

The growth and development of research on ecology in India: A bibliometric study

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Abstract

This study aims at analysing the research output performance of scientists on Ecology. In academic and scientific work, publication is the chief means of communicating research, a primary means of recognition and reward, and hence a central social process in any academic as well as Research Institutions. Therefore, it is through publication the scientists receive professional recognition and esteem as promotion, advancement, and funding for future research. This study attempts to analyse the performance of scientists working in various institutions in terms of growth rate, areas of research concentration, author productivity and authorship pattern.

Keywords: Librametry, Institute of Scientific Information (ISI), Scientometrics, Web of Science (WOS), FID

Introduction

Bibliometrics is a type of research method used in Library and information science. It is a quantitative study of various aspects of literature on a topic and is used to identify the pattern of publication, authorship and secondary journal coverage with the objective of getting an insight into the dynamics of growth of knowledge in the areas under consideration. This consequently leads to the better organization of Information resources which is essential for its most effective and efficient use. Bibliometrics today has attained sophistication and complexity having national, international and interdisciplinary character. The present study focuses attention on the bibliometric analysis of the pattern of publication, authorship and journal coverage by the scientist on Ecology.

The term "Bibliometrics" was first coined by Pritchard in 1969, and its usage and practice can be traced back to the second decade of this country. A pioneer example of a bibliometric study was a 'statistical analysis of the literature'

of comparative anatomy from 1543 to 1860 by counting the number of titles, both books and journal articles, and grouping them by countries of origin within periods.

In 1923 the second study was conducted by Hulme, entitled "statistical Analysis of the history of Science". His analysis was based on the original entries in the seventeen sections of the "English International Catalogue of Scientific Literature".

The third study was the pioneering work of Gross and Gross reported in 1927. They used the method of counting and analyzing the citations appended to articles in the Journal of the American Chemical Society, and produced a list of journals of 'importance in chemical education'. The fourth and prominent work was of Bradford in 1934 on the distribution and in Lubrication research. This research found the backbone of the theoretical foundation of the 'Bibliometrics' study, known as the "Bradford's Law of Scattering."

Bibliometric is just one of many sciences whose name ends with "metrics". Many scientists used the term under different names, but the concepts were more or less supplementary and complementary to each other with some broader and narrower extension of human ideas. One name that was used quite early but very scarcely was statistical

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analysis of the literature by Cole and Eales in 1917, while Hulme used the term 'statistical Bibliography' in 1923.

In 1948, the great Library Scientist, S.R. Ranganathan, coined the term "Librametry", which historically appeared first and perhaps seemed proper to streamline the services of librarianship. The term 'Bibliometrics' is just analogous to Ranganathan's Librametry, the Russian concept of Scientometrics, FID's 'Informetrics' and to some other well established sub-disciplines like 'Econometrics', 'Psychometrics', 'Sociometrics', 'Biometrics', 'Technometrics', 'Chemometrics', 'Climetrics', where mathematical and statistical calculus have been systematically applied to study and solve problems in their respective fields. Now-a-days, the term 'Scientometrics' is used for the application of quantitative methods to the history of science and obviously overlaps with bibliometrics to a considerable extent.

Bibliometric Laws

Bibliometric Laws are statistical expression which seek to describe the working of Science by mathematical means. The three basic laws in bibliometrics are:

Lotka's Law is considered as the earliest and most widely applied study in measuring the scientific productivity of an author. He claims that a large proportion of the literature is produced by a small number of authors and it is distributed so as the number of people producing 'n' papers is approximately proportional to $1/n^2$.

Zipf's Law is a statistical distribution of word frequency on a hyperbolic curve, which states: "If the words are arranged in their decreasing order of frequency, then the rank of any given word of the text will be inversely proportional to the frequency of occurrence of the word.

Bradford's Law is perhaps the best known of all the bibliometric concepts. His law describes how the literature on a subject is distributed in journals. He divides the articles found on a subject into three roughly equal zones, which increase by a multiple of above five. The relation between number of periodicals coming in the first zone of the 'nucleus' and the successive zones could be represented as 1:n:n² ... Apart

from the verbal formula, Bradford also gives a graphical representation of scattering of articles in periodicals.

Application of bibliometrics

Bibliometrics as a technique has extensive application in identifying the research trends in a subject, trends in authorship and collaboration in research, core periodicals, obsolescence and dispersion of scientific literature useful in estimating the comprehensiveness of secondary periodicals, studying the author productivity and impact of research, distribution of scientific publications by Universities, citation studies and so on. Most of these studies pertain to Universities, Scientists, disciplines and documents, Further, bibliometrics could be used in the identification of emerging research areas.

The popularity in the adoption of bibliometric techniques in various disciplines stimulated stupendous growth of literature on bibliometrics and its related areas. The techniques are now being vigorously pursued, and with the result, it has been found that on fourth of all the articles published in a Library and Information Science periodicals also carry a large number of articles on bibliometrics. These techniques are being used for a variety of purposes like determination of various scientific indicators, evaluation of scientific output, selection of journals for libraries and even forecasting potential Nobel Laureates.

In the recent years, there has been an explosive growth in human knowledge. In fact, the nature and tempo of growth has been such as to far outstrip the achievements of the past centuries. As science itself grown in extension and intention and the number of scientists increases. So obviously does the volume of literature generated by the scientific community. The growth of literature itself has caused a fairly widespread alarm and the term that describes explosion also known as information explosion.

It could be noted that at the global level about 5 million articles are being published annually in about one lakh journals. The 5th edition of the world list of scientific periodicals shows a two hundred percent increase in the number of scientific periodicals since 1970. De Solla Price claimed, that the science literature has grown

exponentially in the last three centuries with a doubling rate approximately 15 years.

The major focus of the study is to apply the bibliometric analysis with a view to analyse the performance of research output of Scientists in the Universities of Tamil Nadu. The study has resulted in a special attention on the performance of research output in science. It aims at examining the emergence of research areas, research groups and research department in Universities with a view to map the cognitive or intellectual structure of research.

Literature review

It devotes to examine the review of works relating to various aspects of Bibliometric studies. It could be observed that there are various research studies highlighting the importance of bibliometric analysis and their application to library management and administration. This type of analysis enables the researcher to identify the research gap in the previous studies. By considering this efficiency of various dimensions of bibliometric studies, the researcher has presented the literature.

Louttit (1957) analysed the language performance of writing research papers by psychologists, chemists and physicists. It was observed that reference made by writers in English language journals were 92.5 percent in English, in German journals 91 percent German French journals 64.6 percent French. Further it was said that numerous studies in Social Sciences show reference in American sources having around 90 percent in English.

Simonton (1960) identified that in two language source journals in the field of Fine arts, more than half of the references were the materials in foreign language references.

Ozinonu (1970) made an early survey relating to growth of Basic Science in Turkey. The author identified the growth of manpower and frequency of Publications in Mathematics, Physics, Astronomy, Chemistry and Bio-Science for the period 1933-1966.

Rangarajan and Poonam Bhatnagar(1981) analysed the Bibliometric data compiled from Physics Abstracts on research papers published in the field of Mossbauer effect studies over a

period of two decades from its discovery in respect of media choice.

Klaic (1990) examined the research activity of chemists from Rugjer Boskovic, Yugoslavia during 1976-1985 covering 2018 research papers of scientific work. The papers were classified according to subfields used in the Journal Citation Reports. In this study he found that over 67 percent of papers corresponded to journal articles.

Kannappanavar and Vijayakumar (2001) made a study on the authorship trend in International Monitory Fund Literature for a period from 1991-1998 and concluded that collaborative research is in an increasing trend varying from 0.45-0.62. The average degree of collaboration was found to be 0.56-0.81 by studying five selective journals in geology covering a period from 1987-1996.

Robert Dalpe (2002) conducted a study to assess quality for bibliometric studies in relation to collaboration of authors using biotechnology research and revealed the interaction between Science and Technology.

Garg (2003) has given an overview of the studies published in the International Journal Scientometrics during 1978-2000 on cross-national, national and institutional scientometric assessment.

Abbas Horri (2004) made a bibliometric overview of Library and Information Science research productivity in Iran over the years 1996-1998. In his findings indicate that most contributions to the scientific production of the field are research papers, theses and research reports respectively.

Methodology

The present study attempts to find out the pattern of information published by scientific researchers in the field of Ecology. The study is based on the references to analyse quantitatively the growth and development of publication output as reflected in Web of Science database during the period of 1990-2006. There are 501 records were retrieved from Web of Science, it is the largest abstract and citation database of research literature and quality web sources. It's designed to find the information scientists need. Quick, easy and comprehensive, Web of Science

provides superior support of the literature research process.

The Web of Science is an online edition that combines the three databases SCI expanded (an SCI edition with broader coverage), the SSCI and the ACHI in a unique on-line database published from Institute of Scientific Information (ISI), Philadelphia. The SCIE covers about 5900 journals whereas the SCI covers about 3500, the SSCI covers 1700 journals and 3300 journals selectively, the ACHI finally covers more than 1100 journals fully and about 7000 journals selectively. The Web of Science, in turn, is part of the more comprehensive Web of Knowledge. The Web of Knowledge comprises the above mentioned ISI databases as well as the Derwent Innovations Index, BIOSIS previews, ISI proceedings, CAB ABSTRACTS and INSPEC bibliographic and patent databases.

The Publications of Scientists are mostly in the form of primary Journals, Notes, Letters, review, Editorial-materials, Meeting-abstracts, Bibliographic-items and Discussions. The research papers published by Scientists in the field of Ecology covered in the annual version of Science Citation Index database were taken as the prime source for the present study. The papers published from 1990 to 2006 by the scientists are accounted totally 501. They were retrieved from SCI database which is considered to be a prime source of data for the present study.

The Bibliographical details of publications were entered in the catalogue cards. Finally the cards were arranged in different ways with a view to identify the research performance of faculty Members.

Findings

The present study has been undertaken to assess the research performance of science Scientists on Ecology. The results of research have been published by the scientists in different sources. The findings of the present study leads to the following observations;

* The findings of the year-wise research output of scientists on Ecology brings out the fact that the highest number of publications was 54 published in the year 2005.

* The findings of the Authorship pattern of Ecology Scientists brings out the fact that the

double authored research output is high with 198 (39.52%).

* The findings of the Ranking of Authors based on their publications brings out the fact that J.S. Singh captured the first place with 15 publications during the study period.

* The findings of the collaborative country wise research output brings out the fact that the Faculties are having good relation with various countries for research paper contribution like USA, England, Germany etc.

* The findings of the source wise distribution of research output brings out the fact that the Journal articles occupied the predominant place among the other sources of publication.

* The findings of the collaborative Institution wise research output brings out the fact that they have good relation with other Institutions for research contribution like National Institute of Oceanography, Indian Institute of technology and so on.

* The findings of the ranking of Journals brings out the fact that the highest number of publications was 81 (16.17%) published in Current Science Journal.

* The findings of the Single Vs Multiple authored Publications brings out the fact that the Multiple Authored papers dominate with high of 80.64 %.

* The findings of the subject wise research output brings out that among the various science subjects Multi disciplinary and Environmental Ecology subjects occupied the first two place in order.

Suggestions

The findings of the present study lead to the following suggestive measures:

* There are needs to provide more infrastructural facilities to the Ecology research institutions and Academic Institutions also.

* There is a need to give special training programmes to develop the efficiency to caliber among the scientists of various institutions to pursue their research activities on par with the world output.

* There is a need to provide incentives and awards to the eminent and outstanding scientists

depending on their level of contribution to the growth of research and development of the discipline.

* There is a need to encourage and motivate a collaborative research activities. IN this context scientists of Ecology may be encouraged to undergo collaborative research with the other countries.

* The Scientists should be given more number of project in the subject fields which are lagged behind.

* The funding agencies should allocate equal number of projects to all institutions irrespective of demand and request.

* The state and Central governments should come forward to allocate more funds especially for research activities for all the Institutions.

Conclusion

The research trend in the field of Ecology is collaborative in nature like any other discipline. The studies on bibliometric are mostly concentrated on data drawn from databases, individual journals, individual institutions, research output in a particular field of knowledge, individual subjects research output, individual author's publication and so on. The

present study also appears to be a milestone on the above said fact.

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