Review of Literature
CHAPTER II

REVIEW OF LITERATURE

The second chapter devotes to examine the review of related literature of Scientometrics studies. It could be observed that there are various research studies highlighting the importance of Scientometrics analysis and their applications to researcher to identify the research gap in the previous studies. The Review of related studies is an essential part of any investigation. The survey of the related studies is a crucial aspect of the planning of the study. In the words of Turney and Robb (1971) the identification of a problem, development of a research design, determination of the size and scope. The literature is review to create the content from the past for the new study to be conducted with new subjects and newly obtained data. Harter (1980) defined it as “Critical Summary of different facets of the research problem as reported in existing sources”. Thus literature review assists a researcher

1. To enlighten and enrich to research scholar on his/her conceived area of research,

2. To ascertain about the completed research or ongoing research on the particular area and can be proceed further avoiding duplication of research

3. Provides its gamut of knowledge of the particular area i.e. ideas, theories, explanation and hypotheses for formulating the problem and suggests the methods of research to solve the problem

4. It provides update information to generate of new knowledge and also helps comparative analysis with the present study.
The analysis of related studies revealed that very few studies were conducted in the area of Bibliometrics studies available in the related area are summarized and presented under the following heads.

**1992 Pierre and Herubel** studied by Authorship, gender and institutional affiliation were in the literature published in Libraries and Culture. The focus of the study was to examine gender of authorship and institutional affiliation. Twenty three years of Libraries and Culture were chosen as target volumes. The findings revealed that men published more than women in library history.\(^7\)

**1994 Sinha, S.C and Md.Furqun Ullah** analyzed article 102 publications of Dr.I.N.Sengupta covering the period 1969 – 1992. In 1988 Dr.I.N.Sengupta wrote 14 papers which was considered as peak period of his writing. He suggested that Dr.I.N.Sengupta preferred to publish 11 articles in Indian Journal of Information Science followed by 10 articles published in Indian Association of Special Libraries & Information Centres (IASLIC) Bulletin.\(^1\)

**1998 Van Raan** Scientometric has typically been defined as the “quantitative study of science and technology”. In other words Scientometric is concerned with the quantitative features and characteristics of science and scientific research. Emphasis is placed on investigations in which the development and mechanism of science are studied by 4 statistical mathematical methods.\(^2\)

**2000 Suryanarayana Y** study bibliometric analysis of contribution of journal of tobacco research was done for the year 1987-97. In this paper the author explain information personal are concluding studies on citation analysis, subject areas of their
institution for knowing the extent of utility of journals, monographs, conference proceedings and other literature available in the resources.³

2000 Garg & Padhi analyzed of 766 publications by prolific authors in scientific journals indicated that prolific authors produced about 25% of the total scientific output in periodical literature in laser science and technology. Rinia 2000 in this article author discussed about several pioneering studies performed on behalf of the research councils for physics and technical sciences in Netherlands. Uzun 2002 the author surveyed a set of ten scholarly journals that publish the mainstream of papers in the field of scientometrics, informetrics and bibliometrics. The survey is limited to the research article published in the field for the two decades.⁴

2001 Barooah PK and Shrma NN, The author explain, the journal collection of the library of regional research laboratory Jorhat (RRCI) has been evaluated through a study of use of journals titles for publications of research by scientific community of the laboratory. Journals ranked on the basis of the use for individual groups and percentage of used journals.⁸⁶

2001 Zbikowska- Migon enumerated many different indicators as mentioned Nalimov in his book ‘Naukometriya’. There were among them the number and growth of scientific publications – book and periodicals.⁹²

2001 Granovsky devoted to his article to scientometric research of professor V.V. Nalimov 1910-1997 of Moscow State University. His first scientometric article was published in 1959, mathematical models of world science growth were examined and logical grounds for the applicability of these models were also. ⁹⁰
2001 **Hood and Wilson** discussed a background about the concept scientometric. The term coined by Vassily V. Nalimov in the 1960s, this term has growth in popularity and is used to describe the study of science: growth, structure, interrelationships and productivity. 89

2001 **Glaser and Laudel** discussed the methodological problems of integrating scientometrics methods into a qualitative study. They conducted that integrative attempts of the kind are poorly supported by the methodologies of both the sociology of science and scientometrics. 93

2002 **Lee** made a scientometric study to find out research performance of the Institute of Molecular and Cell Biology (IMCB) of first ten years since its establishment. The findings shows that in the ten years, IMCB produced 395 research papers, 33 book chapters, 24 conference papers, and 4 monographs, graduated 46 PhDs, and filed 10 patents. In order to become world-class, IMCB researchers have been publishing in selected journals. It is found that 95.6% of the articles were published in ISI journals. 82

2002 **Osareh and Wilson** analyzed international collaboration of Iranian scientific publications in Science Citation Index (SCI) during 1995 to 1999. The result discussed about two types. First one the science and technology increased dramatically in the citation index the study period. Another one authors with institutional affiliations in the American countries. 5

2002 **Schubert** carried out a statistical overview of the first 50 volumes of the journal scientometrics. Authorship and co-authorship characteristics, as well as citation and reference patterns of the journal were analyzed. 6
2002 Peritz and Barllan examined the extent the field of bibliometrics and scientometrics makes use of sources outside the field. Examining the references of articles published in scientometrics carried out the research.  

2002 Jeevan and Gupta studied research productivity of nine departments of IIT, Kharagpur by analyzing proportion of papers covered in SCI, Impact rate, Proportion of high quality papers and Publication Effectiveness Index (PEI). In addition to this other factors such as degree of collaboration among departments as well as international collaborations are also measured. On ranking departments on the basis of publication effectiveness index (PEI), it was found that only four departments have received the PEI value above one. They are in order of ranking of PEI values as: chemistry (2.221), Rubber Technology (1.446), Physics and Meteorology (1.289) and Electronics and Electrical Communication Engineering (1.098). It is also observed that those departments, which qualitatively perform better also tends to collaborate more, both at the national, as well at the international level.  

2003 Williams II & Winston carried out a statistical analysis on academic on research and publication towards decision making process. The research presented in the article addresses the original research published in frequently cited library and information science journals to consider the extent to which academic librarians and administrators conduct and publish original research and to evaluate the range of research methodologies used and the level of collaboration among academic librarians, LIS faculty members and others.  

wise distribution of contribution. Citation appended to 59 research articles. It gives average number of citation contribution and type of publication cited and presents a ranked list of cited journals.107

2002 Gupta, B.M. Aerospace science and technology is a major research area for nations because of its economic and strategic importance. A study done to find out the research publications in science and technology in India during the period 1995-1999. In India, the priority areas of research, as reflected in distribution of papers are chemistry, physics, biomedical research, clinical medicine, and engineering and technology. The publications output from 1986-88 to 1995-97 increased from 25.7% to 27.3% in chemistry, 16.2% to 20.2% in physics, and 10.8% to 11.1% in engineering &technology. The 26 co-authored papers in Engineering & Technology are scattered across 8 sub-disciplines. The research was predominately bilateral in aerospace technology, metals & metallurgy, material science, computers and mechanical engineering and multilateral in civil engineering.87

2003 Dutt, Garg and Bali analyzed 1317 published articles in the International journal of Scientometrics during the period of 1978 to 2001. They found output is highly scattered as indicated by the average number of papers per institution.8

2004 Jon stone, Matthew, Alan Carson and sharpe conducted a Systematic Review of its meaning in Newspaper articles. In this study Psychosomatic articles published in 14 Newspapers during the period of 1996 and 2002. The result has been discussed about 34 % articles in which the meaning could be judged. In 56% Psychosomatic was used to describe problem for mind affects. Finally results patients needs to psychosomatic study.9
2004 Signore and Annovazzi research output on Medline covering a period of one year to evaluate Nuclear Medicine papers published from European as compared with out of European countries. He analyzed Europe 939 papers and USA 608 Papers. Germany is the nation that is currently making the greatest contribution to the scientific production of Nuclear Medicine in Europe.\(^{10}\)

2004 Praseeda and Vasudevan the author describes in their paper about the articles of journals. The University news was analyzed to find out the authorships pattern, subject wise break up and the most prolific contribution. The citation was also analyzed book is most favored among citation which is followed by periodical articles and research reports.\(^{11}\)

2005 Leydesdorff discussed about scientometric indicators used for evaluation of research since last 1960 and present scenario with the application of ICT. In a knowledge based economy science fulfils functions that change the definitions of what is considered research and globalization has changed the relevance of national systems of reference so why authors called as reflexive scientometrics.\(^{12}\)

2005 Patra & Chand studied on the chronological growth of Indian Biotechnology. Applicability of Lotka’s Law has been examined for the authorship pattern. Productivity of authors has analyzed and found a list of 35 authors published more than 10 publications. Bradford’s law of scattering has been used to identify the core journals, which cover most of the research and development output of Indian biotechnology. The study shows the active authors, institutions and state wise distributions of Indian Biotechnology research output.\(^{13}\)

2005 Tom, Pin and Huang analyzed published group interview books. The number, length, positive or negative content, and order in which reviews appear have a
significant effect. These results can provide Internet bookstores with a reference for managing their bibliometrics. They can also be of help to librarians in collection development and book circulation promotion.\textsuperscript{14}

**2005 Kademani BS** analyzed quantitatively the contributions made by the scientist of Bio Organic Division at BARC During 1972 to 2002. The division has produced 475 publications in various domains. The highest number of publications 38 was produced in 2001. The collaboration trend among the scientists towards multi authored papers is indicative of the highly specialized areas of scientific work that they were engaged in. It would be useful to study other qualitative indicators based on citations and impact factors, participation an international meetings, academic qualifications, honors and awards received by scientists.\textsuperscript{15}

**2005 Coccia** presented a scientometric model for the assessment of scientific research performance within public institutes. The new model is successfully applied to 108 public research institutes belongs to the Italian Research Council, using data from year 2003 and displays the laboratories with high and law performance. The results are substantially stronger and quicker to obtain than use those calculated by using conventional indicators. This model supports the policy makers, who must decide about the level and direction of public funding for research and technology transfer.\textsuperscript{16}

**2005 Dastidar and Persson** analyzed the mapping of global structure of Antarctic research vis a vis Antarctic Treaty system on the basis of data retrieved 10287 papers from SCI database (CD- ROM), published in 934 journals during the last 24 years 1980 through 2003. The present analysis throws light on the research structure of
Antarctic Science that is being practiced by the nations under the ATS. Bibliometric analysis of Antarctic science on a regular basis will help visualize the functioning of the ATS, where science is occupying in a central place.  

2005 Roth described the emergence of competitors to the science citation index and the web of science. Eugene Garfield’s recognition that the concept of citation searching, from the legal literature, should be applied to the sciences has been amply rewarded. Citation searching has surely seen a dramatic progression from the cumbersome print volumes of SCI. Recent developments in hypertext linking and web browsers have led to the web of science, which results in the relationship between citing and cited documents. Being clearly evident to users recent developments of competitors to the WOS while interesting and useful for quick links to some of citing references are clearly not a substitute for a comprehensive citation search.  

2005 Schamhorst & Thelwall discussed citation analysis with the present hyperlinks network system. Research over the past ten years into hyperlinks and into citation and hyperlinks network is a legacy of Garfield and other key early citation analysis, whether this is explicitly acknowledge or not. Currently however the value of these approaches cannot complete with that of citation analysis, particularly for research evaluation. The near future promises hyperlink analysis and network theories as supporting actors to mainstream citation analysis, although this may eventually change in the future as the web and digital library technologies evolve.  

2005 Gangan Pratap analysed aerospace research in India using the scopus database. The analysis of publications conducted to identify the top countries doing the research. In that, Singapore ranks first and Israel ranks second while India ranks 25th.
USA accounts for about 44% world’s publications in aerospace and china are second with about 12% of publications. There is a strong contribution from Asian institution in Aerospace research during recent years. However only two Indian institutions make it into the list i.e. the IIT and IISc. IISc published 28% of Indian research work followed by NAL with about 20% and four IITs together total about 37% of the papers in the country.88

2005 Patel carried out a bibliometric analysis on a journal of IEEE Transaction on Image processing in light of activities carried out at SAC and importance of scientific periodicals in SAC library. The analysis throws light on different aspects such as nature and scope of papers, publication rate, authorship pattern, country wise contribution, up to date ness, length of articles, citation analysis, distribution of figures/tables/images, subject wise distribution of papers and correspondence items.20

2005 Rajendiran P, Ramesh Babu B and Gopal Krishan S The author explain the objective of the study is to analysis the global output of fiber optics research. Articles covered in the Eitch index database covering the period 1999-2003 have been considered for the study. Grow the literature year wise, country wise, authorship pattern, bibliographic forms, ranking of core journals and nature of research have been analyzed.21

2005 Lewison discussed new ways to evaluate research beyond SCI citation and how they might be used in the future to provide data that can complement both conventional citation analysis and traditional peer-review. They are not particularly difficult to develop, but it would seem worthwhile to set up one or more national evaluation units that would generate the appropriate methodology, or apply that develop elsewhere, for the production of new research indicators, and exchange of data with similar units in other countries.97
2005 Moed presented a critical methodological discussion of the journal impact factor published in ISI’s annual Journal Citation Reports and highlighted the basic assumptions that underlie it. It was not discussed data on journal citation impact from other ISI information products, such as its Journal Performance Indicators. It presents a normalized or relative journal citation impact indicator as an alternative measures. He discussed further issues regarding journal impact measures, outlines new developments.102

2005 Dastidar and Persson analyzed the mapping of global structure of Antarctic research Antarctic treaty system on the basis of data retrieved 10287 papers from SCI Database CD Rom published in 934 journals during the last 24 years 1980-2003. The present analysis throws light on the research structure of Antarctic science that is being practiced by the nations under the ATS Bibliometric Analysis of Antactic science on a regular basic will help visualize the functioning of the ATS, where science is occupying in a central place.103

2005 Yalpani and others applied scientometric methods to chemical research in Iran. Using the corresponding ISI data of the publications 1990-2003 of 24 selected young chemistry Ph.D graduates and present faculty members at various internal academia, a quantitative and qualitative assessment of their achievements has been attempted and the results related to the strengths and weakness of the present science policy of the country.104

2005 Chu examined the taxonomy of in linked web entities through the application of bibliometric methods. Hyperlinked from other websites are in some respect, similar to bibliographics citations. Link analysis like citation analysis in bibliometrics, has emerged as a research area of webometrics in recent years. A sample of
linked web entities was randomly selected from a group of institutions websites. The linked sites, along with the hyperlink data and outlining sites, were analyzed and categorized to form taxonomy of in linked sites. Based on this taxonomy a list of reasons for hyper linking, grouped in top level categories was identified. Compared with bibliographical citations, hyperlinks were made for different set of reasons. ¹⁰⁰

2006 Glanzel and others reviewed on the role of author self citation in information science, bibliometrics and science policy. This article shown the aims and means of quantitative interpretation of bibliographic features in bibliometrics and their re interpretation in research policy and summarized the state of art in self citation research. The authors described three approaches to the role of author self citations and possible conflicts arising from the different perspectives. Concluded that there is no research for condemning self citations in general or removing them from macro or meso statistics; supplementary indicators based on self citations are useful to understand communications patterns. ²²

2006 Singh and Dominic analyzed of citation pattern of Allelopathy journal. The study covers 687 citation appended to the 30 research articles published in four issues of Allelopathy Journal. The study reveals that 30.57% of the total citation are author self citation and 16.16% are journal self citation. The highest percentage of year wise journal citation index was found to be 33.18% in the period of 1981 to 1990. ²³

2006 Mahapatra and Jena described the growth of scientific research literature on Orissa published during 1985 to 2004, Includes 875 research papers from forty different journals. Analyses the data found that majority of authors prefer to publish their papers in collaboration with others. It was also found that research on agricultural science is more compared to other subjects. It was interesting to note that nearly 31% of the
scientific literature is published in non-scientific journals. This may result in the scientific papers going unnoticed by scientific works. More papers are published in Indian journals compared to foreign journals. It was found that majority of papers were six pages long.\textsuperscript{24}

**2006 Garg** and others completed a scientometric study on malaria research. An analysis of 2275 papers on malaria research published in journals and indexed by commonwealth agricultural bureau international CD Rom incorporating Tropical Diseases Bulletin and pub med medline in 1990 and 2000 indicates that the science citation Index covered only about 68\% of the output indexed by CABI and Pub Med. Malaria research output is highly scattered both in terms of the subfields of the journals as well as the publishing country of the journals. The publication activity in Brazil increased significantly during 200 as compared to 1990. The highest output 37\% followed by epidemiology 19\% and Drug resistance anti malarias 16\%. USA and Australia emphasized different aspects of Parasite biology. China and Brazil emphasized different facets of epidemiology. Nigeria and Thailand paid more attention to complicated malaria and its adverse effects and drug resistance and anti malarias.\textsuperscript{25}

**2006 Guna** and others assessed the volume of research performed by Indians in Chemical Sciences, their share of research to world literature in chemistry, journals in which they publish their results, impact of their publication in terms of journals impact factors, institutions involved in research in chemical sciences, extent of international collaboration. Data for this study was culled from the CD- ROM version of Chemistry Citation Index.\textsuperscript{26}

**2006 Bhatia** completed a scientometric study on research trends at the National Institute of Occupational Health have been studied based on the research projects
reported in the annual reports of the institute for a period of 25 years 1975 to 1909. Out of a total of 380 projects carried out during this period by the institute, 180 projects were on 48.4% epidemiological studies, 75 projects 19.7% on environmental studies and 121 were on experimental studies 31.9%.

2006 Glanzel studied about proceedings literature as additional data source for bibliometric analysis. Scientific meeting have become increasingly important channels for scholarly communication. In several fields of applied and engineering sciences they are according to the statements of the scientists active in that fields even more important than publishing in periodicals. There are two fold of objectives of the study as mentioned by the authors to analyze the weight of proceedings literature in all fields of the sciences, social sciences and humanities and use of the ISI proceeding database as additional data source for bibliometric studies. The second objective is exploring the use of a further important feature of this database; namely of information about conference location for the analysis of bibliometrically relevant aspects of information flow such as the relative attractively the extent of mobility and unidirectional or mutual affinity of contents.

2006 Tiew bibliometrically studied the LIS journal Sekitar Perpustakaan. The period covered was from 1994 to 2003. Middle-level professionals had major contribution of papers in the journal and like the study of Tiew, Abdullah & Kaur (2002), single-authored contribution were found dominant by contributing 79% articles.

2006 Schildt and Mattison proposed an alternative algorithm using a data set from the field of family business research and compare it to two alternative methods, multidimensional scaling and clustering and introduced new software tool, sitkis that implements the algorithm and other common bibliometric methods.
2006 **Van Raan** compared the Hirsch-index with standard bibliometric indicators and with peer judgments for 147 chemistry research groups. The data contains works of 700 researchers of 147 chemistry research groups of Netherlands during the period 1991-2000. Results showed that the h-index and bibliographic crown indicator both relates in a quite comparable way with peer judgments.\(^{29}\)

2006 **Dash JN** analyzed JCR report data presented in different journals. JCR is the compiled statistical citation data of multidisciplinary scientific journals. As the citation data varies from discipline to discipline. Here attempts have been made to normalize the IF value for evaluation purposes to permit interdisciplinary comparison. Amount them is Vinkler’s subfield factor a method to normalize IF to allow comparison among subfield. DIF is calculated in a way similar to the IF, but only citations in the discipline core journals are taken into account. Garfield has suggested the most accurate measure of citation potential is the average number of references per paper published in a given field than using average citation count of journal.\(^{30}\)

2006 **Saravanan & Ponnudurai** completed a bibliometric analysis enables identification of potential areas of research in any discipline. An attempt has been made to identify research output area wise in the science of astronomy. This study relates to all publication from G7 countries and India. The study encompasses papers relating to experimental studies on the practice and theory and the mathematical aspects of astronomy as well as application oriented research and those on the general nature of and new developments in the field and other areas of interest.\(^{31}\)

2006 **Sangam and Savanur** presented a bibliometric study on the basic of output of the literatures of Dr. N. Rudraiah, an individual scientist. Bibliometric studies deal
with the biographical study of the individual careers of scientists and researchers and other correlates bibliographical analysis of publications or academic and scientific achievements. On the basics of data analyzed on different on different aspects like domain wise contributions, productivity, researcher and their collaboration channels of communication and the applied of Bradford Zips graph.³²

2006 Godwin explained the history of scientometrics and bibliometrics specially the application in psychology. Amount the many Statistics on science, called scientometrics, bibliometrics holds a privileged place. Bibliometrics is one of the few subfields concerned with measuring the output side of science. According to most histories bibliometric owes its systematic development mainly to D.J.D. Price and Eugene Garfield, as founders. The few works conducted before the 1950s are usually relegated to prehistory. This paper documents how the systematic counting of publications originated with psychologists.⁹¹

2006 Biradar Studied on the basis of the reference appended to the articles published in Indian Journal of Environmental Protection published in the years 1994, 1999 and 2004 respectively. Study highlights the authorship trends and collaborative research in environmental science during 1994, 1999 and 2004. The study found that team research is preferred in the field of environmental rather than solo research. The overall degree of collaboration is calculated and found to be 0.85. The study also found that on an average 11.595 references are referred by each article. Major contributions are mad by universities 31.62% followed by colleges 24.6% and research institutions 23.784. It is also observed that the proportion of single authored papers have decreased from 20.2% in the year 1994 to 4.7% in 2004. ³³
2006 Garg, kumar and Lal analyzed a scientometric profile of Indian agricultural research through science citation Index. They have done an analysis through the data 16891 publications published by Indian scientists during 1993-2002 as indexed by SCI Expanded. On the basics of data analysis indicates that the publication output in the agricultural sciences is on the decline since 1998 onwards. Dairy and animal sciences followed by veterinary sciences constitute the largest component of the Indian agricultural research output. Agricultural universities and institutes under the aegis of Indian council of Agricultural Research are the major producers of research output. Most of the papers published in domestic journals and low normalized impact factor journals with a low rate of citation per paper. Most of the highly productive institutions are either agricultural universities or the institutes under the aegis of ICAR. Most of the prolific authors are from the highly productive institution.¹⁰⁵

2006 Must observed in this study to what extent research priorities set in R&D policy strategy documents are supported with publication and citation data, delivered from ISI databases. As supporting background information the results of questionnaire sent to the committee of senior officials of the cooperation in the field of scientific technical research are used.¹⁰⁶

2006 Jena a bibliometric analysis has been studied on Indian Journal of Fibre and Textile Research during 1996 to 2004. It showed that it covers contributions related to nearly all aspects of textile technology. The increasing trend in the number of contribution in the journal from year to year shows that the journal is a respected primary publication by researcher in the area.³⁴
2006 Buela Casal and others suggested in this study that no single criterion alone is sufficient. This paper surveyed, critically assessed and extended the existing measures of internationality in the context of academic publishing and identified those criteria and they are most clearly resolved and amenable to quantitative analysis.95

2006 Butter and others provided concepts of combining maps and bibliometric maps. Bibliometrics maps of science are well established research subject. But their adoption as a science policy support tool is lacking. Author’s claimed they developed a tool that interfaces between a qualitative map and a bibliometric map which lets the users create a correspondence between the distinct vocabularies of the maps.96

2007 Asha analyzed bibliometric properties of Demographic India from 1972 to 2001. The result core areas of demographic studies, institution wise contribution and geographical area pertaining to the articles. Determined the trend line and five yearly moving average of the year wise distribution of collaboration coefficients for ascertain the trends in the distribution of single and multi authored articles. She identified most cited journals, examined identified most cited journals, examined bibliographic forms of cited documents, average age of citations and rate of citation per article.35

2007 Senthilkumaran and Amudhavalli analyzed the quantitative literature on spices for the period 1968 to 2002 with respect to Asia and India using HORD- CD Database. The result the distribution of literature by categories of spices forms of publications, core journals, prime authors and institutions. Revealed that India dominants research and development activities on spices on in the Asian continent and Indian Institute of Spices Research are a significant contributor scientists top the list of prolific author.36
2007 Kretschmer and Kretschmer highlighted new centrally measure for social network analysis applicable to bibliometric and webometric data. A fairly large number of publications in sociology, in computer science or information sciences, as well as in studies of collaboration in science deal with the studies of social networks with unweighted ties because measures involving unweighted ties are easier to calculate. A few studies on networks with weighted ties have been conducted. Such studies not only need more complex formulas but also a process of quantification specially when quantitative empirical data are not directly available.37

2007 Liberatore, Solana and Guimareas conducted a bibliometric analysis of the journal ‘Ciencia da Informacao’. The results showed that there was less authorship collaboration, while most of the authors affiliation was from Brazilian universities.75

2007 Wena survey of Electronic health record during 1991 - 2005 Scientific production of electronic health record research came to the conclusion that numbers of published articles have significantly increased compared to each five year period. Most articles were published in English 98% and were from the region of America 57%. The top 10 of the 374 journals accounted for 41% of the number of published articles.38

2007 Zhou completed a scientometric analysis of geostatistics using multivariate methods taking data from the science citation index during 1967 to 2005. Hierarchical Cluster analysis was used in publication patterns based on different types of variables. A backward discriminate analysis with appropriate statistical tests was then conducted to confirm CA results and evaluate the variations of various patterns. For authorship pattern, the 50 ost productive authors were classified by CA into 4 groups representing different levels and DA produced 92.0% correct assignment with high reliability. The discriminate parameters were mean impact
factor, annual citations per publications and the number of publications by the first author, for
country pattern, CA divided the top most productive countries into 4 groups with 95.9% correct
assignment and discriminate parameters were MIF, ACCP and independent publication. for
institute pattern, 3 groups were identified from the top 50 most productive institutes with
nearly 88.0% correct assignment. The top 50 most productive journals were classified into 3
groups with nearly 98.0% correct assignment. We also analyzed general pattern for publication
document type, language and subject category and publication growth.39

2007 Kademani, Sagar, Kumar and Gupta analyzed the growth and
development of science and technology activities in India, as reflected in publication
output covered by science citation Index during 1990 to 2004. The Indian scientists
published a total of 1,82,111 papers in SCI covered journals during the above period. The
present study analyses the board features of Indian S & T by focusing on its publication
growth characteristics, language, format and media of communication, research quality,
institutional productivity, patterns of research collaboration and board and narrow subject
areas of interests of Indian Institutions and Scientists. A broad comparison of India’s
research output with select countries, particularly with china has also been made.40

2007 Jauhari completed a study on Zip’s law and number of hits on the WWW.
In this Paper, the distribution of words according to their length and the hits they are able
to generate on the popular search engine Google is discussed. 1775 unique words were
taken from a text of 10043 words from the book and searched for the number of hits they
get on the search engine Google. The word length and word frequency follows a nearly
Gaussian distribution but not for the too lengthy words and thirdly definite relation
between word - length up to 18 and average log hits.41
2007 Kademani tried to highlight quantitatively the contributions made by the scientists of radiochemistry division of BARC during 1958 to 2005. The analysis showed that the radiochemistry division has produced 1044 publications in diverse areas of research. The highest numbers of publications 64 were produced in 2005. The average number of publications per year was 21.75%. The collaborations trend among the Radio chemists towards multi authors is indicative of the highly specialized areas of scientific work that they were engaged in. The most prolific authors identified in the study were/are holding important positions in BARC. It showed that publications productivity is one of the important indicators to identify the scientists for newer responsibilities.42

2007 Gupta and Dhawan analyzed various features of R & D sector such as publications growth and output, impact of research, strong and weak subject areas, collaboration profile and major institutions and their quality.43

2007 Ramakrishnan and Babu completed a bibliometric analysis on the literature of hepatitis as taken from three bibliographic databases namely MEDLINE, Cinahl and IPA. The literature covered in three databases for the period 1984 to 2003 was considered. MEDLINE covered the maximum of 75750 records during the study period the followed by CINAHL and IPA database. There are total numbers of 82617 records in three databases during the study period. The total number of duplicate records among the three databases is 3305 (4%). Total number of records after removing duplicate records is 79312. 85.17% of the total contributions are tending to be collaborative research with different degrees of collaborations ranging from 0.82 to 0.86. The collaborative research trends to be more in the field of hepatitis.44
**2007 Vijay and Raghavan** completed a bibliometric study on the Journal of Food Science & Technology. Bibliometric analysis of 779 articles published, along with citations in five volumes 37 to 41 have been carried out. A similar study was also carried out for the maiden volume of the same journal for the year 1964. Results indicated an increase in the numbers of contributions in successive volumes with India being the major contributor both in the maiden volume as well as in the five volumes studied. The highest number of contributions is by the joint authors. The growth and popularity of the journal is showing a steady upward trend, through contributions from the developed nations from only 15% of the total.45

**2007 Mini Devi** completed a study on bibliographic coupling in toxicology journals. Explored the phenomena of bibliographic coupling in nine core journals in toxicology indexed in the toxicology information online (TOXILINE). A total of 218 articles were taken for analysis using software package for social sciences (SPCC). The journal toxicology had highest percentage of bibliographically coupled articles 15.3%. There was no fixed trend in the development of number of bibliographically coupled articles.46

**2007 Feng Zhou, Huai-Cheng Guo, Yuh-Shan Ho and Chao-Zhong Wu** Multivariate methods were successfully employed in a comprehensive scientometric analysis of geostatistics research, and the publications data for this research came from the Science Citation Index and spanned the period from 1967 to 2005. Hierarchical cluster analysis (CA) was used in publication patterns based on different types of variables. A backward discriminant analysis (DA) with appropriate statistical tests was then conducted to confirm CA results and evaluate the variations of various patterns. For authorship pattern, the 50 most productive authors were classified by CA into 4 groups.
representing different levels, and DA produced 92.0% correct assignment with high reliability. The discriminant parameters were mean impact factor (MIF), annual citations per publication (ACPP), and the number of publications by the first author, for country/region pattern, CA divided the top 50 most productive countries/regions into 4 groups with 95.9% correct assignments, and the discriminant parameters were MIF, ACCP, and independent publication (IP); for institute pattern, 3 groups were identified from the top 50 most productive institutes with nearly 88.0% correct assignment, and the discriminant parameters were MIF, ACCP, IP, and international collaborative publication; last, for journal pattern, the top 50 most productive journals were classified into 3 groups with nearly 98.0% correct assignment, and its discriminant parameters were total citations, impact factor and ACCP. Moreover, we also analyzed general patterns for publication document type, language, subject category, and publication growth.47

2007 Rajendiran and Parihar identified various bibliometric indicators of articles published by the Indian researchers in the field of laser science and technology during the period of 1995 to 2005. The scopus the indexing online database was the main source for the study. The bibliometric techniques such as Bradford’s law, Lotka’s law and subramanyam formula were employed respectively to measure quantitative distribution of literature. The study found that the literature growth has steadily increased and the growth rate over the period of time was 22.436 articles per year. Of the total literature, 97.32% appeared as research articles. Literature was found that published in eight different disciplines, and the percentage of multi disciplinary articles was 18.93. The log log plot drawn for distribution of literature in various sources/journals fits the typical Bradford shaped curve. The study identified 20 core sources and 23 core journals.
It was found that majority of authors contributed only one article 65.04%, which was larger than the 60% of original lotka’s data. The degree of collaboration among authors is 0.94. The average length of an article is 7.09.

2007 Guang Yu and Yi-Jun Li Based on the transfer function model of the observed citation distribution and the expression of the cumulative citation probability distribution, parameters of 12 citation distributions are identified from statistical data of age distributions of references of 10 journals in JCR using the parameter optimization fitting method. At same time, based on the steady state solution of differential equations of the publication delay process and data of publication delays of 10 journals, the publication delay parameters of every journal are identified using the fitting method. Identified parameters of every journal citation distribution are compared with the journal’s publication delay parameters and some valuable conclusions are deduced.

2007 Walke and Dhawan analyzed the growth and publication size of Indian publication in materials science during 1993 to 2001. It was also analyzed various other features of publications output such as modes of communication, areas of research priority, research quality, nature of collaboration, and institutional productivity. The results presented in the study are based on raw bibliographical publications data along with their citations data for the period 1993 to 2001 extracted and downloaded in from the SCI- Expanded version of the Thomsom- ISI. As seen from the publication data, the research institutions publish mainly in low impact journals. The collaborative research is growing faster 368.2% than the country growth in materials science research 7.09%.

2007 Dixit and Katare carried out a bibliometric analysis of the Journal of the Indian Society for cotton improvement. Highlighted the research trend of cotton scientists
by studying the pattern of articles published in the Journal of the Indian Society of Cotton improvement for the period of 1995 to 2004. Pattern related to authorship, bibliographic forms, citations, contributing institutions and subjects were analyzed. Based on these details, ranking of core journals in the field of cotton science has also been done.51

2007 Jiancheng Guan, Ying He The purpose of this study is to explore the character and pattern of the linkage between science and technology in China, based on the database of United States Patent and Trademark Office (USPTO). The analysis is focused on the period 1995–2004, a rapid increasing period for Chinese US patents. Using the scientific non-patent references (NPRs) within patents, we investigate the science-technology connection in the context of Chinese regions as well as industrial sectors classified by International Patent Classification (IPC). 11 technological domains have been selected to describe the science intensity of the technology. The results suggest that the patents and the corresponding scientific citations are related in different ways. Finally, we match the scientific NPRs to the Science Citation Index (SCI) covered publications to identify the core journals and categories. It reveals that the scientific references covered by SCI show a skewed distribution not only in journals but also in categories.52

2007 Gupta, Dhawan and Gupta analyzed the cumulative output in science & technology during 1993 to 2003 of different regions in the world. It is also analyzed the contributions made by the developed and the developing countries in different broad subject fields to identify their strengths in the different fields of research. The publication data for the purpose were taken from the Web of Science database and from ISI Thomson Press Report on Essential science indicators. For comparative study of Indian research output with other countries, the 11 years combined publications and citation data of 146
countries during 1993 to 2003 were analyzed. The developing countries 12.73% share to the global research output and attracted 5.36% share in world citations as seen from the output during 1993 to 2003. Among the developing countries, India ranked at the top in terms of research output in agriculture 5.63%, Plant and animal sciences 3.13%, and biology and biochemistry 1.51%. Developing countries require concentrated efforts for improving the quality and quantity of research output. These countries need to build up more effectively their scientific capacity, competence and knowledge base to bridge scientific and technological gap with developed countries. Achieving this will depend in part by increasing investment in R & D and higher education sector and in part by increasing deployment of qualified and competent S & T manpower, greater interaction among the various S&T sectors, and increased scientific cooperation among developed countries.53

2007 Sevukan and others done a bibliometric study on research output of faculties of plant sciences in central universities of India. The study analyzed a total of 348 bibliographic records of plant sciences retrieved from ISI science citation Index extended for a period of ten years from 1997 to 2006. The output of plant sciences literature has been analyzed by year, document type, authorship pattern and collaboration pattern at different levels viz. international and national. Articles play at predominant source of publications of plant science literature, the plant science research in central universities of India is fairly collaborative and the productivity of authors fit lotka’s distribution while scattering of journals articles does not fit into Bradford’s distribution.54

2007 Verma and others analyzed of contributions in Annals of Library and Information Studies. This paper deals with the analysis of the 31 contributions of the journal published during 1999 to 2005. It examines year wise, institution wise, state wise
distribution of contributions, authorship pattern, citation analysis, length of contributions etc. The study showed that single author contributes most of the contribution of this journal and state wise contribution shows that the most of the contributions are contributed from Delhi. Citiation analysis of 1456 citations includes finding our average number of citations per contribution, types of publications cited and preparing of ranked list of cited journals in contribution of the journal.55

2007 Pillai found authorship patterns in physics literature through an information study on citations in doctoral theses of the Indian Institute of Science. It was a case study of the trend in authorship pattern and collaborative research in physics with a sample of 11412 journals and 1328 books citations appended in the physics doctoral dissertations awarded by the IISc, Bangalore during 1999 to 2003. The study found that team research is preferred in the field of physics rather than solo research. The average number of authors per journal article was 3 and for book it was 1.69. The degree of collaboration in different years was calculated and the value of it for journals was 0.08 and 0.044 for books. The authorship collaboration is more in journal articles then books.56

2007 Parvathamma N and Gobbur, Devendra S carried out a bibliometric study of plastic literature during 1998 to 2002. Bibliometric analysis of 6444 publications related to plastics, as indexed in biological abstracts on CD, during the above period was undertaken. On an average, 1289 papers were published every year. Two and more authored papers constitute majority of the contributions and degree of collaboration amounts to 0.81. This shows that team research is prevalent in the area of plastics. USA produces largest amount of literature related to plastics and English is the most predominant language used for publishing the literature related to plastics during the study period.57
2007 Levitt, Jonathan M Presented his research paper aims to develop and apply a metric for estimating trends in database of articles. The motivation of estimating trends in this database is that these trends are possibly of interest and science policy.  

2007 Shafi and others completed a bibliometric study on D Lib magazine. It was found that collaborative research is given priority over solo research. The degree of collaboration was found 0.66. The study further reveals more contribution from teaching community compared to professionals. Country wise distribution reveals that most of the contribution comes from the USA and Germany while facet wise distribution of articles depicts that most of the articles cover digital libraries and preservation followed by metadata.  

2008 Kumar and Kumar analysis of Journal of oilseeds research during 1993 to 2004 on the basic of 8903 citation given in this journal and said period. Out of 8093 citations, 5642 were given in main article and 2551 in short communications of the JOR. It also analyzed types of documents cited and identifies core journals. Geographical distribution of cited references had also been analyzed. Concluded that 20 core periodicals cover more than 50% references and also indicated that collaborative research in prevalent in oil seeds research.  

2008 Chaurasia undertook a bibliometric study of Annals of Library and Information Studies (ALIS) from 2002 to 2006 and revealed authorship pattern, degree of collaboration, subject coverage of articles and some other facets.  

2008 Sam studied the Ghana Library Journal from 2000 to 2006. The majority of items cited were journals with 44.5%, followed by books with 32.5%. Current sources of
information were about 62.9% of the journals and 48.8% of the books appeared in the reference lists and were published in 1990 or later. The subject area most researched was academic libraries. Majority of the authors were affiliated with universities and were local.76

2008 Raut was carried out a citation study on Strategic Management Journal. The objectives of their study were to find the distribution of different forms of cited documents. The two volumes 26 & 27 published in 2005 & 2006 of strategic management journal have been used for this study. Out of total 8716 citations found the journals contribute the highest 76.46% and books come second accounting for 19.7% and rest others like patents, theses and reports etc. Two authored citations were found the highest in case of authorship pattern of journals. In case ranking of authors in journal found bamey JB holds 1st position. Strategic Management Journals holds 1st position securing the highest citations and USA found the top position in case geographical distribution of contribution.61

2008 Gupta and Dhawan carried out a scientometric study on S&T publications output of India. The paper analyzed India’s publications output in three major international multidisciplinary databases, as indexed during 1981 to 2005. It reports on India’s comparative strength in world science and technology output, its growth and decline, its strong and weak subject areas of research, media of communication, its collaborative profile and quality of S&T output, institutional productivity and quality, dynamics of Indian research at institutional and sector levels. The study also provides suggestions for improving the quantity and quality of research S&T in India.62

2008 Bakri and Willet covering period from 2001 to 2006 and compared the results. The comparison showed that the number of publications increased, statistically
significant changes occurred in types of articles, number of references per article and length of the articles also increased. Two-authored articles were greater in number and the major contribution was from Malaysian authors.\textsuperscript{73}

\textbf{2008 Surwase} and others done a scientometric study attempts to highlight the neutron scattering research in India as per the number of publications appeared in the Scopus database. During the period 1992 to 2006 a total of 1808 publications were published by the Indian scientists in the field of neutron scattering. The average number of publications published per year was 113. The highest number of publications 284 was published in the year 2006. Authorship and collaboration trends were towards multi-authored publications. There were 934 international collaborative publications. India had the highest number of collaborative publications. India had the highest number of collaborative publications with USA followed by France with 116 (12.42\%), Germany with 106 (11.35\%) and Japan with 83 (8.89\%) publications. The most productive Indian institutions were Bhabha Atomic Research Centre, Mumbai with 425 publications, Saha institute of Nuclear Physics, Kolkata with 99 publications and Tata Institute of fundamental Research, Mumbai with 97 publications. The most preferred journals by the scientists for publications were. Physical Review B with 129 publications followed by Physical B with 80 publications, Journal of Physical Chemistry B with 76 publications, Pramana Journal of Physics with 75 publications and Journal of Physics condensed matter with 51 publications. The high frequency keywords were neutron scattering 266, micelles 183, surface active agents 104, molecular dynamics 96, phase transitions 96, phonons 84, and small angle neutron scattering 84. The highly cited Indian publications have also been identified.\textsuperscript{63}
2008 Mukherjee analyzed scientific productions for Indian academic Institutions articles during 2000 to 2007. The results show that among four universities, the authors of Delhi University contributed the highest number of articles, followed by Banaras Hindu University. There is also an increasing tendency toward collaborative research among Indian authors as well as more frequent collaboration with international authors. Biochemistry and Molecular Biology are two of the most prolific research areas in these four Indian universities.64

2008 Kumar and others carried out a scientometric study on web resources in INSPEC database. This study attempts to analyze the growth and development of web resources in inspec database during 1995 to 2005. A total of 18673 publications appeared in 171 web resources contributed by the scientists in various areas of research. Physics 11076, Computers and control technology 5524, Electrical and Electronics engineering 2050 and information technology 23. The highest numbers of publications in web resources in inspec database were from USA with 8364 (44.79) publications followed by Italy with 4342 (23.35%) publications and UK with 1967 (10.53%) publications. The publications in web resources have started appearing in the inspec database since 1995 with six publications. The highest numbers of publications in web resources published per year were 1698.65

2008 Mini Devi studied authorship pattern and validity of Lotka’s Law in toxicology literature. The author was collected data from TOXLINt database as produced by the National Library Medicine, USA during 1998 to 2003. A total of 9585 citations in 2247 articles were collected for the study. The objective of the study were the determine categories of authors in citations, to study the extent of collaboration among
the authors, to analyze the rate of citation of single and collaborated authors and to apply Lotka’s Law. The value of group co efficient for publications was 0.73. the degree of collaboration among co authors was maximum in articles written by more than three persons and minimum in two authors publications. The value of group co efficient for citations was 0.75. The year 2002 and 2003 witnessed the emergence of citations which of collaborative nature. The rate of citation of single and collaborated authors showed two authored articles had maximum citation rate 1.84 and more than three authored articles had minimum citation rate 1.4. as the number of persons increases in a work the rate of collaborative authors decreases, the joint authors will have a lesser number of citation rate the famous Lotka’s Law was not found fit for the study.66

2008 Kumar completed a scientometric analysis on Pramana Journal of Physics. Focused on publishing trend, impact factor, authorship pattern, types of articles, institutional collaboration of authors, affiliated institution of authors, countries of contributing authors, keyword analysis and referencing pattern. The number of articles was published in Pramana and its ISI impact factor on increasing trend. There was an upward trend in number of collaborative papers.67

2008 Nandi and Bandyapadhyay completed a bibliometric study on the journal of Indian economic Review. They found out the results of a bibliometric study covered in the issues of Indian Economic Review during 1982 to 2002. It analyses 1653 citations appended to 68 research articles. The finding revealed that 43.25% citation was from books and 52.69% from journals. The degree of collaboration in The Indian Economic Review is 0.33 and it gradually decreases during the study period. Geographical distribution of the authors reveals that most of the contributors are from India with 48 authors 52.17% 68
2008 Hou and others analyzed the structure of scientific collaboration networks in scientometrics. The structure of scientific collaboration networks in scientometrics is investigated at the level of individuals by using bibliographic data of all papers published in the international journal scientometrics retrieved from the science citation index of the years 1978 to 2004. Combined analysis of social network analysis co-occurrence analysis, cluster analysis and frequency analysis of words is explored to reveal. The microstructure of the collaboration network on scientists of scientometrics, the major collaboration fields of the whole network and of different collaborative sub networks and the collaboration center of the collaboration network in scientometrics.69

2008 Garg and others completed a scientometric study on the journal Mausam. An analysis of 369 items published in Mausam during 2003-2006 indicated 72% were papers, 23% letters the editor, 4% report on weather India and rest 1% as articles. Indian researchers belonging to India Meteorology Department contributed most of the items. Climatology, agricultural and environmental meteorology, synoptic meteorology, hydrometeorology, numerical weather forecasting and physical meteorology constituted about 56% of the total output. The references cited by the journal are mostly international like other journal in the field. However, majority of the citations are older than 10 years. Based on the pattern of citations the journal received in the international literature its impact factor for 2005 and 2006 is almost the same (0.19) 101

2009 Anyi, Zainab & Anuar Single journals have been the focus of many bibliometric and scientometric studies. A number of contributors have conducted bibliometric analysis of library and information science literature in different countries around the globe. According to an estimate 21 single journal studies in LIS are reported71
2009 Mukherjee found that single-authored articles were higher in number in the Journal of the American Society for Information Science and Technology. The arithmetic mean of page length of all the articles ranged from 10. To 12. Similarly, A citation analysis of the Journal of American Society for Information Science and Technology was conducted by Tsay (2008). The findings revealed that the production rate of JASIST literature doubled and the average number of references per paper increased 2 to 3 times in the period of 25 years.77

2009 Naseer and Mahmood studied Pakistan Library and Information Science Journal from its volume 1998 to 2007. The findings showed that single author contribution was the highest with a ratio of 88.6%, most of the authors were Pakistani with a ratio of 66.9% followed by North Americans. Male authors were dominant with a proportion of 61%. Majority of the articles were descriptive with 61% and two-third (65.7%) of them were in English language. The popular subject category was “industry, profession and education.”78

2009 Sharma evaluated research performance and collaborative writing pattern among scientists of Central Potato Research Institute (CPRI) and found that majority of scientists preferred to work in collaboration and publish research papers in joint authorship.80

2010 Park studied D-Lib Magazine was covering thirteen years and the data were collected by examining issues from July 1995 to May/June 2008. The findings showed that two and more authors’ contribution was the highest with a ratio of 57%; most of the authors had a single contribution; the proportion of the male authors was much higher with a ratio of 74%; authors from the United States contributed 70% of the articles and
the average number of references was 15. The literature review showed that many
bibliometric studies on single journal literature in the field of LIS have been conducted
but no such study of PJLIS has been conducted. Therefore, there is a need to analyze the
literature published in PJLIS.79

2011 Sudhier and IS analyzed the research productivity of social scientists at the
Centre for Development Studies (CDS), Thiruvananthapuram during 1998-2008. There
were 599 research articles published by the CDS researchers, including 38.23% journal
articles, 23.54% chapters in books and 15.03% working papers. The highest number of
publications was in the year 2008. More than 66% of journal articles published are in
Indian journals and 33.19% are published in foreign journals. Economic and Political
Weekly, contributes the highest number of articles 79 (34.50%) followed by Indian
Journal of Labour Economics with 7 (3.06%).83

2012 Baby and Kumaravel studied research productivity of Periyar University
faculties in India using the Scopus database for a period of thirteen years from 1998 to
2010. The results indicate that the growth of research has steadily increased from a single
article in 1998 to 102 articles in 2010. The Relative growth rate and doubling time is 0.45
and 2.27 respectively. It was found that three-author publications predominate amongst
the pattern of authorship. Journal articles occupy the entire place among sources of
publication.84

2012 Maclean and Lewison estimated the financial resources going into malaria
research. Garg estimated the quantum of malaria research output during 1990 and 2000
using PubMed and the Commonwealth Agricultural Bureaux International incorporating
the Tropical Disease Bulletin. Lewison and Srivastava mapped the malaria research
output during the years 1980–2004 using the Science Citation Index (SCI) and malaria vaccine research. However, none of these studies deals with the status of malaria research other than the medical data bases, which constitutes approximately 9% of the total malaria research output.85

2014 Lorna Wildgaard, Jesper W. Schneider and Birger Larsen An increasing demand for bibliometric assessment of individuals has led to a growth of new bibliometric indicators as well as new variants or combinations of established ones. The aim of this review is to contribute with objective facts about the usefulness of bibliometric indicators of the effects of publication activity at the individual level. This paper reviews 108 indicators that can potentially be used to measure performance on individual author-level, and examines the complexity of their calculations in relation to what they are supposed to reflect and ease of end-user application. As such we provide a schematic overview of author-level indicators, where the indicators are broadly categorized into indicators of publication count, indicators that qualify output (on the level of the researcher and journal), indicators of the effect of output (effect as citations, citations normalized to field or the researcher’s body of work), indicators that rank the individual’s work and indicators of impact over time. Supported by an extensive appendix we present how the indicators are computed, the complexity of the mathematical calculation and demands to data-collection, their advantages and limitations as well as references to surrounding discussion in the bibliometric community. The Appendix supporting this study is available online as supplementary material.70
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