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## Research Article

### RESEARCH OUTPUT ON GLOBAL WARMING DURING THE YEAR OF 2008-2010: A SCIENTOMETRIC ANALYSIS

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#### ABSTRACT

The present study deals with the Scientometrics analysis of Global Warming from 2008 to 2010: A Scientometrics Analysis. The Scientometrics techniques are getting used for a range of functions like determination of assorted scientific indicators, the evolution of scientific output, choice of journals for libraries and even statement the potential of a selected field. The recognition within the adaptation of Scientometrics techniques in varied disciplines stirred large growth of the literature on Scientometrics and its connected areas.

##### Key Words:

Scientometrics, Authorship pattern,  
cooperative analysis, Relative rate,  
Doubling Time

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#### INTRODUCTION

Nowadays the Scientometrics, studying mainly the quantitative aspects of science (in cognitive, as well as in social context), has strengthened its position as a significant component of the general Science of science, and it appears to be a completed disciplinary field with clearly outlined subjects of research, specific set of good elaborated research methods and techniques, a significant concerning size and geographical scope research community, numerous research institutions, constituted regular conferences and its own printed organ – the prestigious international journal Scientometrics.

##### Research Methodology and Limitation of the Study

The data for the study were retrieved from Web of Science database, which is a scientific and indexing service maintained by Thomson Reuters. The global warming research output was analyzed. For this study bibliographic details such as author wise, language wise, document type, etc. was analyzed using Bibxel. Bibxel is a software package used for Scientometrics analysis and information visualization. The collected data were analyzed with the Bibxel software, Manual, Microsoft Excel Sheet and presented in the form of tables.

##### Objectives of the Study

1. To find out the year wise publication of the article
2. Relative Growth Rates [R( C )] and Doubling Time [Dt ( C )] for Citations
3. To calculate the Language wise distribution.
4. To determine the type of document wise distribution of Global Warming output
5. To find out the Authorship pattern of publications
6. To identify Source wise Distributions of publication

#### REVIEW OF LITERATURE

Bandyopadhyay (2001)<sup>1</sup> Studied authorship pattern by analyzing the citations appended to 92 doctoral dissertations submitted to the 'University of Burdwan' for the period 1981 to 1990. The results revealed that the average number of authors per article in Physics was 2.25, followed by Mechanical Engineering (1.48%), Mathematics (1.44%), Philosophy (1.15%) and Political Science (1.05%). Kannappanavar and Vijaya Kumar (2001) conducted a study on authorship pattern in 'International Monetary Fund (IMF) Literature' for the period 1991 to 1998. The study revealed that the degree of collaboration in IMF research is 0.56.

Kim (2002)<sup>2</sup> Examined the citation patterns of Korean researchers in 'Physics' and 'Mechanical Engineering' to identify the type of publication source and type of authorship.

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The study revealed that out of 1,200 physics papers, 68.8% (825) were by one or more Korean researchers, and 31.3% (375) were co-authored by Koreans with researchers from other countries. Among the 375 internationally co-authored papers, 146 (38.9%) were by Korean scientists as first authors, and 229 (61.1%) were first authored by researchers from other countries. There is a significant difference in the average number of journal citations per paper between papers authored solely by Koreans and those first-authored by foreign researchers,

Koley and Sen (2003)<sup>3</sup> Studied 457 citations appended to 26 articles published in the four issues of 'Quarterly Indian Journal of Physiology and Allied Sciences' for the year 2001. The authorship pattern showed that papers with two authors were highest in number (30.89%) and single author papers constituted 23.58% of the total citations. Udofia (2002) analyzed 'African Trypanosomiasis Research Literature'. The study revealed that single authored articles accounted for 29.01 percent, followed by two authors (27.99%), three authors (18.47%), four authors (12.07%) and five and more than five authors (6.81%). The degree of author collaboration as indicated by the weighted average was 2.87 for the ten years.

Guan and Ma (2004)<sup>4</sup> Studied the research performance in the 'Computer Science' for four major western countries, along with India and China on the basis of the INSPEC database during the period of 1993-2002. The authors observed that scientists in the western countries preferred to work separately or only with one collaborator but Asian scientists preferred multi-authors collaboration patterns.

Suresh and Garg (2005)<sup>5</sup> Compared 2,058 papers published by Chinese authors and 2,678 papers of Indian authors in the field of 'Computer Science' during 1971-2000. India's output is significantly higher than the Chinese output. The proportion of a single author papers in China is greater than India's contribution. The proportion of two author papers, multi-author, and mega-author papers are greater for India as compared to China. It is interpreted that team research in India is greater than in china.

Nacke, Wehmeier and Eisenhardt (1980)<sup>6</sup> Suggested that Informetrics and scientometrics are special disciplines within information science that assess information production, storage, analysis and dissemination by measuring their accompanying phenomena, or 'indicators'. Scientometrics is used to analyse indicators for high-level scientific research. The resulting information can optimise research policy, where so much money and so many staff are involved. According to Otsuka and Maruyama (1988), Scientometrics is a method of measuring scientific output similar to bibliometrics used by librarians and information scientists. It can be used to measure the efficiency of resources input to research output, comparing the work of similar groups.

Grupp (1990)<sup>7</sup> Applied the concept of entropy well-known in information theory and thermodynamics to the fields of scientometrics and innovation research in order to introduce an indicator for institutional involvement in the location of research and development. By means of this concept 4 application in the fields of research and national technology policy, industrial technology management, and innovation research are outlined. Arenas (1993) discussed the usefulness

of scientometrics indicators for the best exploitation of research and development resources. Examines the role of bibliometrics indicators focusing on the evaluation of publishing output and citation analysis.

Guimaraes and Humann (1995)<sup>8</sup> Discussed the present day results of a national plan, called PNPG, which was initiated in Brazil almost 30 years ago to establish and support training and development of human resources for strengthening science and technology. They explained how this plan could be viewed as a successful programme, noting the institutionalization and consolidation of research activity in universities and research centres, and the numerous technological advances that have been achieved in many areas. They also highlighted the acceleration and improvement of agriculture, metallurgical engineering including the metal mechanic industry and paper cellulose complex exploitation, and how this stimulated better performance in related areas. Authors stressed that the existence of an effective system based on a group of funding agencies was an essential factor in the success of the plan.

Lewis and Dawson (1998)<sup>9</sup> Presented a paper at the 6th conference of the International Society for Scientometrics and Informetrics, Jerusalem, Israel. The Research Outputs Database was used to investigate the effects of different input variables, including the numbers of funding bodies, on the impact of research papers in a biomedical subfield (gastroenterology). This was determined by the medium term impact of the journals in which they were published. It was shown that, when account was taken of the effects of the other input factors, the mean impact for a group of papers increased with the number of authors, the type of research (basic more than clinical), and with the number and identity of the funding bodies.

Wagner-Dobler (1998)<sup>10</sup> Presented a paper at the 6th conference of the International Society for Scientometrics and Informetrics, Jerusalem, Israel. Results concerning the existence of long-term cycles of economic activity are still controversial. They described a study in which the 'ups and downs in the pulse of science and technology' (Price) are related to economic growth cycles. Shows that the contention of an inverse relationship between the level of scientific and technological activity on the one side and economic growth on the other side is correct for 1500 to 1900. Indirect proof is also thereby furnished for the existence of long economic growth cycles in the last centuries.

Harinarayana *et.al.* (2016)<sup>11</sup> Conducted study on facebook posts and lotka's law; the study examined the participation of librarians in Facebook by testing whether it follows the pattern given by Lotka's law. The result shows that it does not. The paper analysed the reasons and also provides the methods of collecting data for bibliometric study.

Sangam, Madalli & Arali (2015)<sup>12</sup> Carried a scientometric study of Genetics publications in Web of Science. In this research an attempt has been made to study the Growth pattern, doubling time of world and Indian Genetics literature. During both the block periods (1993-2002 and (2003-2012) Evolutionary Genetics has lesser number of publications. Study finally inferred that the Logarithmic and Linear growth models fit well for World's genetics literature whereas for India Exponential and Logistic models fit well.

Gorraiz, Reimann, Gumpenberger (2012)<sup>13</sup> Carried a bibliometric study of collaboration of Austria and six countries to differentiate between bilateral and multilateral contingents in the assessment of international scientific collaboration. The study focused on Degree of bilaterality and citation degree of bilaterality which resulted in lower than 1/3 and 1/5 of multi contingent Only a very weak correlation between ‘times cited’ and the number of affiliations or authors was observed at publication level. Neither the number of authors or affiliations determines impact increase. Rather internationalisation and cooperation seem to be the crucial factors.

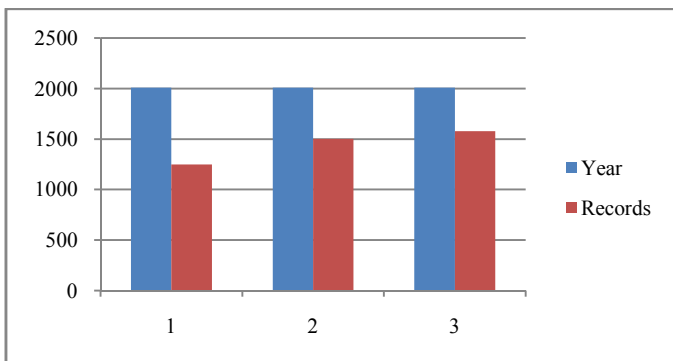
Kretschmer *et. al.* (2012)<sup>14</sup> Carried a scientometric study of gender studies in “Psychology of Women Quarterly”. Collaboration behaviour in gender studies is different from that in the natural sciences. The results confirm our expectation that the strength of gender bias is related to the subject matter of journals, and that it is less expressed in the journals of gender studies.

Mooghali *et.al.* (2011)<sup>15</sup> Conducted a scientometrics study of scientometric journal, Findings revealed that out of 691 articles in the field of Scientometrics, a total number of 183 articles (26.48%) were written during 1980 to 2009 by the top ten authors. Some of these articles were produced in authors’ collaboration and some of them were by single authors. Geographical analysis indicated that the field had evolved considerably in different regions of the world. Hungarian Academy of Science with 40 records (5.71%) was the most productive institution in the field of Scientometrics. Furthermore, chronological analysis disclosed that the scientific production in the field of Scientometrics showed a slow increase from 1980 to 2009. The overwhelming majority of documents were in English, and the international journal of Scientometrics was the most prolific journal in the field. It has also been declared that 67.87% of the literature was published in the area of Library and Information Science.

**Data Analysis and Interpretation**

**Table 1** Year of publication

S.No	Year	Records	%	Cumulative	Cumulative%
1	2008	1250	28.9	1250	28.9
2	2009	1503	34.7	2753	34.7
3	2010	1578	36.4	4331	36.4
Total		4331	100		100



**Figure 1** Analysis of year of Publication

This table and figure analyses the yearly output brought out by the scientists on Global Warming at world level from 2008 to 2010. From the table, We could clearly see that there are about 4331 total outputs brought out by the scientists on Global

Warming the year wise analyses indicates the increasing trend. The highest number of publications is published in the year 2010 -1578 Records it followed by 2009 for 1503, And finally in the year of 2008 the 1250 records were published.

**Table 2** Relative Growth Rates [R(C)] and Doubling Time [Dt(C)] for Citations

Year	Records	Cumulative	Log1 (W1)	log2 (W2)	R(C) (W2-W1)	Mean [R(C)]	Dt(C)	Mean Dt(C)
2008	1250	1250	-	7.13	-			
2009	1503	2753	7.13	7.92	0.79	0.41	0.87	0.80
2010	1578	4331	7.92	8.37	0.45		1.54	
Total		4331						

Table 2 shows that the relative growth rate of total contribution published had gradually increased. The growth rate in 0.79 in 2009, which is increased up to 0.45 in 2010. The overall study period has witnessed a mean Relative Growth Rate in 0.41. In general the relative growth rate of publications of all sources in Global Warming output has shown an increasing trend. The overall study period has witnessed a mean doubling time as 0.80

**Table 3** Language wise distributions

Languages	Records	%	Cumulative	Cumulative %
English	4223	97.51	4223	97.51
German	21	0.48	4244	0.48
French	19	0.44	4263	0.44
Chinese	14	0.32	4277	0.32
Japanese	13	0.30	4290	0.30
Spanish	11	0.26	4301	0.26
Portuguese	9	0.20	4310	0.20
Polish	6	0.14	4316	0.14
Turkish	5	0.12	4321	0.12
Croatian	3	0.07	4324	0.07
Hungarian	2	0.05	4326	0.05
Korean	2	0.05	4328	0.05
Slovak	1	0.02	4329	0.02
Italian	1	0.02	4330	0.02
Rumanian	1	0.02	4331	0.02
Total	4331	100		100

This table lights on the language wise distribution of research output given by Global Warming the overall strong period covers 15 different languages. The majority of the scientists publishing their reserved output in English language were 4223 (97.51%) followed by Japanese 21(0.48%). French 19 (0.44%) records.

**Table 4** Document type of distributions

Name of the Document	Records	%	Cumulative	Cumulative %
Article	3397	78.43	3397	78.43
Review	332	7.67	3729	7.67
Article; Proceedings Paper	208	4.80	3937	4.80
Editorial Material	123	2.84	4060	2.84
Book Review	88	2.03	4148	2.03
News Item	65	1.50	4213	1.50
Letter	63	1.45	4276	1.45
Meeting Abstract	22	0.51	4298	0.51
Review; Book Chapter	20	0.46	4318	0.46
Article; Book Chapter	4	0.09	4322	0.09
Correction	4	0.09	4326	0.09
Reprint	2	0.05	4328	0.05
Poetry	2	0.05	4330	0.05
Article; Retracted Publication	1	0.02	4331	0.02
Total	4331	100		100

Table shows the distribution of research output according to forms of publication. There are about 14 forms of publications

observed in the study .They are Journals, Articles Observed in out of 14 forms of publications ,the journal ,article this recorded more than 78.43 Percent of Output performance. The form of Review stands to be the second preferred form among the Global Warming. It has shown 7.67 percentages over the study period. The form of Article; Proceedings Paper stands to be the Third preferred form among the Global Warming. It has shown 4.80 percentages over the study period. The least preferred forms observed from the study are Article; Retracted Publication it has shown 0.02 Percentage.

**Table 5** Authorship wise distributions

No. of Authors	Records	%	Cumulative	Cumulative%
1	988	22.81	988	22.81
2	899	20.76	1887	20.76
3	783	18.08	2670	18.08
4	633	14.61	3303	14.61
5	392	9.05	3695	9.05
6	257	5.93	3952	5.93
7	149	3.44	4101	3.44
8	71	1.64	4172	1.64
9	59	1.36	4231	1.36
10	21	0.48	4252	0.48
11	16	0.37	4268	0.37
12	17	0.39	4285	0.39
13	9	0.21	4294	0.21
14	9	0.21	4303	0.21
15	5	0.12	4308	0.12
16	3	0.07	4311	0.07
17	1	0.02	4312	0.02
18	2	0.05	4314	0.05
19	3	0.07	4317	0.07
20	1	0.02	4318	0.02
22	3	0.07	4321	0.07
23	1	0.02	4322	0.02
24	1	0.02	4323	0.02
26	1	0.02	4324	0.02
28	1	0.02	4325	0.02
29	3	0.07	4328	0.07
33	1	0.02	4329	0.02
35	1	0.02	4330	0.02
56	1	0.02	4331	0.02
Total	4331	100		100

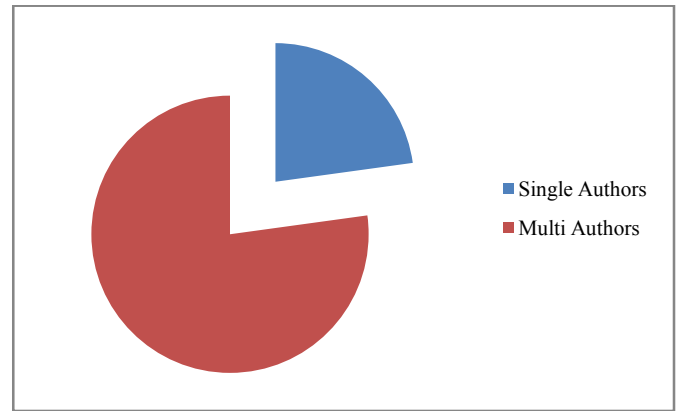
**The study reveals that a total number of authors had contributed 4331Records**

The table clearly indicates it could be observed from the results that more than 56 authored publications rank first in order sharing 0.02 percent of the total research output. The Single authored papers follow taking 22.81 percent of the total research contributions. Second authored contributions take the Second position in order sharing 20.76 percent of the total research output during the study period. Three authored papers rank next in order reporting 18.38 percent of total research.

**Analysis of Single Vs Multi Authors**

No of Authors	Records	%	Cumulative	Cumulative%
Single Authors	988	22.81	988	22.81
Multi Authors	3343	77.19	4331	77.19
Total	4331	100		100

It is observed from the table no 6 that the authorship pattern in terms of single authors and multi authors during the period of study. Out of 4331 research outputs, Multi-authors published the majority of 3343 (77.19 %) papers and single authors published the rest of 988 (22.81 %) articles. It is noted that most of the authors are interested to publish their research papers with co-authors.



**Figure 2** Analysis of Single Vs Multi Authors

**Table 7** Source wise distributions (Top 20)

S.No	Document Type	Records	%	Cumulative	Cumulative%
1	Geophysical Research Letters	104	2.40	104	2.40
2	Global Change Biology	96	2.22	200	2.22
3	Journal Of Climate	73	1.69	273	1.69
4	Proceedings Of The National Academy Of Sciences Of The United States Of America	72	1.66	345	1.66
5	International Journal Of Life Cycle Assessment	68	1.57	413	1.57
6	Science	41	0.95	454	0.95
7	Climatic Change	41	0.95	495	0.95
8	Journal Of Geophysical Research-Atmospheres	40	0.92	535	0.92
9	Energy Policy	37	0.85	572	0.85
10	International Journal Of Climate Change Strategies And Management	34	0.79	606	0.79
11	Chemical & Engineering News	33	0.76	639	0.76
12	Environmental Research Letters	31	0.72	670	0.72
13	Energy & Environment	30	0.69	700	0.69
14	Environmental Science & Technology	30	0.69	730	0.69
15	Journal Of Cleaner Production	29	0.67	759	0.67
16	Nature	29	0.67	788	0.67
17	Renewable & Sustainable Energy Reviews	28	0.65	816	0.65
18	International Journal Of Global Warming	27	0.62	843	0.62
19	Climate Dynamics	27	0.62	870	0.62
20	Atmospheric Environment	25	0.58	895	0.58

Table shows the Source wise Distributions according to forms of publication top 20 only. They are Journal of Geophysical Research Letters 104 Records of publications 2.40 Present over the study period; the form of Global Change Biology to be the second preferred the least preferred Records observed from the study are Journal of the form among the Global Change Biology. It has shown 96 Records 2.22 present over the study period. The form of Journal of Journal of Climate to be the Third preferred form among the Global Warming. It has shown 73 Records 1.69 percentages over the study period Atmospheric Environment it has shown 25 Records 0.58 Percentage.

**CONCLUSION**

The Scientometrics studies are regularly used to assess the journal research publications and to generate information that could be used by policy makers and experts. This study has proven to be the useful tool in the assessment of Research

Output On Global Warming During The Year of 2008-2010: A Scientometric Analysis. This study has highlighted the Scientometrics analysis to measure various factors such as Year of Publication, growth of articles, Language Wise Distribution, Document Type, authorship pattern, and Source wise Distribution, which can be used to understand the nature and characteristics of the journal global wise. For analysis Research Output Performance of Scientists on Global Warming From 2008-2010: A Scientometrics Analysis.

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