

Research Metric Techniques Definitions: An Overview

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Abstract

The paper deals with various concepts of research metrics techniques. These techniques are citation analysis, Librametrics, Bibliometrics, Scientometrics, Informetric, Webometrics and Altemetrics. It describes the terms and definitions of research metric techniques.

Keywords: Librametrics, Bibliometrics, Scientometrics, Informetric, Webometrics and Altimetric.

I. Introduction

Research Metric studies include quantitative and qualitative techniques. For this purpose several metrics techniques have been developed and used in research study. There are various metrics techniques that evaluated different aspects of research impact taking into account the number of publications, citations and career length. They search for to measure the quantity and quality any of scientific publication. Metrics helps us to understand the standing of our research within the context of another research. It helps us to understand progress towards our strategic goals. We can use them as part of our methodology for ranking institutions. When used appropriately, metrics can provide an indication of performance, which can reduce the time burden associated with intensive

auditing and reviewing process. Some of the developments of research techniques and their definitions given by authors that will be discussed here are as follows: Citation analysis can be used for identifying the core periodicals, methodology, giving credit for related work, recognizing pioneers, criticizing previous works, earlier research and characteristic features such as: authorship pattern, subject, length, age, area, language, obsolescence, half-life, aging factor, impact factor, bibliographical forms, bibliographic coupling, scattering, co-citation etc. Other than citation analysis, several new terms have appeared on the horizon representing quantitative studies in Library & Information Science. They were known as 'Librametrics' in 1940's, 'Bibliometrics' in 1960's, 'Scientometrics' in 1970's & 'Informetric' in the midst of 1980's, Web metrics emerged in 1990's. And now Altmetrics.

III. Metric Techniques: Some of the metric techniques are discussed as follows

i. Citation Analysis

Citation analysis has become one of the popular methods employed in the identification of core journals in a particular subject field or for particular scientific community in a geographical area.

II. Definitions of Citation Analysis

The Cambridge Encyclopaedia defines citation analysis as "the quantitative analysis of the use of bibliographical citations in academic publications. The number of times a research study or a journal is cited by others can be interpreted as valid indicator of its productivity and importance" Martyn has defined citation analysis as "the analysis of citations or references or both which form part of the scholarly apparatus of primary communications. The

techniques used for putting items of references in some kind of rank or order, whether they are journals or author cited”.

According to Smith (1981:83), a ‘reference’ is the “acknowledgement that one document gives to another” Citation analysis reveals interesting information about knowledge producers in terms their information seeking behavior and usage of various information sources. It can highlight the familiarity, awareness and usage of knowledge producers regarding the online and print information sources. Citation analysis examines the frequency, patterns and graphs of citations in articles and books (**Garfield et al., 1983**).

ii. Bibliometrics

The term bibliometrics was proposed by Alan Pritchard (1969) as a replacement to the term “Statistical Bibliography”. Bibliometrics as “the application of mathematical and statistical methods to books and other media of communications

Definitions of Bibliometrics

More recently **Potter** defined bibliometrics as “the study and measurement of the publication patterns of all forms of written communication and their authorship”. More explicitly, **Sengupta** defines it as the “organization, classification and quantitative evaluation of publication patterns of all macro-and micro communications along with their authorships by mathematical and statistical calculus”. While coining the term bibliometrics **Pritchard** defined it as “The application of mathematics and statistical methods to books and other forms of written communication”. This means, bibliometrics is a sort of measuring technique by which interconnected aspects of written Communications can be quantified. Here it may be necessary to mention at least some classic definitions of bibliometrics for further connotation of the term. **Fairthorne** described it as “quantitative

treatment of the properties of recorded discourse and behaviour appertaining to it".

Later, in 1972, Pritchard further elucidated bibliometrics as "Metrology of the Information transfer process and its purpose is analysis and control of the process". He argued that measurement is "the common theme through definition and purpose of bibliometrics" and "the things that we are measuring when we carry out bibliometric study are the process variables in the Information transfer process".

The British Standard Glossary of documentation of Terms explained Bibliometrics as "the study of the use of documents and patterns of publication in which mathematical and statistical methods have been applied", which is basically similar to Pritchard's original definition. **Hawkins** looked at bibliometrics as "Quantitative analysis of the bibliographic feature of a body of literature". **More recently potter**, defined bibliometrics as "the study and measurement of the publication patterns of all forms of written communication and their authorship". **Sengupta** defined it more explicitly as "Organisation, classification and quantitative evaluation of publication patterns of all macro- and micro-communication along with their authorships by mathematical and statistical calculus". **Schrader** said it even more simply bibliometrics is "the scientific study of recorded discourse". **Broadus** presented a historical overview of various definitions of bibliometrics and proposed an alternative definition. According to him, bibliometrics is the quantitative study of physical published units or of bibliographic units or of surrogates of either. **According to Dorothy Hertzell** "Bibliometrics, the Science of recorded discourse - which uses specific methodologies, mathematical and scientific, in its research in a controlled study of communication. It is the body of a literature, a bibliography quantitatively or numerically or statistically analysed - a statistical

bibliography, a bibliography in which measurements are used to document and explain the regularity of communication phenomena".

While elaborating scope and purpose of bibliometrics, **Pritchard** very lucidly assigned the purpose of bibliometrics as "To shed light on the process of written communication and of the nature and course of development of a descriptive (in so far as this is displayed through written communication) means of counting and analysing the various facets of written communication".

Nicholas and Ritchie in 1978 stressed that the scope of bibliometrics is "... to provide Information about the structure of knowledge and how it is communicated". They classified bibliometrics into two broad groups: descriptive studies and behavioral studies. Descriptive studies generally describe the characteristics or features of a literature; while the behavioural ones are those that examine the relationships formed between components of a literature (**Lawani , 1981; Sengupta, 1992; Maheswarappa, 1997; Hood and Wilson , 2001; Pardhi and Garg, 2004 ; Thelwall , 2008 ; Jalal and Mukhyopadhyaya, 2009**).

iii. Librametrics

The term 'Librametrics' was proposed by Ranganathan in 1948. Its primarily aims at the quantitative analysis of the management of libraries and its services. It is related to examine such as the utilization of documents, library staff and library users.

Definitions of Librametrics

According to Rao, 1985 presented his paper during the 15th India IASLIC Conference on Bibliometrics held at Bangalore University in December in 1985 where he defined Librametrics as "information processes and information handling in libraries and

information centres by quantitatively analysing the characteristics and behaviour of documents, library staff and library users”.

... information processes and information handling in libraries and information centres by quantitatively analysing the characteristics and behaviour of documents, library staff and library users (Ravichandran Rao and Neelameghan,1992). According to Sengupta, 1992 Librametrics as, “Quantitative analysis of various facets of library activities and library documents by the application of mathematical and statistical calculus to seek solution to library problems” (Sengupta, 1992). According to Brookes, 1990:40 - “the measurement of all quantitative data directly related to libraries.” Subba Rao (1993) defines Librametrics as “Measurement of library activities and results of its services would form the – of Librametrics. Essentially the method is an objective analysis that puts down quantitative phenomenon as data measuring a uniform norm, and examine the inter relationships of the assembled data, drawing formulae of behaviour pattern or conclusions in the shape of trends of established maxima-minima units for the phenomenon” (Ravichandran Rao and Neelameghan, 1992).

iv. Scientometrics

“The term scientometric, coined by Tibor Braun, has become fruitful in science policy studies. The term has now established a significant role in social sciences. Though the techniques of scientometric and bibliometrics are closely similar their different roles are distinguished by their very different contexts.”

Definitions of Scientometrics

According to Nalimov and Mulchenko in their book defined Scientometrics as: “A quantitative method of investigating the development of science as an information process”.

Brookes (1990, p. 42) gave further insight into the use and definition of Scientometrics According to **Hood & Wilson (2001)** the term scientometric is mainly used to study all aspects of the literature of science and technology. Thus it “*includes all quantitative aspects of the science of science, communication in science, and science policy*” (**Hood & Wilson, 2001:293**). According to **Sen**, bibliometrics deals with documents and its components while metric studies pertaining to information is informatics. Morales uses the term informetric to cover almost all the aspects of bibliometrics and Librametrics. All those four metrics have overlapping areas. *Scientometrics* is the quantitative study of science as such (**Hood and Wilson 2001**). It “involves quantitative studies of scientific activities and also includes among others publication, and thus overlaps *bibliometrics* to some extent” (**Tague-Sutcliffe 1992, p.1**). There has been a considerable amount of confusion in the literature about the distinction between scientometric and bibliometrics.

Another definition is provided by **Tague-Sutcliffe (1992a, p. 1)**: “Scientometrics is the study of quantitative aspects of science as a discipliner 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 among others publication, and so overlaps bibliometrics to some extent.” Scientometrics, on the other hand, is the “mathematical and statistical analysis of research patterns in the life and physical sciences” (**Diodato, 1994:145**). The term refers to methods that analyze the structure and development of science, scholarly communication, information seeking behavior and government policy as they relate to science. Spiegel-Rosing (**in Diodato, 1994:146**) believes scientometric consist of methodologies that apply quantitative mathematical studies to science and technology. Scientometrics can be defined as the “quantitative study of science,

communication in science, and science policy” (Hess, 1977, at p. 75). Thus, **Scientometrics, may be defined as**, “A quantitative and qualitative measuring techniques for evolution and interpretation of science including its different activities like productivity, progress, organization and management Science, by application of mathematical and statistical calculus.”

Brusilovsky (as cited in Garfield, 1979:313) further defines scientometrics as “the study of the measurement of scientific and technological progress”, while Malin (in Garfield, 1979:313) terms scientometrics as the “science of science”. Garfield explains that scientometrics is concerned with the demographics of the global scientific community (Garfield, 1979:313). **B.Ya.Brusilovsky** defined scientometrics as “a set of mathematically correct methods in science studies.”

According to Merton and Garfield, “Scientometrics is the field of enquiry given over the quantitative analysis of science and scientific field came to be known as Scientometrics or bibliometrics”. **According to Haiturn** ‘Scientometrics’ is a scientific discipline which performs reproducible measurements of scientific activity and reveals its objective quantitative regularities. Scientometrics is part of the sociology of science having application to science policy making. It involves quantitative studies of scientific activities including among other publications and also overlaps bibliometrics to some extent. **According to J.P. Courtial**: “Scientometrics is hybrid field made of invisible college and a lot of user thus controlled by both scientific research and final uses.” **Sengupta** recently outlined the objective of Scientometrics as “to evaluate quantitatively recent of any basic scientific discipline, and the factors responsible for the steady growth in research activity in that area of knowledge in the post war period.” (Sengupta,1992).

v. Informetrics

It was first proposed in 1979 by Nacke. It is the study of the quantitative aspects of information in any form, not just records or bibliographies and in any social groups not just scientists.

Definitions of Informetrics

Bjorneborn and Ingwersen stated that the scope of Informetrics is drawn from the overlapping fields of both Bibliometrics and Scientometrics. **According to Tague-Sutcliffe (1992)**, Informetrics is “the study of quantitative aspects of information in any form not just records or bibliographies and in any social group, not just scientists”. Informetric research includes studies pertaining to scattering of articles and journals, growth and obsolescence of documents, productivity and impact of research, distribution of scientific publications by country by language and circulation studies. **Ingwersen and Christensen (1997, p. 13)** have the following definition: “The term Informetrics designates a recent extension of the traditional bibliometric analyses also to cover non-scholarly communities in which information is produced, communicated and used.” **Wilson (2001)** concludes the latest ARIST review with the following definition: “... Informetrics is the quantitative study of collections of moderate-sized units of potentially informative texts, directed to the scientific understanding of informing processes at the social level.” **(Ravichandra Rao and Neelameghan, 1992, Hood and Wilson, 2001)**

6. Webometrics

The term Webometrics was first coined by Tomas Almind and Peter Ingwersen in 1997 and seems to be widely accepted by the

research community together with the term Cybermetrics. Webometrics is the study of quantitative aspect of web/website.

Definitions of webometrics It is also defined as “the study of the quantitative aspects of the construction and use of information resources, structures and technologies on the Web drawing on bibliometric and informetric approaches” (in Björneborn and Ingwersen, 2004: 1217), Björneborn and Ingwersen (2004) defined Webometrics as “The study of the quantitative aspects of the construction and use of information resources, structures and technologies on the Web, drawing on bibliometrics and Informetrics approaches.” Thelwall (2009) defines Webometrics as “the study of web-based content with primarily quantitative methods for social science research goals using techniques that are not specific to one field of study”.

vii. Altmetrics: The term ‘Altmetrics’ was proposed by Jason Priem, Altmetrics (alternate or alternative metrics) is a new field of web-based metrics, which focuses on measuring scholarly impact in the online environment.

Definitions of Altmetrics

According to Adie, Euan (2013) the founder of Altmetric.com; “Altmetrics indicate the quantity and quality of online attention in multiple channels, including social media, blog posts, and news coverage”. Australian Open Access Support Group (AOASG) (2013). Altmetrics are quantitative indicators of public reach and influence (It provides a more comprehensive understanding of impact across sectors, including public impact. Altmetrics is the study of new metrics for analysing and informing scholarship based on the social web. Alternative metrics (called Altmetrics to distinguish them from bibliometrics) are considered an interesting option for assessing the societal impact of research, as they offer new ways to measure (public) engagement with research output

(Piwowar,2013). Altmetrics is a term to describe web-based metrics for the impact of scholarly material, with an emphasis on social media outlets as sources of data”(Shema,Bar-Ilan,&Thelwall,2014).

Conclusion

This paper defined the terms of bibliometrics, Librametrics, Scientometrics, Informetrics, webometrics and Altmetrics Metrics method is best for analysis of quantitative data and qualitative research. These techniques can be used to identify the emerging research areas in any branch of knowledge to evaluate the research performance of scientists, research groups and countries, to map the cognitive or intellectual structure of a research area and to study the relation between authors, institutions and journal articles. It is very useful for the growing subject that help librarians to plan and organize library services and the scientists also know that they are growing in their field of knowledge.

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