

A Scientometric Anylysis: A Study

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Abstract

Scientometrics could be a newly emerging field that analyses the quantitative characteristics of science and is usually used with identical that means as bibliometrics which implies the appliance of quantitative ways to the history of science, but now it is usually used for a variety of research perspectives in the study of science. That quantitative side of science will be used to access the characteristics of science. From the last few decades, the field of library and information science has developed various quantitative methods for study. Library and information science is an interdisciplinary field in which academics from various disciplines have played an important role in the development of its procedures. Scientists from different backgrounds other than library and information science such as Tibor Braun (Chemistry), or Vasily Nalimov (Philosophy) have contributed important concepts. The paper deals with concept like Webometric, Bibliometric, Scientometric, Librametric and Altmetrics etc.

Keywords: Scientometrics, Scientometric Analysis, Bibliometrics.

Introduction

Science and scientific communication are linked with each other and one has an effect on others for the creation of information. Among scientists and social scientists, it's believed that public analysis meted out in tutorial, and government establishments could be a drive behind engineering and economic improvement. Research had made a tremendous contribution to the economic upturn of the country. Today, millions of documents in various disciplines are being created every hour in every field. It has been estimated that the number of standard periodicals in science and technology alone is 70,000 and about 1,000 new titles are added every year. This continuous increase in the number of published information is referred to as "Information Explosion" which produced many challenges among library and information professionals. Finding suitable information and making use of that information is a big challenge. Thus, various techniques are needed to overcome these challenges and are used to measure the output of research and development in various fields.

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Pouris defined " Scientometrics is for science what econometrics is for economics. So it is a pplication of quantitative techniques to communication of scientific kind and with various objectives of

1. Developing science indicators.
2. Measuring the impact of science on society; and
3. Comparing the output as well as the impact of science at national and international levels."

Garfield (1979) defines scientometrics as "the study of measurement of scientific and technological progress.

Aim of the Paper:-

Basically, the main purpose of the scientometrics in the field of library and information science is to analyze and evaluate the research article includes measuring the impact of authors, publications, journals, institutes, research publications. It also aims to understand the behaviour of scientific citations as a mean of scholarly publication.

The aim of the research study to identify the various perspective and their use of scientometrics methods in the field of library and information science."

This research article also explain the how to analyze and evaluate the research article with the impact factor and citations.



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The term Scientometrics originated as a Russian term 'naukometriya' by Vassily V. Nalimov and Mulchenko in the year 1969. The word "metrics" is "derived from the Latin and Greek word "metricus" or "metrikos" meaning measurement.

Tibor Braun of the Hungarian Academy of Sciences launched the first journal in this field named as "Scientometrics". Recently the scientometrics is totally based on the work of Derek J. de Solla Price and Eugene Garfield. The latter founded the Institute of Scientific Information (ISI) that meted out the scientometric analysis. The analysis of scientific literature began in the 20th century by analyzing the scientific output of different countries based on their work published. "Scientometric analysis promotes the quantitative aspects of generation, dissemination, and utilization of scientific information in terms of contribution to the understanding of the mechanism of scientific research." Scientometrics literature is usually referred to as "socio-metrics" or somewhat derogatorily, as "research-on-research."

Definitions of Scientometrics

Various definitions have been given by experts in the field of scientometrics, one of the them is by Nalimov and Mulchenko (1969) " Quantitative methods which deal with the analysis of science viewed as an information process" Whereas in the year 1992 Tague Sutcliffe defined "scientometric as " the study of the quantitative aspects of science as a discipline or economic activity. . It is part of the sociology of science and has application to science policy-making. It involves quantitative studies of scientific activities, including publication, and so overlaps bibliometrics to some extent."

Scientometrics is basically a technique or method that helps in identifying the research trends to check the authorship pattern and various collaborators attached to it, trend of a area or subject, periodicals, dispersion and trend of obsolescence of scientific literature that leads to evolution of secondary periodicals, the impact of research, the productivity of author, citation pattern, distribution of scientific publication of any institution etc. It also helps in knowing the various areas which are coming up or flourishing in recent areas.

Direct counts, graphical representations specific bibliometric entities like publications and patents, keywords, addresses or citations, etc. type the premise of one-dimensional techniques. These square measure won't generate indicators to watch the state of the art science and technology system. Scalar indicators have found tremendous use in science policymaking each as descriptive and diagnostic tools

History

Many years passed and many new words came into picture which represents quantitative studies of library science, data science and information science etc. These are known as 'Librametrics" In the year 1960 term Bibliometrics and scientometrics appeared and represented quantitative studies within the library science and data science. They were far-famed as: 'Librametrics' within the

1940s, 'Bibliometric' within the 1960s, 'Scientometrics' within the 1970s, and 'Informetrics' in the middle of the 1980s and with the arrival of data technology and new ideas, namely, 'Cybermetrics' and 'Webometrics' emerged within the 1990s and a new idea emerged in 2010 named as 'Almetrics'.

Review of Literature

John Mingers (2015) describes Scientometrics is the study of the quantitative aspects of the process of science as a communication system. It is centrally, but not only, concerned with the analysis of citations in the academic literature.

In recent years it has come to play a major role in the measurement and evaluation of research performance. In this review we consider: the historical development of scientometrics, sources of citation data, citation metrics and the "laws" of scientometrics, normalisation, journal impact factors and other journal metrics, visualising and mapping science, evaluation and policy, and future developments.

Alireza Abbasi, Hamid R Jamali (2020) investigates whether universities should go for greater diversity in their research or specialise and concentrate their research and try to only excel in a few fields. To answer this question, we assess the association between universities' research diversification, measured by breadth and depth and their impact and ranking. Universities' diversification is measured based on the disciplinary ratings of universities in Excellence in Research for Australia (ERA 2018). Research output and citation impact data from In Cites database were used for the analysis. Breadth is measured by the ratio of the fields in which a university is active to the total number of fields. Depth is related to the ratings a university has received for its research fields. The results show a significant positive relationship between both university diversification indicators developed in this study and most of the university citation-based performance metrics and research ranking measures.

Richard Webber1, Philip Roe2, Grant Lewison (2021)

The UK's recent departure from the European Union may make it harder for researchers from other countries to be employed here and may discourage research institutions from seeking them. We sought to develop a methodology to see if non-native heritage scientists (with foreign names) brought measurable benefit to their host countries' research

Jacqueline Leta1.*, Kizi Araujo (2021) Past and current efforts towards the development of world R&D, however, have occurred in a context of great inequality, widening social and economic gaps not only between world regions but mainly between countries. A clear example of this scenario of inequality in science is the leadership of the "big five", that is USA, China, countries from European Union, Japan and Russia. As indicated in the UNESCO report, the group alone held 78.1% of all global investment in R&D in 2013. A similar unbalanced picture is also observed when the number of

researchers is considered: the big five encompasses 72.2% of the 7.8 million researchers worldwide.

Bibliometrics

Alan Pritchard (1969) defines bibliometrics as “the application of mathematical methods to books and other media of communication.”

According to Fairthorne (1969) “Bibliometrics is the quantitative treatment of properties of recorded discourse and behavior appertaining to it.”

The term “Bibliometrics” may be a type of mensuration technique by that the interconnected aspects of written language may be quantified. It is that the study, or measure, of texts and data. Bibliometrics utilizes chemical analysis and statistics to explain patterns of publication at intervals a given field or body of literature. Researchers might use Bibliometric ways of analysis to see the influence of one author, as an example, or to explain the connection between two or more writers or works. One common means of conducting bibliometric analysis is to use the scientific discipline Citation Index, the Science Citation Index, or the humanities and Humanities Citation Index to trace citations. Bibliometrics studies may be divided into two classes (a) descriptive and (b) critical. Descriptive studies square measure involved with the number of publications in distinct countries, distinct fields, and distinct periods. Critical studies concentrate on the literature utilized by the researchers operating within the field, their citations, etc. the character and scope of bibliometrics have varied into different styles of output like patents ideally than the scientific literature alone.

Librametry

“Librametry” has two words associated with it one is “Libra” and another is “Metrics”. Libra means Library and Metrics means activity. Dr. S. R. Ranganathan (1949) introduced the term “Librametry” in 1948 at the ASLIB Conference command in Lamington Spa, “that librarians should develop “librametry” on the lines of life science, econometry, and psychological science, as a result of several of the matters connected with library work and services involve a giant number.” Librametry, being the oldest, is that the least used term within the library and data science. The term “Librametry” was used as a generic description for the applying of applied math and mathematical techniques to library issues.

Ranganathan (as cited in Garg, 2001) used varied applied math ways, for instance, to distribute the order of books within the stack rack, inserting the foremost demanded books next to the doorway, and also the least any away. By this implies, he ensured that the library workers would need to walk the shortest distance potential to retrieve the foremost requested books. Ranganathan has used librametry for varied different tasks: budget twenty-four allocations, 7 optimizing the employment and workers' employment, and even the physical coming up with libraries. Although the term isn't widely accepted, that repeatedly results in doubt between librarians and data scientists, who transcribes bibliometrics and its consequences from a distinct point of view.

Informetrics

The term “Informetrics” was initially projected by Otto Nacke of West Germany within the year 1979. Nacke elaborates it to hide all components of knowledge science, managing the measuring of knowledge phenomena and also the applying of mathematical ways to the problems related to the discipline to parts of the data retrieval theory and Bibliometrics. Informetrics is outlined as that that formalizes and consolidates measuring studies that concentrate on information productivity. It integrates information technology and sophisticated intersections of knowledge theory, cybermetrics, call theory, etc. Tague-Sutcliffe defines the term as “the study of quantitative aspects of knowledge in any type, not simply records or bibliographies, and in any social teams, nor simply scientists...It will incorporate, utilize, and extend the numerous studies of the measuring of knowledge that lie outside the boundaries of each ‘Bibliometrics’ and ‘Scientometrics’.” Informetrics has developed applied math and mathematical procedures for assessing and up the effectivity of knowledge. Informetrics has currently big up to a well-defined subject that has cluster analysis, applied statistics, modeling, the study of citation networks, simulation, etc. It deals with electronic media and so includes several topics like applied math analysis of scientific text and hypertext systems, library circulations, and quantitative aspects of knowledge retrieval, library systems, and data live in electronic libraries.

Cybermetrics

Cybermetrics is one in all the recently emerged fields at intervals the road of metric studies. It's gained abundant quality since the mid-1990s with the arrival of knowledge Technology. Because it is principally involved with computer science-based approaches, it's outdated all different metric studies during this Internet Era. Cybermetrics is projected as a generic term for “The study of the quantitative aspects of the construction and use of information resources, structures and 8 technologies on the whole Internet drawing on bibliometric and informetric approaches.” In general, it is defined as “the quantitative study of internet-related phenomena.” Cybermetrics thus encompasses math studies of dialogue groups, mailing lists, and another computer-mediated communication on the internet, along with the globe wide net. Besides covering all computer-mediated communication, exploitation of internet applications, this definition of Cybermetrics put together covers quantitative measures of internet backbone technology, topology, and traffic. The breadth of coverage of cybermetrics implies big overlaps with proliferating laptop science-based approaches within the analyses of online page, link structures, web usage, and internet technologies.

Webometrics

The term “Webometric” was first planned by Almind and Ingwerson within the year 1997. Consistent with them, “The Webometrics study relies on quantitative measurement—indirectly includes the quantitative facet also—of structures, use of data

resources and technologies on WWW drawing on bibliometric and infometric approach.” Within the definition, ‘structure’ means that the characteristics of the web site. It implies that the knowledge that will begin by an internet site makes a well-defined flow diagram for that. The technique known as “scientific mapping” in the bibliometric analysis is also wont to construct areas that seem to be most helpful, supported the number of times they’re hyperlinked to alternative websites. Bjorneborn and Ingwersen outlined webometrics as “the study of the quantitative aspects of the development and use of data resources, structures and technologies on the net drawing on Bibliometrics and Informetrics approach.” Today the term Webometrics is introduced. Therefore, the journal in Webometrics still carries the name “Cybermetrics”. Webometrics and Cybermetrics area unit the terms synonymously used. The sphere has gained eminence with internet Impact issue for the analysis of a website or several alternative areas of the web that relies on the number of hyperlinks linking to that. Bjorneborn and Ingwersen detailed that the webometrics may be a quantitative life that’s involved with four areas of research that is as follows: · Analysis of web content, · Analysis of internet link structure, · Analysis of internet technology, · Analysis of internet usage.

The field of webometrics study is totally encompassed by bibliometrics, as a result of internet documents, whether or not text or multimedia system area unit recorded info keep on internet servers. This recording is also temporary barely as all paper documents aren’t properly achieved. 10 And it’s part lined by scientometrics as several studious activities these days area unit web-based. Moreover, the complete webometrics is enclosed in Cybermetrics.

Altmetrics

The concept of Altmetrics was coined in 2010 as an initiation of article-level metrics that focuses on tracing, collecting, and scheming the activity on behalf of publishers. Social media has deeply modified however folks connect. Currently, they’re finding their manner into bookish communication, as students increasingly force them to uplift their visibility, connect with others, and spread their work. No one will browse everything. We tend to believe filters to form a sense of the bookish literature, however, the slender, ancient filters square measure being swamped. However, the expansion of the latest, on-line bookish tools permits the U.S.A. to form new filters; these altmetrics mirror the broad, the fast impact of scholarship during this burgeoning ecosystem.

Functions of Scientometrics

Sivakami (2006) elaborated the following functions of scientometrics:

1. Scientometrics provides a quantitative analysis of the pattern of publications in different subject fields at micro and macro levels.
2. Scientometrics measures the pattern of publication of all written types of communication.

3. Scientometrics gives information about the structure and formation of knowledge and the process in which it is communicated.
4. It provides an assessment measure that shows the country’s output individually.
5. It investigates the use of various document sources.
6. It analyses the use of individual contributions.
7. It shows the citation pattern of literature

Limitations of Scientometrics

Scientometrics is not free from criticism like any other technique. Kademani et al. (2006) have elaborated the following limitations of scientometric methods:

1. Scientometrics describes the text only. It does not describe meaning and context;
2. Monographs are not covered;
3. Citation indexes give selective coverage of journals which is mostly in English;
4. In the citation indices, only the first author of an article is cited

Homographs, that is, more than one author which is listed under a single name is mixed with a full name with variant initials;

1. Transliterated and translated names;
2. Authors with articles names (de, des, von, van, etc.);
3. Married and maiden names in case of female authors;
4. Typographic errors of human;
5. Some important articles begin to hide as they are taken for granted in the field;
6. Sometimes citations are biased for other scholarly reasons;
7. Some articles may be ahead of their time, thus not cited;
8. Different referencing to the same item (year, volume, page, etc.) Despite these limitations, the scientometric study is considered as the principal method for the extraction of knowledge of scientific productivity of various institutions, authors and to study the pattern of growth of literature, information needs of the scientists, age of literature used, etc.

Applications of Scientometrics

Scientometrics is a technique that helps in identifying the research trends in authorship and their collaborations, trends in a subject, core periodicals, dispersion and obsolescence of scientific literature that helps in evaluating the comprehensiveness of secondary periodicals, the impact of research, and studying author productivity, citation studies, and distribution of scientific publications by research institutions, etc. Scientometrics is also used in the identification of newly emerging research areas. The emergence of information and communication technology has promoted greater proportions in the field of scientometrics study. This development has forwarded unexpected chances for acquiring, interchanging, and processing the information. It is feasible with the help of ICT to include large

scientometric data in large expert information systems and gives the calculated information to the researchers which were difficult for the person to collect data manually. The expansion of the scope of scientometrics is still another direction of development because it deals with the different types of sources. Scientometrics has to take action to the growing demands of the market dealing with the scholarly needs of the researcher, website presentation, business information, etc. Now, scientometrics is linked with other metrics to get the more correct output. The concept called "webometrics" goes through immediate progress. Dikumar (as cited in Ivancheva, 2008) in his study indicated the creation of complex "hybrid" indicators, integrating the purely scientometric information and social, economic, in particular- "demographic type of data, such as the so-called "factor of scientific development", incorporated indicators as the number of publications of the scientists of a given country, indexed in the databases of ISI- the USA, Philadelphia; the number of population in the country; the total number of world population for the corresponding year." Campanario (1995) in his study mentioned that the field of scientometrics also advances the process of "mapping" the networks of disciplinary fields, authors, journals, institutions, etc. Other than the classical methods such as factor analysis, graph theory, cluster analysis, multidimensional scaling, it has been implemented to the theory of neural networks with its attributes "algorithm of Kohonen". Recent trends in the development of scientometrics are the study of the business industry, academic science, and the correlation between science and other disciplinary fields. Scientometrics study also focuses on the recognition of new technology fields, for example, in the field of biotechnology and nanotechnologies. The term "Bio-bibliometrics" is used as a method of retrieving and visualizing biological information in Medical Sciences to generate semantic links between genes. Thus, it is recommended that "Scientometric portrait" is a suitable phrase for the studies on scientists, and "Informetric portrait" for the studies on researchers in other disciplines such as arts, humanities, and social sciences (Koganurmath, 2004). It is also looking for new indicators of technology as well as a development like Literature-Based Innovation Output data.

1.10 Scientometrics: Changing Research Landscape The interest in mediating, observation and assessing scientific and technological activities pattern indicators generated from merchandise, notable publications, arises inside the 20th century, with the prominence of researchers like Lotka, Zifp, Bradford, Nalimov, Solla, Price, and Eugene James Garfield, UN agency brought the first contributions for the event of the areas of Bibliometrics and Scientometrics. Inside the 1960s, the event of these areas grew and got 16 powerfully institutionalized, for the foremost half, as a result of the interest in pattern their methods, theories, and principles to manage tutorial and scientific activity, in exceedingly lacking resources, in addition to needing to live the effectualness and efficiency of the

investments created among all completely different comes, institutions, and analysis groups. A relevant historical mark at intervals the event of bibliometric and scientometric indicators was the use of the analysis of citations to assess and monitor analysis comes. The analysis of citations is closely related to the thought of Impact issue, a method projected by Eugene United States President in 1955, aiming to qualify scientific journals, practice associate index calculated from the standard variety of citations from papers disclosed throughout the previous two years. The rise of the field, the popularization of cyberspace, the digitalizing of scientific production, and conjointly the implementation of databases created it potential to come up with and analyze a lot of comprehensive and complex indicators, involving completely different dimensions, in associate degrees ever-growing speed. Throughout this context, cyberspace of Science information and Science Citation Index arose, which were, for several years, a lot of the only tools out there to produce scientific indicators. Throughout time, different agents received the shut, broadening the alternatives for generating and analyzing science and technology indicators. Some examples are the creation of the Scopus database and SciELO, that besides begin giving indices and indicators supported citation, in a way just like the one projected by Eugene. Bornmann&Leydesdorff (2014) delineated the subsequent points that highlighted the dynamical follow of analysis which bibliometrics is associate degree integral a part of the standard evaluation: Bibliometrics could be a standing operating procedure in analysis with each blessing and drawbacks, however, the question arises whether or not bibliometrics measuring and assessment are seemingly to vary scientific follow. Some analyses fix on specific indicators for measurement research performance, this ends up in the adaptation of international researchers' behavior. One reason for analysis is to extend analysis performance i.e. productivity. However, there also are unintentional effects. as an example, some researchers adopt a publication strategy referred to as 'salami-slicing' during which the results of a hunt project is revealed in several little elements, though it is revealed in a very single or massive paper. This method is also thought to enhance the bibliometrics score. 17 It is additionally fascinating for researchers to publish their learned communication in purported journals whereby the results with a high impact are revealed. Therefore to meet or satisfy the wants, the requirement to control or altered the results consequently. In the national system for analysis, scientometrics plays an awfully necessary role; indicators are typically used while not a lot of data. There's a community of pros in scientometrics UN agency to develop advanced indicators for citation impact measuring and productivity. These centers of skilled experience have generated analytical versions of the databases, as an example, at the Centre for Science and Technology (Centrum voor Wetenschappen Technologische Studies, CWTS, Leiden) or the Centre for the analysis and Development observation (ECCOM, Leuven). A range

of suppliers of bibliometrics knowledge, like Elsevier or Thomson Reuters, have developed 'desktop bibliometrics' that could be an analysis system that produces results concerning any given knowledge at the press of the button. It additionally will increase the danger of research of the info while not a lot of data on the topic. This is often why the results of the analysis don't forever correspond to the present standards of bibliometrics. Until the Nineties, politicians have a religion that pushing the standard of science to the best levels would mechanically generate returns for society. Quality controls within the analysis were involved with the utilization of analysis for analysis. Because the competition between the nations cared-for grow, the direct social edges have affected more and more into the foreground of quality assessment. The state does not have a religion that wonderful analysis alone is mechanically best for society. Basic analysis, especially, has become subject to scrutiny, since it's tougher to indicate a link between its results and useful applications. Recent years have so seen a bent to implement analysis procedures that plan to give data on the social impacts of research. Evaluating the social impacts of analysis doesn't stop at the standard merchandise of analysis, like prizes or publications, however, includes different parts like code, patents, or information sets. However, there square measure still no accepted normal procedures that yield reliable and valid information. So-called altmetrics, the amount of page views, downloads Alzheimer diseases, shares, saves, recommendations, and comments from social media platforms, like Twitter, Mendeley, and 18 Facebook might offer a potential different to bibliometric information. An advantage of altmetrics is the ability to produce recent information, whereas citations want time to accumulate. Another advantage is that different metrics can even live the impact of analysis in alternative sectors of society, as social media platforms square measure utilized by people and establishments from several elements of society. Finally, metrics got to be valid by correlating them with alternative indicators. The current challenge of mensuration has triggered a scientific revolution in scientometrics, wherever the impact of publication will be now no longer equivalent to citations, and productivity not solely means that publication. Scientometrics can currently enter a section of traditional science wherever it'll notice answers to the queries. Intelligibly, scientometrics has become a vital part of the analysis. Scientometrics plays a crucial role in creating choices like funding promotions, job offers, national analysis policy, and therefore careers of scientists. Scientometrics is one such technique wherever we have a tendency to get relevant, reliable, and clear results that square measure made through completely different indicators and citation-based information if done properly. Currently, the new challenge is to develop Altmetrics to identical standards.

Conclusion

The universe of knowledge could be the advanced output of man's intellect within the kind of

documented literature and it's ever-expanding each quantitatively and qualitatively in a very multi-disciplinary and three-dimensional manner. The productivity of scientific research performance can be perceived through a communication system. Communication can be examined for a library professional, an archivist, financial expert, business expert, a sociologist, a psychologist, and so on.

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