A Global Warming (Global and Planetary Change) 2001-2010: A Bibliometric Study

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(Received on 20 August 2012 and accepted on 22 October 2012)

***Abstract* – This bibliometric study on global warming literature aims at analyzing the research output performances of global warming literature. The analysis covers mainly the number of articles, authorship pattern, subject-wise distribution of articles, average number of pages per article, the degree of collaboration, cited documents and the length of the article. The statistical data show a well defined trend of the global warming research.**

***Keywords:* Bibliometrics, Citation Analysis, Degree of Collaboration, Length of Articles, Productivity of Authors**

I. Introduction

Bibliometrics is the statistical analysis of texts and information. In a research environment a common example of bibliometrics is the use of citation analysis to determine how many times a researcher's work has been cited in key literature. Increasingly bibliometrics are being used as a measure of research impact or research influence. Bibliometrics analyses quantitative and qualitative data to describe publication patterns within a field of research. This information can be used to evaluate the influence/performance of a researcher and to provide a comparison between researchers. Scientific practice and methods vary across disciplines. The sciences largely publish in journal articles which lend themselves to cited reference counts and bibliometric analysis. The social sciences and humanities make greater use of monographs and conference papers which are less likely to have citation counts. In addition social science and humanities research may be more local in orientation, and publish in their mother tongue, so that readership may be more limited.

Global warming is, in fact, the increase in the temperature of the earth's neon- surface air. It is the greatest challenge facing our planet. It is one of the most current and widely discussed factors. It has far-reaching impact on biodiversity and climatic conditions of the planet. Several current trends clearly demonstrate that global warming is directly impacting on rising sea levels, the melting of ice caps and significant worldwide climate changes. In short, global warming represents a fundamental threat to all living things on earth. Global Warming effects on the natural balance of environment. The world climate is going a significant change day by day.

II. Literature Review

The bibliometric analysis of the global change papers prepared by intramural and extramural researchers of the U.S. Environmental Protection Agencys (EPA) Global Change Research Program was made and reported in the year 2008. For this analysis, 432 journal publications and 12 non-journal publications were reviewed, and they were published from 1998 to 2007 (the programs first papers were published in 1998). The journal publications were cited 5,925 times in the journals covered by Thomson Scientifics Web of Science and Elseviers Scopus. The non-journal publications were cited 720 times in journals and books. Of the 444 publications global change publications, 397 (89.4%) have been cited at least once in a journal or book. A study on the bibliometric analysis of the literature regarding CO_2 reduction trends published in the Science Citation Index-listed periodicals from 1999 to 2009 was reported. A total of 3,177 authors from 56 different countries wrote 855 articles published in 355 journals in 102 subject categories. Of these, the most titles were found in Abstracts of Papers of the American Chemical Society (3.9%). The most frequently cited paper was "Chemical CO_2 fixation: Cr(III) salen complexes as highly efficient catalysts for the coupling of CO_2 and epoxides", and the same paper contained the most often-used keyword. The reports are very scarce in this area.

III. Need For The Study

Periodicals are the indicators of literature growth in any field of knowledge. They emerge as the main channel for transmitting knowledge. Due to the escalating cost of the periodicals and lack of adequate library budgets, the selection of any particular journal for a library should be done carefully. Library authorities are forced to reduce the number of journal subscriptions. Bibliometric analysis has many applications in library and information science in

identifying research trends, core journals, etc., and thereby framing subscription policies for tomorrow. These studies will be helpful for librarians in collection development. The handy outputs of such bibliometric and scientometric studies in a given field are very important information sources on some occasions. The present era has evolved with many scientometric techniques and studies not limited to traditional sources of information but digital and web resources.

Global warming represents a fundamental threat to all living things on earth. Global warming is an urgent issue nowadays that needs solution to be able to continue our living on the Earth. The danger of global ecocatastrophe is acknowledged by the governments and peoples of developed countries of the world. The struggle for life-saving of our civilization becomes more and more popular. At this point of time a bibliomeic study in this regard will be of an immense help to the researchers, policy makers and related people.

IV. Objectives of The Study

The present study has been undertaken with the objective of analyzing the following aspects.

1. To make an analysis of articles published in Global and Planetary Change from 2001 -2010.
2. To identify the number of contributions published during the period of study.
3. To determine the year-wise distribution of articles.
4. To study the authorship pattern.
5. To study the subject coverage of articles.
6. To study the length of articles.
7. To study the degree of collaboration .
8. To discover the number of cited documents and the average number of references per article.

V. Methodology

The methodology applied in the present study is bibliometric analysis, which is used to study in details the bibliographic features of the articles and citation analysis of the references at the end of each article published in Global and planetary change from 2001 to 2010. For this the relevant data are collected and recorded. Then they are tabulated and analysed for making observations. Searches of Web of Science and Science Direct were conducted to obtain the data for the Global and planetary change journal publications and searches of Web of Science and Google Scholar were conducted to obtain times cited data for the non-journal publications. The publications made in the Science Direct data base with respect to the key word "Global Warming" has been taken in the present studies for the bibliometric analysis.

VI. Results And Discussion

Table I shows year-wise break up of papers with number of articles that varies from year to year. In the year 2008, highest number of 82 (15%) articles was published and in the year 2002 minimum number of 25 (5%) articles has been published. In all, 544 research articles were published during 2001-2010.

Table I Year-Wise Distribution of Articles

Year	Number of Articles	Percentage
2001	45	8
2002	25	5
2003	42	8
2004	59	11
2005	57	10
2006	32	6
2007	76	14
2008	82	15
2009	70	13
2010	56	10

The top twenty subjects under which global warming has been discussed is in Table II. It shows that a majority of the contributions are with respect to the climate change studies. The next position is taken by the Ice sheet. This is followed by the study about the North Atlantic. From the table it is clear that most of the subjects like climate change, ice sheet, North Atlantic, sea level, Planatary change are about the effects of the global warming. This is followed by the studies based on the effects of global warming in specific places like Tibetan plateau, Antarctic ice, Southern ocean, Earth, Greenland ice, Northern hemisphere, Young dryas, Lake Baikal, Late Permian, Northern Eurasia, Northern Eurasia, River basin, Surface temperature, etc.

Table II Subject-Wise Distribution of Articles

S.No.	Subject	The Number of Articles	Percentage
1	Climate change	44	8.08
2	Ice sheet	40	7.35
3	North atlantic	36	6.61
4	Sea level	31	5.69
5	Planetary change	26	4.77
6	Tibetan plateau	18	3.30
7	Antarctic ice	17	3.10
8	Southern ocean	14	2.57
9	Atmospheric Co_2	13	2.38
10	Earth	13	2.38
11	Global change	13	2.38
12	, Indian ocean	13	2.38
13	Greenland ice	12	2.26
14	Northern hemisphere	12	2.26
15	Young dryas	12	2.26
16	Lake baikal	10	1.83
17	Late permian	10	1.83
18	Northern eurasia	10	1.83
19	River basin	10	1.83
20	Surface temperature	10	1.83

Table III and IV presents data on authorship pattern of the papers. It is found from Table III that out of 544 papers, the number of multiple authored papers (above 5 authors) is the highest and it accounts for 119 (21.87%). The number of two and three authored papers are 115 (21.13%) and 106 (19.48%) respectively. This was followed by four author 80(14.70%), one author 64 (11.76%) and five author 60(11.02%) respectively.

Table IV shows year wise break up of authors with number of authors that varies from year to year. In the year 2007, highest number of 341 (19.86%) authors have published their articles and in the year 2002 minimum number of 60 (3.49%) authors have published. In all, 1717 research authors have published their findings during 2001-2010.

Degree of Collaboration

In order to calculate the degree of collaboration among the authors, formula given by Subramanyam was used which is expressed mathematically as

Degree of collaboration, DC = Nm/Nm+Ns

Where Nm = No. of Multi-author publications during a specific period in a discipline

Ns = No. of single-author publications in a discipline during a given period of time.

Table III Year-Wise Authorship Pattern

No. of Authors	Year										Total	Percentage
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010		
Single	11	5	8	9	5	2	8	7	5	4	64	11.76
Two	11	5	10	26	11	8	13	11	10	10	115	21.13
Three	12	7	13	3	11	3	20	21	9	7	106	19.48
Four	10	2	5	8	12	2	13	11	11	6	80	14.70
Five	1	4	2	7	6	6	5	12	6	11	60	11.02
Above five	-	2	4	6	12	11	17	20	29	18	119	21.87

Table IV Year-Wise Distribution of Authors

Year	Total No of Authors	Percentage
2001	114	6.63
2002	60	3.49
2003	154	8.96
2004	182	10.59
2005	204	11.88
2006	139	8.09
2007	341	19.86
2008	333	19.39
2009	307	17.88
2010	247	14.38

Table V Degree of Collaboration Among Co-Authors

Year	Single Author	Multiple Author	Total	Degree of Collaboration
2001	11	44	45	0.75
2002	5	20	25	0.80
2003	8	34	42	0.80
2004	9	50	59	0.84
2005	5	52	57	0.91
2006	2	30	32	0.93
2007	8	68	76	0.89
2008	7	75	82	0.91
2009	5	65	70	0.92
2010	4	52	56	0.92

Table VI shows that 378 (69.48%) papers had length in the range more than 10 pages, followed by 130 (23.89%) of papers of 6-10 pages length and 36 (6.61%) papers are of 1-5 pages in length. Table V shows the distribution of the total number of pages between the year 2001 and 2010. The total number of pages is 6684. The number of pages per author is more in the 2001 (6.21) and less in the year 2010 (1.92). It indicates that over the period from 2001 to 2010 the number of authors involved in the studies are increasing.

Table VI Length of Articles

No. of Authors	Year										Total	Percentage
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010		
1-5	5	3	3	2	6	1	3	3	8	2	36	6.61
6-10	5	5	6	11	8	7	13	30	23	22	130	23.89
11- more	35	17	33	46	43	24	60	49	39	32	378	69.48
Total	45	25	42	59	57	32	76	82	70	56	544	100

VII. Citation Analysis

The reference provided by the authors at the end of their articles are the basis of citation analysis. Citation traces a connection between two documents, one which cites and the other which is cited. The JCR Impact Factor is a well known metric in citation analysis. It is a measure of the frequency with which the average article in a journal has been cited in a particular year. The Impact Factor helps evaluate a journals relative importance, especially when compared to others in the same field. The Impact Factor is calculated by dividing the number of citations in the current year to articles published in the 2 previous years by the total number of articles published in the 2 previous years. The five year impact factor of the journal 'Global and planetary change' is 3.918. The total citation of all the articles is found to be 2127.

VIII. Conclusion

Bibliometrics is an important field of information science because it represents a unique set of techniques for the monitoring and analysis of information resources and for the management of knowledge in social and organisational contexts. In all, 544 research articles were published during 2001-2010. In the year 2008, highest number of 82 (15%) articles was published and in the year 2002 minimum number of 25 (5%) articles has been published. In the subject wise analysis more number of the articles are about climate change. It is found that out of all the papers, the number of multiple authored papers (above 5 authors) is the highest and it accounts for 119 (21.87%). The overall value of the degree of collaboration, as shown by Table V has been calculated to be 0.86 LPP which shows that the trend is towards Multi

authored collaborative approach. About 378 (69.48%) papers had length more than 10 pages. The total citation of all the articles is found to be 2127.

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