

SCIENTOMETRY

System of analysis in Information Science

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Abstract:

This article deals with basics of scientometry. It gives history, definitions, various aspects and examples of scientometry. This system of analysis in Information Science will be more helpful for researchers in the field of Physical and Life Sciences as it provides them a ready to use database. The article gives the variety of sources of journals, book, web addresses that provides data on scientometrics. The article also discusses use of scientometrics in Library and Information Science. At the end, the conclusion is made, that the scientometrics becomes an especially perspective part of the general “science of science”, and a powerful tool of the research and innovation policy. Scientometrics is thus gaining popularity in the recent days.

Introduction:

Scientometrics is the science of measuring and analyzing science. In practice, scientometrics is often done using bibliometrics which is a measurement of the impact of (scientific) publications.

The terms bibliometry and scientometry were introduced almost simultaneously by Pritchard, Nalimov and Mulchenko in 1969. When it was first used, the term bibliometry was defined as “the application of mathematical and statistical methods to books and other means of communication, dealing especially with library and research center management, while scientometry refers to those quantitative methods that are used in science analysis regarded as an information process”. Although bibliometric and scientometric methods are similar, we must emphasize that scientometry analyzes the quantitative aspects of generation, propagation and use of scientific information, in order to contribute to understanding the mechanism of scientific research.

Definition:

Scientometry is the study and valuation of science by quantitative means, such as the number of papers published in a field.

According to Nalimov and Mulchenko, define this term, 'as a sub-field which applies quantitative methods to the study of science as an information process. In this information model, publications are carriers of information and promoters of communication.' (Zafrunnisha)

History:

The use of scientometric indicators in research evaluation emerged in the 1960s and 1970s, first in the United States and then also in various European countries. Before that time, research evaluation had not been formalized other than through the peer review system, on the one hand, and through economic indicators which

h could only be used at the macro-level of a (national) system, on the other.

Scientometrics was introduced and came into prominence with the funding of the journal named 'Scientometrics' by T.Braun in 1977, originally published from Hungary and currently from Amsterdam.

Scientometry was established to measure the development of the countries and nations rather than the individuals. The reason is that it was first created by Soviet Russia, then was used in eastern European countries and finally was accepted by other countries. Scientometry is now regarded as a measurement for growth and development. Scietometry, as a newly emerged measurement, has some common concepts with bibliometry, and it is a new domain in research activities.

Need of Scientometrics:

Evaluation is something necessary in all aspects of our lives by which one can measure things, activities, and processes. It is also very important for decision makers. Without evaluation, no body and then, no country, or nation can decide where to go and what to choose.

In our technological world in which the changes are the main factors to determine things, the evaluation is of great importance.

Features of scientometrics:

Scientometrics investigates quantitative aspects of Science, Science of Science, scientific communication and on science policy studies. It deals with creation, flow, dissemination and use of scholarly scientific information. It is acting as a bridge between science / scientists and texts.

In practice, Scientometrics is often done using bibliometrics that is measurement of (Scientific) publications. “Bibliometrics is a type of research method used in library and information science. It utilizes quantitative analysis and statistics to describe patterns of publication within a given field or body of literature. Researchers may use bibliometric methods of evaluation to determine the influence of a single writer, for example, or to describe the relationship between two or more writers or works. One common way of conducting bibliometric research is to use the *Social Science Citation Index*, the *Science Citation Index* or the *Arts and Humanities Citation Index* to trace citations.”

The majority of Scientometric analysis deals with empirical investigation of publications in specific scientific fields and subfields. Such research is often carried-out by information specialists and is published in information science journals.

Scope of Scientometrics:

The wider thematic scope of scientometrics includes issues as: quantitative studies of scientists, projects, funding of research, research infrastructure, etc.; quantitative studies of publications, patents, and citations by institutions, countries, languages, co-authorships, thematic fields, etc.; investigations and monitoring of individual, institutional, or state research production; identification of relations between different research disciplines; studies of the internationalization of science; tracing the development of a given scientific field, research community, institution, etc.; revealing of emerging research problems; assessing the impact factor of scientific journals;

The main set of research instruments, applied in scientometrics, comprises observation, measuring, mathematical processing, comparison, classification, generalization, visualization, and interpretation of data.

Types of indicators:

The objects of study in scientometric research are two main types:

- 1) “input” ones: connected with the research process – scientists, financial parameters, infrastructure and organization entities, research programs, etc.;
 - 2) “Output” ones: related to the research products – implemented projects, registered discoveries, patents, publications (or their components), as well as the citations of them.
- The scientific documents (articles, monographs, conference reports, patent descriptions,

etc.) and their derivative elements are the major subject of *bibliometrics* as an important part of the considered research approach.

Classification of the scientometric methods:

There are some classifications of the scientometric methods and models, submitted mainly by representatives of the Russian school of scientometrics.

So, for instance, Haitun (1983) divides the scientometric methods into several classes:

- *Statistical method* with measures – number of discoveries, number of journals, number of institutions, number of scientists, frequency of co-authorship.
- *Publication counting* with a measure – number of research products (articles, monographs, patent descriptions, reports, etc.);
- *citation index* with a measure – number of citations; *text analyses*(content analysis, thesaurus)

Sources of Scientometrics:

The following are the journals, books and web addresses, which provide information on Scientometrics.

Journals

Scientometrics: Scientometrics is an international journal for all quantitative aspects of the Science of Science, communication in science and science policy. The journal aims at publishing original studies, short communications, preliminary reports, review papers, letters to the editor, and book reviews on Scientometrics.

Cybermetrics: Cybermetrics is an electronic journal developed to the Scientometrics, informatics and bibliometrics and the scientific and scholarly communications on the Internet.

Cybermetrics is both an Electronic and a virtual forum devoted to the study of the quantitative analysis of scholarly and scientific communications on the Internet. It is open to world-wide researchers to publish and discuss their findings. Cybermetrics also maintain a series of directories of electronic resources including secondary archives of interesting web papers in pdf format. The aim is to provide a reference tool to those researchers involved in the quantitative description and analysis of the internet as a scholarly communication tool.

Cybermetrics is an International peer-reviewed journal published in English and distributed free of charge in the World Wide Web. The web address of this journal is given below:

<http://www.cindoc.csic.es/cybermetrics/cybermetrics.html>

Books:

A few books on Scientometrics are given below:

1. The Challenges of Scientometrics by Loet Leydesdorff- 356 p
2. Seventh conference of the International society by Cesar A Macias Chapula.
3. Scientific Genius by Dean Keith Simonton- 240 p
4. Information Visualization by Chaumei Chen-316p.
5. Bibliometrics by Devarajan.Ess Esspublications, New Delhi-294p.

Databases:

Broadly accepted empirical sources of information for scientometrics are the databases of The Institute for Scientific Information (ISI, Philadelphia, USA) – Thomson Scientific: *Science Citation Index, Social Sciences Citation Index, Arts and Humanities Citation Index, Essential Science Indicators, Journal Citation Reports*, etc.

In recent years similar information resources and services have been provided by the information system *Scopus* as well.

Web addresses:

A few web addresses which provide more information about Scientometrics are:

<http://www.leydesdorff.net>

<http://www.kluweronline.com>

<http://www.wkap.nl>

<http://kluweronline@wkap.nl>

<http://upmf-grenoble.fr>

<http://www.web.uni-bielefeld.de/iwt/mw/service2.html>

<http://www.en.wikipedia.org/wiki/scientometrics>

<http://www.springer.com/sgw/cda>

<http://www.issi-society.info>

Examples of applications of scientometrics in library science:

1) A Bibliometric Study of Published Literature in Library and Information Science in IASLIC Bulletin: 2003 – 2007 by Sambhu Nath Halder and Suvra Chandra

This paper highlights the growth patterns of Library and Information Science literature on the basis of bibliometric study. Efforts have been made to analyze the articles of IASLIC Bulletin published from the year 2003 to 2007. The investigation focuses on distribution of contributions, authorship pattern of contributions, distribution of references, analysis of length of literature, distribution of illustrations used, state wise distribution of contributions and subject trends of the articles, etc.

METHODOLOGY ADAPTED:

For this study IASLIC Bulletin had been selected as the source journal. All the lead articles and research paper of five volumes (Vol 48-Vol 52) containing 20 issues published during 2003-2007 have been taken up for the study. In these 5 volumes, there is total number of 126 articles. The details with regard to these published articles, such as the title of the articles, number of authors, address of authors, number of references and their categories, number of pages, number of various illustrations used in those articles, sub – fields of IASLIC BULLETIN are recorded and analyzed for making observations. Statistical tools, like tabular presentation of various data, line diagram, bar diagram and pie diagram are used to represent the study effectively.

Findings:

In this context, this study may provide new information emerging out from the bibliometric study particularly of IASLIC Bulletin. As this bulletin is one of leading journals in the field of library and information science, the findings must reveal various aspects of the characteristics and pattern of contributions of this journal.

2) Bibliometric and Scientometric Service by National Science Library, New Delhi:

Bibliometric service is carried out for studying growth, development and spread of any area of research, and also for identifying centres of excellence, influential authors etc. The service is useful for heads of departments / institutions, research planners, policy makers and individual scientists. Under this service following analytical studies are carried out:

Citation Analysis: Checks how many times and where a given paper has been cited in world literature.

Impact Factor of Journals: Impact factor of a journal implies the frequency with which the average article of the journal has been cited in a particular year.

Bibliometric Analysis: Analysis of research papers published by institutions, groups of scientists, individual scientists etc. in comparison with other similar research.

Institutional Research Output: An Analytical report of research papers published in national and international journals (covered by WoS) by the R&D scientists of the institution. Analysis is based on impact factor of journals covered by WoS.

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 organizational contexts. In this sense, bibliometrics is also relevant for researchers, policy and decision makers and also researchers outside the library and information science.

It must be noted that scientometry is neither an absolute measuring tool nor an act as a magic, but up to now it has been considered as the best means to measure scientific potentials and introduce some solutions to the problems.

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