CHAPTER-IV

REVIEW OF LITERATURE
BIBLIOGRAPHIC STUDIES AT ABROAD & INDIA:

(I) AT ABROAD:

The first Bibliometric study appeared during 1917. Cole and Eales (1) published a statistical analysis of the literature as part-I in their article in the history of comparative anatomy in the journal *Science Progress* Vol.II April 1917. This study covers the literature of comparative anatomy published during the period 1550-1860 and showed the fluctuations in interest over the period. It also showed the distribution of the literature among the countries within periods and by divisions of the animal kingdom.

The former librarian of the British Patent office, Ewyndhan Hulme (2) brought out a statistical analysis during the year 1923. This study was based on the journal entries in the seventeen sections of the international catalogue of scientific literature. This study revealed the following:

(i) the rank order of entries in physiology, bacteriology, serology, biology and other medical sub-disciplines;

(ii) the rank order of the sciences based upon their output of periodical literature;
(iii) the number of journals referred to in the annual issues arranged by subject, and the number of indexed journals arranged by country publication.

(ii) **IN INDIA**

As per records the first article on citation studies (Bibliometric studies) in India appeared in the Journal of scientific and Industrial Research written by Dutta and Rajagopalan (3) in the year 1958. The title of the article is literature citations in scientific and technical periodicals. However a serious attempt with regards to Bibliometric studies was started in the year 1963 when a seminar was organised by DRTC on documentation periodicals.

Sen and Narendra Kumar (4) has reviewed 191 contributions relating to Bibliometrics and published an article "Indian contributions in Bibliometrics in Annals of Library and Documentation" in 1986.

This study revealed that during the last 27 years (upto 1984) about 200 papers have been published on the coverage and overlapping of literature by scientists and others, testing of various Bibliometrical laws and so on.

During the last decade a notable scientometrist of international reputation Dr. Indra Narain Sen Gupta contributed more through his articles, books and his two
Ph.D., thesis on the topics (a) "Bibliometric Analysis of the impact of the Growth of Bio-chemical knowledge on other biological and medical sciences"., and (b) "Recent Directions of Growth of Bio-chemical knowledge: An Analytical study based on observed changes in the scientific impact of serial Publications". His continuous research on Bibliometrics studies for the last two decades enabled him to publish a book entitled Bibliometric Research Growth of Biomedical literature Vol.I. This book supplies with "some original ideas and techniques which have provided more flexibility in citation studies and Bibliometrics as whole".

Another important person Ravi Chandra Rao (5) from D.R.T.C. has also contributed Bibliometrics through his publication "Quantitative methods for library and information science" in the year 1983. He also organised the 3rd International Conference on (Informetrics 91/92) during August 1991 and brought out a book "Informetrics-91".

Today the use of Bibliometrics and citation analysis is well received by Library and Information science professionals to evaluate periodical publications in various
The Bibliometrics grew into a distinctive research area and motivated many researchers from other disciplines to work on various facets of Bibliometrics. It resulted in a very rapid and accelerated growth of the literature of Bibliometrics for the past few decades. This rapid growth of knowledge of Bibliometrics brought out three empirical laws. There are (1) Lotka's Inverse Square Law of Scientific Productivity (2) Bradford's Law of scattering of scientific papers and (3) Zipf's Law of Linguistics. These three laws provided tremendous boost in the research activities of Bibliometrics.

THESE THREE LAWS ARE RESPECTIVELY BASED ON:

(i) number of authors contributing in a discipline or other fields;

(ii) distribution of periodical publications in a defined area of knowledge or number of papers in a set of journals and;

(iii) Ranking word-frequency in a particular set of documents.
Unlike Laws of nature, Bibliometric laws are empirical laws and hence remain valid so long as the sociology, structure and pattern of information generation, communication and dissemination remain the same and may not hold good once the pattern of basic organisation changes due to social and scientific phenomena. The said three Bibliometrics laws are discussed in detail.

**BRAD FORD’S LAW:**

On the basis of data obtained in his study of the literature of Applied Geophysics and Lubrication, Bradford formulated his empirical law of scatter as follows:

"The aggregated number of articles in a given subjects, apart from those produced by the first group of large producers (periodicals) is proportional to the logarithm of the number of producers concerned, when these are arranged in order of decreasing productivity"

(6).

Bradford also stated that "if scientific journals are arranged in order of decreasing productivity of articles on a given subject, they may be divided into a number of periodicals. More particularly devoted to the subject and several groups or zones containing the same number of articles as the nucleus, when the number of periodicals in
the nucleus and succeeding will be as $1:n:n^2$......". The mathematical formulation of this law by Brookes (7) is the one that is more easily applied in practical situations. It is expressed in two parts.

(i) $R(n) = an^b$ ($1 \leq n \leq c$)

(ii) $= N \log n/s$ ($c \leq n$)

**LIMITATIONS OF THE LAW:**

A precise and universally applicable statement of the law is yet to be made. The real use of the law can be made formulating journal subscription policy, if some Organisation can list the core journals in various fields of knowledge and keep the list upto date.

**LOTKA'S LAW:**

The frequency distribution of productivity of authors of scientific papers was first studied by Alfred Lotka, who proposed that the number of authors making n contribution is about $1/n^2$ of those making one contribution, and the proportion of all contributors, who make a single contribution is about 60 percent, or a $n=K/n^2$

Where as the number of authors producing n papers and k a constant. (8)
According to Potter (9) the Lotka's inverse square law "might reflect an underlying pattern in the behaviour of those people who produce publications, whether those publications are books or journals articles".

Solla price (10) has derived a theory from Lotka's Law; this theory states that "the total number of scientist goes up as the square, more or less, of the number of good ones" or, stated in another form, that "half of the scientific papers are contributed by the square root of the total number of scientific authors". The relationship has become known as "Price Law".

**ZIPF'S LAW:**

If words are ranked on the basis of the frequency of their occurrence in a long text in decreasing order, the law states, that the frequency of occurrence of a word is the reciprocal of its rank (11). The law is represented by

\[ f(r) = \frac{C}{n} \]

Where C is a Constant, (or)

\[ \log f(r) + \log n = \log C \]

The law represents only an approximation of the relationship between rank and frequency, which is hyperbolic.
According to Scarrott (12) a feature of Ziff’s law is that it highlights the Phenomenon that once, by change a group has-achieved a dominant position it retains that position for a long time and, indeed is more likely to be promoted than the less fortunate groups. This feature is also known as the "Success breeds success" Phenomenon, i.e., success increases the chances of further success.

The rationale behind the rank frequency Phenomenon has been stated by Zipf as the "Principle of least effort". In any language, the words which have a high frequency of occurrence are those that cost less in usage or require less effort in communication.

APPLIEDION OF BIBLIOMETRIC LAWS:

Though the term Bibliometrics was introduced only in 1969 to indicate a new discipline which employs quantitative methods for analyzing various aspects of written documents, its origin can be traced back to the efforts of early twentieth century documentalists to apply mathematical and statistical analysis to bibliographical units.

Of the various prominent studies mentioned earlier, the three laws became the cornerstones of Bibliometrics. They were:
1. Lotka's inverse square law
2. Zipf's law about the frequency occurrence

Several attempts have been made to bring out the interrelationship among these three laws. In fact much of the later Bibliometric studies were made either to substantiate, modify, extend, link or challenge these three empirical laws. The end result of such efforts was the emergence of some more empirical laws and many theoretical models. Some of the other empirical laws are:

i) Price's Square Root Law of scientific productivity.
ii) Garfield's Law of Concentration
iii) Sengupta's Law of Bibliometrics.

The discovery of the empirical laws of Bibliometrics has led to a series of studies, which can be broadly differentiated, into two-quantitative and qualitative. B.C. Brookes is of opinion that such quantitative studies have some general objectives:

i) Prediction of publishing trends
ii) Design of more economic information systems and networks.
iii) Improvement of efficiency rates of information handling process.
iv) Identification and measurement of deficiencies in bibliographical services, and

v) Discovery and elucidation of empirical laws.

On the other hand, qualitative application studies emphasize practical utilization of research findings. The findings, which are use in library management are:

i) Identification of a core literature

ii) Ranking publications in zones of diminishing importance

iii) Classifying segments of a literature through inter connection of citations.

**LOTKA'S LAW:**

Lotka's proposition led to a whole gamut of studies on scientific productivity. Such productivity studies have gained momentum in the post-second world war period. This is fact, has culminated in the rise of a new discipline called scientometrics. Scientometrics is defined as the study of the measurement of scientific and technological progress. It provides an understanding of the structure of scientific activity, the discipline being researched, the organisations involved the strength and deficiency in the
scientific groups and their communication channels at different levels of aggregation.

Scientific productivity studies have been made from different angles. Impact of social change on scientific productivity, relationship of publication output on scientific recognition, identification of elites in different discipline are some approaches made in this line.

**ZIPF'S LAW:**

Zipf's law can be effectively used in the generation of semi-automatic or automatic indexes useful for an information retrieval system. Its use has increased tremendously with the emergence of natural language indexing of textual matter especially in electronic form. Several studies aimed at finding out the pattern of frequency distribution of descriptions of a thesaurus and the distribution of indexing terms are available.

Zipf's law provides a measure of the richness in vocabulary of an author. This technique can be used for deciding the correct authorship of disputed works. The law is also used for identifying words more frequently used in different foreign languages.
BRADFORD’S LAW:

The statistical regularity pointed out by Bradford's law provides an objective means of determining zones of relative richness or value to a given kind of library collection. This has implications to the acquisition process in a library. A library can safely stock the journals which belong to the core zone.

While preparing bibliographies we are faced with a problem of coverage, the journals that are to be scanner etc. Bradford's distribution can be used to estimate the total size of a bibliography and periodicals that should necessarily be included in the list of items to be covered.

This law is applied to study not only the scattering of publications but also in other spheres of activity also.

CITATION ANALYSIS:

The primary function of citation is to provide "a connection between two documents, one which cites and the other which is cited". There are number of reasons for giving citations. Many have attempted to explore the possible reasons for giving citations. Citation analysis is very often fruitfully applied to derive the following benefits.
i) To lead the reader to further studies in the field.

ii) For the preparation of bibliographies

iii) To study the use pattern of different types of documents.

iv) To study the scattering of subjects

v) To prepare the ranked lists of journals

vi) To study the rate of collaborate research

**LIMITATIONS IN APPLICATION:**

Though most of the studies tend to support the Bradford distribution, some other researchers should not get satisfactory results. Chonez tested a large number of different areas and found that the law applied in a very small proportion of them. Out of fifty bibliographies studied by him only six followed the law. However, much of deviation is attributed to the problems of initial data collection. In the case of Lotka's law, it was found to fit in most cases. However the value of the index 'n' was found to very for different groups of scientists. Another problem with Lotka's law is that it totally ignores the potential authors who have not produced any publications so far. Because of these limitations, the empiric nature of these laws are questioned.
THE LIMITATIONS OF CITATION STUDIES ARE:

i) Too much self-citation.

ii) Citations given just to dress up the paper

iii) Negative citation i.e., citing a paper just to copy it.

It is a fact that there are extraneous considerations in giving citations. But that does not totally undermine the value of them.

Bibliometrics has emerged as the most active field of library and information science. Citation analysis studies form a major portion of it. A major portion of the studies pertains to the applications of Bibliometric laws and models. However, there is a long way to go in achieving perfection in the studies. The changes that are frequently occurring in the publication practices are likely to complicate the studies in future.

BIBLIOMETRIC MEASUREMENTS

CITATION COUNTING:

Citation counting is a technique that determines how many citations a given document, author, journal etc., has received over a period of time originally used by Gross and Gross (13).

The rationale for this is that citations are objective indicators of use and therefore an article, author, journal,
that is frequently cited is more useful or productive as the case may be than, one that is less frequently cited.

**BIBLIOGRAPHIC COUPLING:**

The concept of Bibliographic coupling was first suggested by Fano (14) but Kessler (15) elaborated, tested and coined the term. It is the number of common reference cited in two documents that indicates the degree of similarity of contents of the citing papers. Two source documents containing a large number of common references are said to have a coupling strength and are likely to be on the same topic. Taglizcozzo (16) is of the opinion that "the back that the two papers have reference in common is no guarantee that the both papers are referring to the same piece of information". So it is merely an indication of the existence of the probability of relation between two documents.

**CO-CITATION:**

The concept of co-citation was for the first time suggested independently by small (17) and Marshakova (18) almost simultaneously in 1973 and later developed by small. The number of times two papers are cited together in subsequent literature determines the co-
citation strength of cited papers can be studied over a period of time as they continue to be cited together in subsequent literature. But one of the disadvantages of co-citation technique is that, it requires comprehensive citation data.

**IMPACT FACTORS:**

The term impact factor is coined by Garfield (19). He defined the impact factor as, "the ration of the number of times a journal is cited in a given time period to the total number of times a journal is cited in a given time period to the total number of source items published in the journal, during the specified period of time." The impact factor is a measure of the frequency with which the average cited article in a journal has been cited in a particular years. While Sengupta (1986) might argue the desirability of ranking of journals on a citation per word basis, a measure more commonly used is the impact factor, which relates the number of citations a journal receives to the number articles it publishes.

Naidu, Chouhan and Parashar (20) analysed the literature cited in the Ph.D., Dissertations in the faculty of Biological Sciences in Devi Ahilya Vishwa Vidyalaya Library...
during the years (1999-2003). The objectives of this study are

(1) To identify the type of documents used by the researchers in Ph.D Thesis. (2) To study the decade-wise distribution of citation of journals. (3) To prepare a rank list of the core journals. (4) Identify the year-wise distribution of journals having more than 40 citations. (5) To prepare a list of 10 most frequently cited journals.

They summarized the list of core periodicals country wise, distribution of journals and form of documents used by the researchers.

THE MAJOR FINDINGS OF THE STUDY ARE:

(1) Journals are mainly consulted in the research work and they form the premier mode of scientific communication.

(2) Most of the citations cited from the journals are from USA followed by U.K. India and Germany.

(3) The periodical 'Journal of plant physiology' 'Plant Cell Report and 'Plant Cell, Tissue and Organ Culture' occupies the first three ranks respectively.

Johry (21) tried to attempt the Bibliometric analysis of the International Social Science Journal in National Social Documentation Centre, ICSSR.

The objectives of this study are:

(1) To identify various themes covered in this journal.
(2) To know who are the contributors of this journal, and identify authorship pattern.
(3) To know to which country and continents they belong to. 
(4) To know the contributions of Indian authors. 
(5) To know the institutional affiliations of the contributors.

The findings of the contents of the items published are diversified and quite balanced. The contributors to the journal are predominantly specialists from abroad spectrum of disciplines. The highest number of
contributions are from Universities/colleges. Single authors have contributed most of the papers.


It examines year wise distribution of papers, authorship pattern, affiliation and country wise distribution. It also shows subject wise break-up of articles, citation pattern and illustration. Each individual article was scanned, tabulated for necessary data as required. Then data further analyzed, interpreted and presented in tabular as well as chart form.

The major findings of the study are (1) Authorship pattern shows that maximum number of papers are contributed by single author. (2) Maximum articles are contributed from academic institutions. (3) India contributed the maximum number of articles since the journal is published from India.

Gayatri Mahaputra (23) made a Bibliometric analysis of the three top ranking Indian Journals of Library and information science. To determine the reasons of their getting top positions among the other journals. She
studied in detail the special features like citing and non-citing articles, rate of citations per article, self citation behaviour, authors collaboration, type of documents cited and recency of cited documents.

The major findings of the study are that the journal that publishes a large number of articles may not necessary be considered as scholarly. Rather a journal which publishes articles having a high rate of citations may find top positions in the ranking of journals. This indicates that articles written with references are preferred to be cited than the articles without citations. The journals with a large number of referencing articles may also have brighter chance to be cited by other articles and therefore may get top positions in the ranking of journals. It was also seen that more number of collaborated works were cited by the top ranked journal than the single authored works. Therefore, the journal that publishes larger number of collaborated works seems to be a scholarly than the journal containing more single authored works. Among the different categories of documents cited, the articles of journals were preferred. Citations were mostly drawn from the recent publications. Self citations one also a common habit in the top ranking journals. The Journal that
provides more number of self citations and self citing articles in comparison to non-self citing articles may be regarded as a Scholarly Journal in the field.

Suchitra Das and Seth (24) analysed the patterns of research contribution in the subject Hydrometallurgy. Such analysis will be helpful to the concerned user and the contributors to recognize the information needs, requirements and national network of research work in this discipline Hydrometallurgy. The present study intends the bibliographical forms of the literature used to identify the list of highly cited journals. The authorship patterns of contribution, the scattering of the literature of the subject institute-wise contributions in Hydrometallurgy in India and other countries.

The major findings of the study are (1) Main research publications cover 94% and Technical notes cover only 5% of total publications. (2) Shows that maximum contribution is made by Canada 39 (Thirty nine) followed by USA 28 (twenty eight). India 24 (twenty-four), South Africa. (3) Team research is the trend of the present day, and is dominant over solo research, The study of authorship pattern reflects the research trend in the field of Hydrometallurgy. (4) Citation pattern shows that
journals are very important communication media of Scientific research. It is also observed that a few journals other than in English are also used. (5) Shows that 76.9% of the total citations are journals. 13.2% are from books 5.3% are from proceedings.

The most frequently referred journal of the subject. It is also revealed that literature is also scattered in other 200 more journals. It shows that the scattering of the literature is very wide. Regarding publications it is found that research papers are published in a minimal time lag.


The objectives of the study are to determine the following factors 1. Year wise distribution of papers 2. Distribution of contribution among types of organisation 3. Authorship patterns subject wise publications of articles and 4. Countrywise publication of articles.

Authorship pattern shows that most of the papers are contributed by single author. Indian authors contribute maximum no. of paper followed by USA, UK, Canada and Australia. The Journal, Indian Journal of
Social work provides literature for social scientist, social workers and disseminating Knowledge in the changing social context. Social science knowledge development and dissemination are main objectives of the journal is main media of knowledge for social work professionals.

Ramesh (26) made a Bibliometric study of Fifty years of Library and Information Science research in India.

The major objectives of the study were to find out Chronological distribution of Ph.Ds. awarded during the 50 years (i.e., 1951-2000) (1) The affiliation of Research degree holders in this discipline (2) The Broad subject wise distribution of doctoral degrees. 3. The Geographical distribution of Ph.D. Degree holders from different states of India.

The suggestions made are: there must be a national finding agency to finance the research programmes in library and information science. The quality of research activity would be boosted if a national level examinations on the pattern of UGC or CSIR is conducted to regular candidates for Ph.D. Every student going for doctoral programme should be familiar with the research methodology.
The review of literature indicates that no effort has been so far made about the application of Bibliometrics to the study of Humanities. The Present study is maiden effort made in this direction.

Saraswathi, Rajagopal and Kanakacharya (27) made a Bibliometric study of tribal linguistics in India. Tribals in India constitute around 8% of the total population. They are unevenly distributed all over the country. Tribal languages are mainly oral rather than written literature. There are about 350 tribal languages spoken by nearly 51 million people. Their languages have been systematically studied by linguists, language planners and administrators. Due to the increase rate and importance of tribal linguistics, it is forming a separate discipline on par with other subjects as far as teaching and research are concerned. An amount of sufficient literature dealing with various aspects of the tribals have been published in India. The present study aims to know the growth of literature in this discipline, the authorship pattern, the distribution of publications in different forms and years etc.,

Major findings of the study are: (1) Most of the languages 63.03% are covered by the Tibeto-Burman family group.
Many of the publications of Indian Tribal languages 40.50% are from Dravidian family of language groups. Most of the publications 98.30% are with the single authors only.


They made a study aiming at describing both the common and the distinguishing features of coauthorship trends and patterns in selected science fields. The relation between coauthorship schemes and other Bibliometric features, such as publication activity and citation impact are analyzed. The study indicates that co-publication activity has grown considerably, the extent of co-authorship and its relation with productivity and citation impact largely varies among fields.

Authorship is a primary Bibliometric descriptor of a scientific publication. Its trends and patterns characterize the social and even the cognitive structure of research fields. The most characteristic tendency of recent times is intensifying scientific collaboration. Collaboration in
research is reflected by the corresponding co-authorship of published results, and can thus be analyzed with the help of Bibliometric methods.

The authors analyzed scientific papers of the French elite in the early eighteenth century and concluded that collaboration is associated with higher productivity. In a recent paper, Braun, Glanzel, & Schubert (2001) have analyzed the relation between co-operativity and productivity in different author categories in the field of neurosciences.
REFERENCES:


