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Analysis of Earth Science Research Output: A Scientometric Study

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Abstract

In this study, few studies have attempted to make a comprehensive and quantitative review on this topic. This study conducted a scientometric review on the Earth Science research from 2015 to 2019 using HistCite. Totally 4200 articles from the Web of Science core collection database were selected as the research samples. Our result show that The highest publication output in the year of 2019 with 1026 records (24.43%) and lowest publications founded in the year of 2016 with 685 (16.31%) publications. The most vital development in Earth Science research occurred in the USA, China, England, Canada and Germany. We are Suggest special strengthening in building international partnerships since cooperation occurs in most countries. International cooperation can improve research performance and in the end it leads to better exploitation.

Keywords: Earth Science, Scientometric, Web of Science, Relative Growth Rate

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AN OVERVIEW OF EARTH SCIENCE

All fields of natural science related to planet earth are included with earth science or geosciences. It is a branch of science that deals with the physical structure of the earth and its atmosphere. Earth science is the study of the physical characteristics of our planet, rainfall from earthquakes and flood fossils. Earth science can be considered as a planetary science branch, but with a much older history. Different sciences are used to learn about the earth; however, there are four main areas of earth science study: geology, meteorology, oceanography, and astronomy.

Geology: Earth Science

Geology is the basic earth science. The word means "study of the earth". Geology works by combining earth's materials, earth structures and earth processes. It also has concerns with the creatures of the planet and how the planet has changed over time. Geologists search for minerals and fuels, study natural hazards and work to protect the Earth's environment.

Meteorology: Science of the Atmosphere

Meteorology is the atmosphere study and how processes in the atmosphere determine Earth's weather and climate. Weather is a very practical science because everyone is concerned about

the weather. How climate change over time in response to human actions is a topic of global concern.

Oceanography: Science of the Oceans

Oceanography is the world's oceans - their composition, dynamics, organisms, and processes. Oceans cover most of our planet and are an important resource for food and other products. They are increasingly being used as sources of energy.

Astronomy: Science of the Universe

Astronomy is the universe study; here are some examples of why it is important to study space outside the earth: the moon runs the tidal system, planetary effects have repeatedly destroyed Earth's inhabitants, and energy from the sun exerts our weather and climate.

OBJECTIVES

- a) To identify and analyze the growth rate of world research output in Earth Science research
- b) To identify the global research output of document wise distribution of publications
- c) To analyze the prolific authors
- d) To assess the institution wise research concentration
- e) To examine the country-wise distribution of publications

METHODOLOGY

The survey was retrieved and downloaded records from 5 years of publications on global outputs in Earth Science research output from the Web of Science online database for the period 2015 to 2019. The aim of the current study is to analyze the research output of researchers in the field of Earth Science Research output. Totally 4200 articles are downloaded and analyzed by using the HistCite software.

LITERATURE REVIEW

Batcha & Ahmad (2017) analyzed Indian Journal of Information Sources and Services (IJISS) and Pakistan Journal of Library and Information Science (PJLIS) during 2011-2017 and studied various aspects like year wise distribution of papers, authorship pattern & author productivity, degree of collaboration pattern of Co-Authorship, average length of papers, average keywords, etc. and found 138 (94.52%) of contributions from IJISS were made by Indian authors and similarly 94 (77.05) of contributions from PJLIS were done by Pakistani authors. Papers by Indian and Pakistani Authors with Foreign Collaboration are minimal (1.37% of articles) and (4.10% of articles) respectively. Batcha, Jahina, & Ahmad (2018) has examined scientometric analysis of the DESIDOC Journal and analyzed the pattern of growth of the research output published in the journal, pattern of authorship, author productivity, and, subjects covered to the papers over the period (2013-2017). It found that 227 papers were published during the period of study (2001-2012). The maximum numbers of articles were collaborative in nature. The subject concentration of the journal noted was Scientometrics. The maximum numbers of articles (65 %) have ranged their thought contents between 6 and 10 pages. Ahmad & Batcha (2019) analyzed research productivity in Journal of Documentation (JDoc) for a period of 30 years between 1989 and 2018. Web of Science database a service from Clarivate Analytics has been used to download citation and source data. Bibexcel and Histcite application software have been used to present the datasets. Analysis part focuses on the parameters like citation impact at local and global level, influential authors and their total output, ranking of contributing institutions and countries. In addition to this scientographical mapping of data is presented through graphs using

VOSviewer software mapping technique. Ahmad & Batcha (2019) studied the scholarly communication of Bharathiar University which is one of the vibrant universities in Tamil Nadu. The study find out the impact of research produced, year-wise research output, citation impact at local and global level, prominent authors and their total output, top journals of publications, collaborating countries, most contributing departments and publication trends of the university during 2009 to 2018. The 10 years' publication data of the university indicate that a total of 3440 papers have been published from 2009 to 2018 receiving 38104 citations with h-index as 68. In addition, the study used scientographical mapping of data and presented it through graphs using VOSviewer software mapping technique.

Ahmad, Batcha, & Jahina (2019) quantitatively identified the research productivity in the area of artificial intelligence at global level over the study period of ten years (2008-2017). The study identified the trends and characteristics of growth and collaboration pattern of artificial intelligence research output. At the outset the study reveals the fact that the artificial intelligence literature research study is one of the emerging and blooming fields in the domain of information sciences. Batcha, Dar, & Ahmad (2019) presented a scientometric analysis of the journal titled "Cognition" for a period of 20 years from 1999 to 2018. The present study was conducted with an aim to provide a summary of research activity in current journal and characterize its most aspects. The research coverage includes the year wise distribution of articles, authors, institutions, countries and citation analysis of the journal. The analysis showed that 2870 papers were published in journal of Cognition from 1999 to 2018. The study identified top 20 prolific authors, institutions and countries of the journal. Researchers from USA have made the most percentage of contributions.

DATA ANALYSIS AND RESULTS

Table 1: Year wise Distribution of Earth Science Research Output in the World

Publication Year	Records	Percent	Cumulative	Cum. %	W1	W2	R(a) W2- W1	TLCS	TGCS
2015	915	21.79	915	7.48	6.81	6.81	0	375	9048
2016	685	16.31	1600	13.09	6.52	7.37	0.85	429	15898
2017	738	17.57	2338	19.12	6.6	7.75	1.15	351	9914
2018	836	19.90	3174	25.96	6.72	8.06	1.34	176	5356
2019	1026	24.43	4200	34.35	6.93	8.34	1.41	54	1699
Total	4200	100.00		100					

Table 1 shows that world's publications output during 2015–2019 consists of 4200 papers. The highest publication output in the year of 2019 with 1026 records (24.43%) and lowest publications founded in the year of 2016 with 685 (16.31%) publications. The average relative growth rate of articles of worldwide distributions, has increased over a period of five years from 2016 (0.85) to 2019 (1.41). The highest number is found to be 429 Local Citation Scores and 15898 Global Citation Scores. It is also found from the table that the lowest number is 54 with 10536 LCS and 1699 GCS.

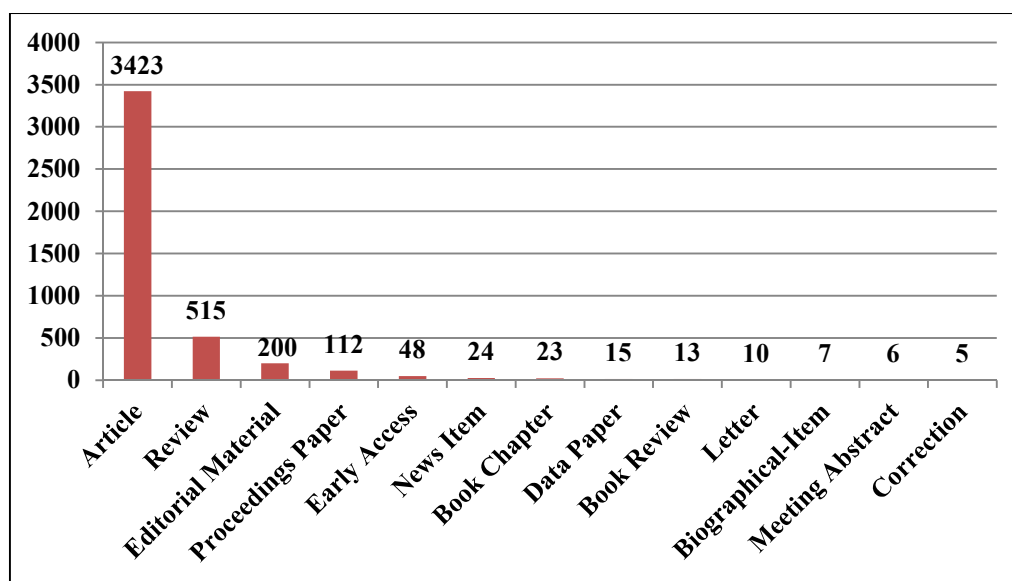


Figure 1: Documents Type Analysis of Earth Science Research in the World

Found from the Figure 1 that the Articles from journal Article capture the first position out of 3423 publications, with 1069 TLCS and 29048 TGCS. The format of Review as a source of mentioned research 515 publication output follows second in order with 251 LCS and 11191 GCS of publication. The source of Editorial Materials publications is 200 of publications with third position. The remaining sources were Proceedings Paper 112, Early Access 48, News Item 24, Book Chapter 23, Data Paper 15, Book Review 13, Letter 13, Biographical-Item 7, Meeting Abstract 6 and Correction 5 articles published during the study.

Table 2: Top 10 Prolific Authors of Oceanography Research in the World

Sl. No.	Author	Records	Percent	TLCS	TGCS
1	Li J	16	0.08	8	148
2	LI X	16	0.08	15	134
3	Wimmer-Schweingruber RF	15	0.07	0	166
4	Zhang L	15	0.07	3	109
5	Zhang Y	15	0.07	2	156
6	Li Y	14	0.07	2	424
7	Wang B	14	0.07	10	47
8	Anonymous	12	0.06	4	133
9	Liu Y	12	0.06	2	43
10	Steffen W	12	0.06	103	1090

Table 2 reveals that the first 10 prolific authors of Earth Science research output belong to maximum number of research works. Among 21215 authors, Li J and Li X have published the maximum number of articles so as 16 (0.8%). And to this with second rank by Wimmer-Schweingruber RF, Zhang L and Zhang Y have published the articles 15 (0.0%). Third rank goes to Li Y and Wang B have published 14 (0.07) articles. The maximum TLCS (103) and TGCS (1090) received by Steffen W.

Table 3: Journal wise Contribution of Earth Science Research in the World

Sl. No.	Journal	Records	Percentage	TLCS	TGCS
1	Remote Sensing	72	5.60	6	731
2	Acta Astronautica	66	5.13	31	297
3	Geophysical Research Letters	48	3.73	22	346
4	Earth-Science Reviews	42	3.27	17	835
5	Advances In Space Research	41	3.19	33	311
6	Comptes Rendus Geoscience	41	3.19	1	116
7	Space Science Reviews	36	2.80	39	1240
8	ICARUS	36	2.80	19	333
9	Scientific Reports	34	2.64	0	341
10	Remote Sensing of Environment	30	2.33	48	402

Table 3 reveals the contribution of top 10 Journals out of 1286 in Earth Science research in world. It has found out that Remote Sensing journal stands first with 72 (5.60%) records, followed by the journal Acta Astronautica with 66 records. It has clearly seen that the journal Earth-Science Reviews stands third with 42 records, followed by the journal Geophysical Research Letters with 48 records. In the fifth place, the Advances in Space Research and Comptes Rendus Geoscience have 41 records. It is inference from table, the journal of Space Science Reviews has highest received 1240 TGCS.

Table 4: Language wise distribution of Earth Science Research Output in the World

Sl. No.	Language	Records	Percent	TLCS	TGCS
1	English	4109	97.83	1381	41771
2	Chinese	40	0.95	1	113
3	Spanish	20	0.48	0	17
4	German	9	0.21	3	13
5	French	8	0.19	0	3
6	Polish	3	0.07	0	0
7	Russian	3	0.07	0	0
8	Italian	2	0.05	0	0
9	Portuguese	2	0.05	0	2
10	Croatian	1	0.02	0	0
11	Czech	1	0.02	0	0
12	Lithuanian	1	0.02	0	0
13	Slovene	1	0.02	0	0
Total		4200	100.00		

The language-wise distribution of records in Earth Science is shown in Table 4. The maximum of 4109 (97.83%) of the total articles published were only in English language among thirteen languages. This is followed by Chinese (0.95%) and Spanish (0.48%) languages. It is inference to note that some contributions are published in more than one language simultaneously.

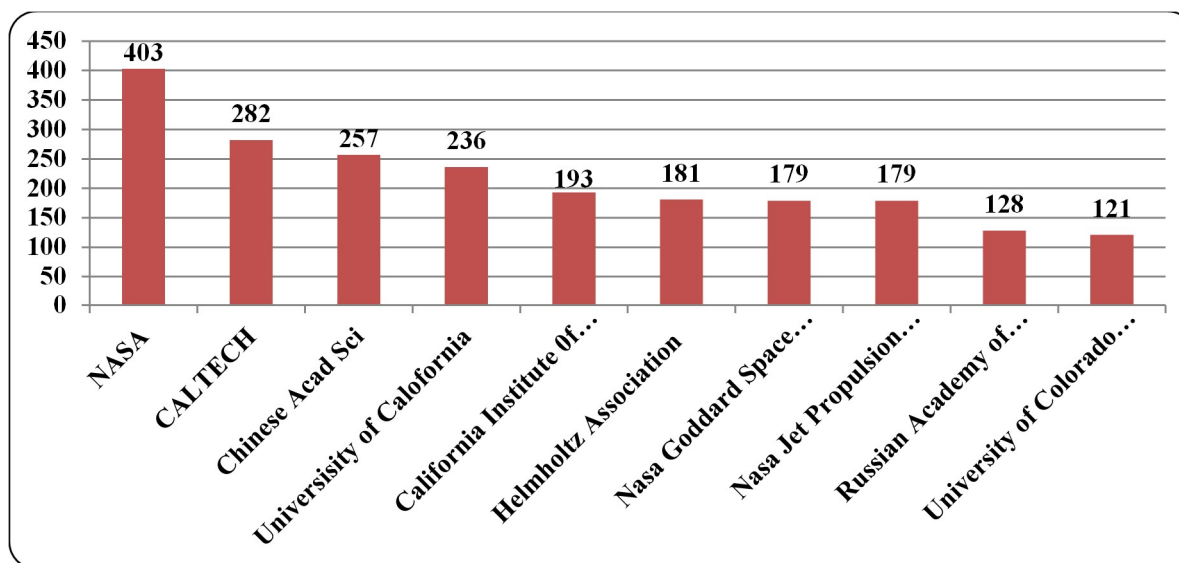


Figure 2: Institution wise Contribution of Earth Science Research in the World

The ranked list of top 10 Institutes in Earth Science research during the period based on the frequency of publication productivity. Figure 2 shows the top 10 most productive institutions by publication. NASA gets the title of topmost contributing institution in the world with 403 articles of the total share. The next most prolific institution is Chinese Academy of Sciences that gets the second place with 282 of the world share. University of California gets the third place with 256 publications.

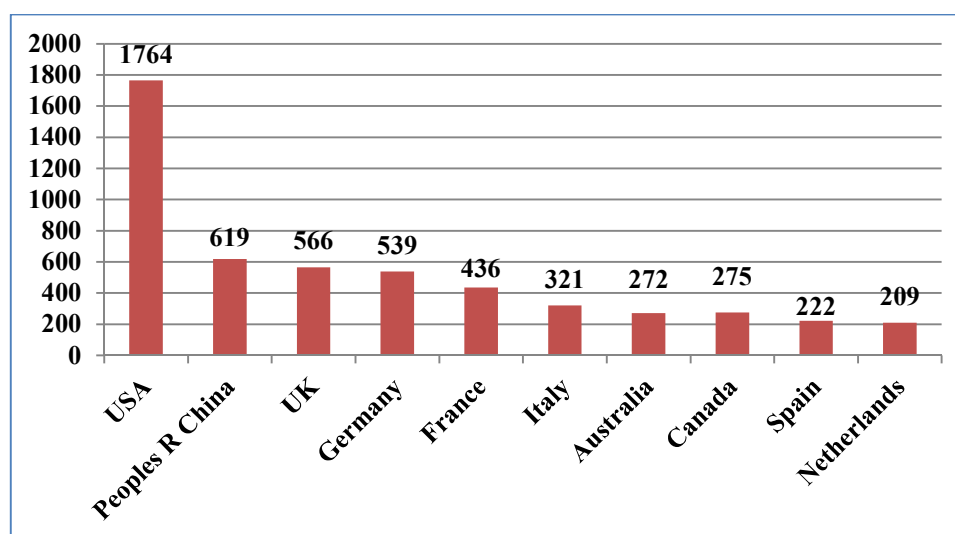


Figure 3: Country wise Contribution of Earth Science Research in the World

The Figure 3 shows the production-wise ranking of countries in EarthScience research. There were 116 countries involved in EarthScience research. The USA topped the list with the highest share of 1764 publications. China ranked second with a share of 619 articles. Germany who gets the third rank with share of 539 articles followed by France 436 publications, Italy produced 321 publications and Australia had a share of 272 publications. India contributed a world share of 137 and scored the 14th position.

CONCLUSION

Here we use a quantitative approach to uncover, the structure of the production of scientific knowledge related to the use of Earth Science. We presented an overview on the subject and elucidate the relations of scientific production between, organizations authors and countries. The research results have strong reference value for researchers and practitioners in Earth Science research. Our findings result show that The average relative growth rate of articles of worldwide distributions, has increased over a period of five years from 2016 (0.85) to 2019 (1.41). Articles from journal Article capture the first position with 3423 publications. Finally, we suggest that the development of new methods, for the interpretation and use of more complex genetic data in Earth science.

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