

Power point slide for Post Graduates of SOS in LIS

Topic: Bibliometric Studies

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DR. NIDHI SRIVASTAVA (Guest Faculty)

S O S in Library & Information Science

Jiwaji University, Gwalior (M.P.)

BIBLIOMETRICS

Cole & Eale's study entitled 'The history of comparative Pt. 1: a statistical analysis' is considered to be the first bibliometric study, where for the first time in 1917, the expression Statistical Analysis has been used. He studied the contributions in the field of anatomy by counting the number of publications produced by different countries, covering a period of more than three hundred years (1543-1860). This count included books and journal articles.

In 1923, **Hulme** used the phrase "Statistical Bibliography" to describe the study of use and non-use of information. He studied the author and journal entries in the International Catalogue of Scientific Literature ranked the results according to the country of origin and concluded that Germany ranked at the top position in the production of scientific literature during the period of 1909-13.

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In 1938, the term of 'Statistical Bibliography' was, again used by **Heckle** in his paper entitled 'The periodical literature of bio-chemistry', in 1943 by **Gosnell** in his dissertation and later in 1984 in his article. Later, the term of 'Statistical Bibliography' was used in 1948 and 1949 by **Fuslier**, in 1962 by **Raisig**, in 1966 by **Baker**, in 1969 by **Pritchard**. This term was considered very clumsy, not so descriptive and can be confused with statistics itself or bibliographies on statistics.

In 1948, **Dr. S R Ranaganathan** coined the term, Librametry connote the use of statistics to evaluate an existing or proposed library service and resources. This term is a wider term which includes in it the concept of

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bibliometrics. But this term did not take its place in library science and was forgotten for many years. Later, it was called “Librametrics.”

The Russian word ‘aukometriya’ (first translated as science metrics) was coined by **V V Nalimov** (1910-1997) in 1969, although this field was not his main concern. In the work of this multifaceted and intriguing scientist and scholar, scientometrics was only of central concern for a short period of time. Nevertheless, it is a coincidence that **Nalimov** is regarded as one of the founding fathers of Scientometrics. **Nalimov** wrote his basic book, ‘Scientometrics: studying science as information processes, explaining that “Scientometrics is a complex of quantitative (mathematical and statistical) methods, which are used to investigate the processes of science.”’

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The term 'Bibliometrics' was first coined by **Alan Pritchard** in 1969. He defined it as, the application of mathematical and statistical methods to books and other media of communication." During 1970s, bibliometrics developed into a scientific tool for literature assessment and now it has been based mainly on the principles of mathematical statistics.

As **Fairthorne** says, "The field of bibliometrics is the quantitative treatment to the properties of recorded discourse and behaviour pertaining to it."

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Ravichandra Rao defined that, "Bibliometric is understood to cover the study of statistical distribution of the process relating to the activities of library staff and readers, "While J.M. Britain defines it as "The study of nature, use and non-use of documents only. It deals only with the document that is the unit of analysis is the document and its characteristics. It does not deal with the user and his needs." Simpson expressed that bibliometrics now include databases, databanks and view data system and also embrace statistical information relating to users.

Bonitz defined it as, "Bibliometrics is a methodological sub-discipline of library science, including the complex of mathematical and statistical methods, used for analysis of scientific & non-scientific documents, library networks, indexing languages, information systems communication systems, etc."

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It is considered that 'Bibliometrics' is analogous to 'librametrics', Russian term 'Scientometrics', FIDs term 'Informetrics' and also to some other established sub-disciplines such as, 'Econometrics'. "Psychometrics", Sociometrics' 'Biometries' where mathematical and statistical methods have been systematically applied to analyse and solve the problems in the field of library science, history of science, information science, economics, psychology, sociology and biology respectively.

In 1982 the term 'Infometrics' was suggested by Germany Scientists **Blackest** and **Stegel** a branch of science, using mathematical and statistical methods to investigate scientific and technical information on theoretical level and practical information activities.

In short, the Bibliometrics is a formed scientific sub-discipline including the complex of mathematical and one statistical methods used to analyse bibliographical characteristics of documents. While Scientometrics is formed structural part of methodology, including the complex of mathematical and statistical methods used to analyse the quantitative characteristics of science as an enterprise. Further, information is a scientific sub-discipline not yet formed. The problem of its research objective to be formed on the concept "information" is not solving yet.

BIBLIOMETRIC LAWS: FUNDAMENTAL LAWS

There are three fundamental laws which laid the solid foundations of bibliometrics:

- A) Lotka's Inverse Square Law of Scientific Productivity (1926)
- B) Bradford's Law of Scattering of Scientific Papers (1934); and
- C) Zipf's Law of Word Occurrence (1949).

Lotka's Inverse Square Law

The frequency distribution of productivity of authors of scientific papers was first studied by **Alfred J. Lotka**, who proposed that the number authors making 'n' contributions is about $1/n^2$ of those making one contribution, and the proportion of all contributors who make a single contribution is about 60 or a $(n) = k/n^2$ Where 'a' is the number of authors producing n papers and 'k' is a constant.

In other words, for every 100 authors contributing one article, 25 will contribute two articles, about 11 will contribute 3 articles and 6 will contribute 4 articles and so on.

Bradford's Law of Scattering

This law was given by **Samuel Clements Bradford** in 1934. Bradford examined two bibliographies prepared in the science library on 'Applied geophysics' and 'Lubrication' and he prepared lists of journals arranged by decreasing order of source items contributed by the journals of the bibliographies.

He noticed that in each subject, there were a few very productive sources, large number of sources of constantly diminishing productivity. In the list of periodicals ranked by diminishing productivity, Bradford identified three groups of periodicals that produced approximately the same number of articles on the subject, but the number periodicals in these three equi-productive zones increased by a constant factor

Based on this he stated this law as "If scientific periodicals are arranged in order of decreasing productivity of articles on a given subject that may be divided into a nucleus of periodicals more particularly devoted to the subjects and several groups or zones containing the same number of articles as the nucleus when the number of periodicals in the nucleus and succeeding zones will be given as:

$$1: n: n^2$$

Where '1' is the number of journals in the nucleus and 'n' is a multiplier.

Zipf's Law of Word Occurance

This law was given by **George K. Zipf** in 1949. Zipf developed and extended an empirical law, as observed by Estoup governing a relation between the rank of a word and the frequency of its appearance in a long text.

If 'r' is the rank of a word and 'f' is its frequency, and then mathematically Zipfs law can be stated as follows:

$rf = c$, where 'c' is a constant

This law states that in a long textual matter if 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 the occurrence of the word.

He found that by multiplying the numerical value of each rank (r) by its corresponding frequency (f), he obtained a product (c) that is constant through out its text e.g.

Some Other Empirical Laws

(i) Price Square Root Law of Scientific Productivity:

This law was given by Derek J. de Solla Price in 1971. This law states that "half of the scientific papers are contributed by the square root of the total number of scientific authors."

(ii) Garfield's Law of Concentration:

This law was enunciated by Eugene Garfield in 1971. This law states that "a basic concentration of journals is the common nucleus of all fields."

Some Other Empirical Laws

(iii) Sengupta's Law. of Bibliometrics:

This law has been put forward by I. N. Sengupta in 1973 which is also known as off setting weightage formula for re-ranking periodicals to avoid discrimination against new journals which necessarily have citation credits. This is basically an extension of the Bradford's Law.

It states that "during phases of rapid growth of knowledge in a scientific discipline, articles of interest to that discipline appears in increasing number of periodicals distant from that field."

Mathematically this law stands in the following form:

$$F(x+y) = a + b(x+y)$$

Where $f(x+y)$ is the cumulative number of reference as contained in the first $(x+y)$ most productive journals, X indicates number of journals in the same discipline and y stands for number of journals of unrelated disciplines ($y > x$) and 'a' and 'b' are two constant.



Thanks!