano research is also comparably interdisciplinary. It is also clear that much nanoresearch is concentrated in the macrodisciplines of materials science and chemistry, and that researchers in the field tend to cite work in neighbouring fields more than work in more distant fields.

**3.1. Methodology**

Using the topic option, the data (1962) were extracted from the Web of Science database. The term “Sustainable Library” was the subject of the research, and core journals were the focus of the study. The study assesses the whole body of literature produced over a ten-year period (2013 to 2022).

**3.2 Objectives of the study**

- ⇒ To analyze the year-wise publication
- ⇒ To understand the Document Type
- ⇒ To find out the country wise records
- ⇒ To measure the year wise authorship pattern
- ⇒ To observe the single author vs multi-author
- ⇒ To determine the degree of collaboration
- ⇒ To measure the relative growth rate and doubling time

**Table 1 Sustainable Library Research Article During 2018 to 2022**

S. No	Details About Sample	Observed Value
1.	Duration	2013 to 2022

Australian Academy Of Science (2009). Nanotechnology In Australia: Trends, Applications And Collaborative Opportunities. [www.Science.Org.Au/Reports/Nanotechnology09.Pdf](http://www.Science.Org.Au/Reports/Nanotechnology09.Pdf)

<sup>8</sup> Alan L. Porter And Jan Youtie(2009). Where Does Nanotechnology Belong In The Map Of Science? Nature Nanotechnology. Vol.4. Pp.534-536

2.	Time Span	10 years
3.	Total Records	1926
4.	Document Types	10
5.	Languages	6
6.	Contributing Countries	23

Table 1 indicated the period of research publications from the year 2013 to 2022, we got 1926 articles between the year based on the research article instead of keyword Analysis “Sustainable Library”

**Table 2 Types of Documents**

Document Types	Record Count	% of 1,926
Article	1,654	85.88%
Review Article	259	13.45%
Early Access	21	1.09%
Proceeding Paper	8	0.42%
Book Chapters	6	0.31%
Book Review	5	0.26%
Editorial Material	5	0.26%
Data Paper	2	0.10%
Meeting Abstract	2	0.10%
Art Exhibit Review	1	0.05%

From the above analysis, it is declared that the Article (1654) from to be the most preferred form of publications among the Sustainable Library. The other preferred form Review Article. This is the second rank respectively. And the lowest record on Art Exhibit Review.

**Table 3 Year-wise Distribution**

Publication Years	Record Count	% of 1,926	Citing Articles	Times Cited	H-Index
2021	278	14.43%	2514	2536	17
2022	251	13.03%	315	315	7
2020	218	11.32%	2961	3012	25
2019	197	10.23%	2945	2966	28
2018	173	8.98%	4432	4521	31
2014	171	8.88%	4133	4265	35
2016	169	8.78%	4242	4349	34
2015	161	8.36%	4802	4876	42
2013	154	8.00%	5893	5944	37
2017	154	8.00%	3231	3270	31
Total	1926	100%			

The yearly output of Sustainable Library at world level resulted that There is about 1926 total output in the last ten years. In the year 2021, the output measure is 278 (14.43%); this is the highest records out of 1926 records. In the year 2017 and 2013, the output measured is 154 (08%); this is the lowest records out of 1926 records.

**Table 4: Language-wise Publication**

Language	Record Count	% of 1,926
English	1.912	99.27%
Chinese	6	0.31%
Portuguese	3	0.16%
Spanish	3	0.16%
French	1	0.05%
Japanese	1	0.05%

The language wise distribution of research output is 06 different languages. The majority of the scientists prefer publishing output in the English language. It is rated to be about 1912. Out of total output 1926, the English language occupies to be the top and it is calculated to 99.27 percentages. The next language is Chinese which is accounted to 06 (0.31%), Portuguese and Spanish 03 (0.16%). French and Japanese languages are having 010.5%.

**Table – 5: Ranking of Countries**

Rank	Countries	Record Count	% of 1,926
1	China	525	27.26%
2	USA	454	23.57%
3	India	193	10.02%
4	England	110	5.71%
5	Germany	109	5.66%
6	Japan	104	5.40%
7	South Korea	74	3.94%
8	Italy	73	3.79%
9	Iran	67	3.48%
10	France	64	3.32%

The analysis brings out the fact the China is ranked to be the first and it has given producing of 525 (27.26%) records. The China is considered to the most productive country is brought out research. The second rank is occupied by USA which has 193 (10.02%) publications output. India is ranked to the 3<sup>rd</sup> in order. The output of INDIA is accounted to 193.

**Table – 6: Types of Web of Science Index**

Web of Science Index	Record Count	% of 1,926
Science Citation Index Expanded (SCI-EXPANDED)	1,857	96.42%
Index Chemicus (IC)	105	5.45%
Social Sciences Citation Index (SSCI)	97	5.04%
Current Chemical Reactions (CCR-EXPANDED)	85	4.41%
Arts & Humanities Citation Index (A & HCI)	45	2.34%
Conference Proceedings Citation Index – Science (CPCI-S)	8	0.42%
Book Citation Index – Science (BKCI-S)	6	0.31%
Conference Proceedings Citation Index – Social Science & Humanities (CPCI-SSH)	2	0.10%

There have been 1857 (96.42%) papers published by Science Citation Index Expanded (SCI-EXPANDED). It ranked at first place of research output in the field of Sustainable Library. The second position is taken by index Cheicus (IC) 105 (5.45%) papers published. Social Sciences Citation Index (SSCI) 97 (5.04%) publications. The last position occupied in the Conference Proceedings Citation Index – Social Science & Humanities (CPCI-SSH) has published 02 (0.10%) articles.

**Table-7: Year-wise Authorship Pattern**

Year	1*	2*	3*	4*	5*	5+*	Total
2013	3	16	19	27	28	61	154
2014	9	13	19	25	21	84	171
2015	9	16	17	20	25	74	161
2016	4	9	22	26	23	85	169
2017	5	14	19	23	18	75	154
2018	9	21	20	24	26	73	173
2019	2	20	22	36	22	95	197
2020	10	12	33	34	33	96	218
2021	5	19	34	38	38	144	278
2022	17	24	25	20	31	134	251
Total	73	164	230	273	265	921	1926

1\* one author 2\* two author 3\* three author 4\* four author 5\* five author 5+\*above five author

In clearly indicated it could be observed from the results that more than above five authored publications (921) rank first in the total research output. The four authored (273) papers follow second in the total research contributions. Five authored (265) contributions take the third position in the total research output during the study period. Followed by three authored papers 230 contributions take the fourth position, followed by two authored 164 contributions in fifth position and one authored stand at the last position in order witnessing 73 contributions of total research output.

**Table-8: Single Authors Vs Multi Authors**

Authorship pattern	Records	Percentage
Single Author Papers	73	3.79
Multi Author Papers	1853	96.21
Total	1926	100

It is observed from the Table 7 that the authorship pattern in terms of single authors and multi-authors published the majority of 1853 (96.21%) papers and single authors published the rest of 73 (3.79%) articles. It is noted that most of the authors are interested to publish their research papers with co-authors.

The table shows the details about the degree collaboration which indicate tend in single and multiple authorship during 2013 – 2022 as shown in table. The degree of collaboration ranges from 0.93 to 0.98 and the average degree of collaboration is 0.96. The DC is calculated by using the formula K. Subramanian, 1982:

The formula is were

DC = Degree Collaboration NM = Number of Multi Authors NS = Number of Single Authors

$$DC = \frac{NM}{NM + NS}$$

In the present study the value of DS is 0.96.

As the result, the degree of collaboration in the study Sustainable Library is 0.96 which shows the collaborations of multiple authors.

**Table-10: Relative Growth Rate (RGR) and Doubling (DT)**

Year	Single Author (NS)	Multi Author (NM)	Total (NS+NM)	DC=NM/NS+NM
2013	3	151	154	0.98
2014	9	162	171	0.94
2015	9	152	161	0.94
2016	4	165	169	0.97
2017	5	149	154	0.96
2018	9	164	173	0.94
2019	2	195	197	0.98
2020	10	208	218	0.95
2021	5	273	278	0.98
2022	17	234	251	0.93
Total	73	1853	1926	0.96

Table 9 is shown about the relative growth rate and doubling time. The highest relative growth is 2.4 in the year of 2022. And the lowest relative growth is 0.64 in the year of 2014. And then highest doubling time is 1.08 in the year of 2014. And lowest doubling time is 0.33 in the year 2022.

Year	Records	Cumulative	W1	W2	W2-W1	Mean RGR	Doubling Time (DT)	Mean DT
2013	154	-	5.03	-	-	1.54	-	0.50
2014	171	325	5.14	5.78	0.64		1.08	
2015	161	486	5.08	6.18	1.1		0.63	
2016	169	655	5.16	6.48	1.32		0.52	
2017	154	809	5.03	6.69	1.66		0.41	
2018	173	982	5.15	6.88	1.73		0.40	
2019	197	1179	5.28	7.07	1.79		0.38	
2020	218	1397	5.38	7.24	1.86		0.37	
2021	278	1675	5.62	7.42	1.8		0.38	
2022	251	1926	5.52	7.56	2.04		0.33	
Total	1926							

## **Findings**

- ⇒ The highest publication is 278 in the year 2021, followed by 2022 with 251 records, 2020 with 218 records, and 2017 and 2013 with 154 records. The lowest record is 154 in these years, and the second highest publication is in 2022.
- ⇒ The scientific output of Sustainable Library spans 10 different forms of published medium, including articles, review articles, early access, preceding papers, book chapters, book reviews, and others.
- ⇒ It is evident from the data that articles, which account for 85.88% (2286) of all publications, are the most common bibliographic form publishing.
- ⇒ Table 3 and the accompanying chart list the six languages used in the current study: English, Mandarin, Portuguese, Spanish, French, and Japanese.
- ⇒ 99.27% of the articles that we found to be a medium of scholarly presentation were authored in English.

## **Conclusion**

Sustainable Library maximizes the use of renewable resources, and conducts its operations in a more cost effective and efficient manner. Based on the analysis, the research literature on Sustainable Library has a regular growth during 2013- 2022. Maximum research works are the English Language articles. Overall, The research literature on Sustainable library are scholarly presentations which reveals that the world has getting to transform the traditional library to sustainable one.

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