20. Ibid.


CHAPTER II

Review of Literature

One of the most important early steps in a research project is the conducting of the literature review. A literature review is designed to identify related research, to set the current research project within a conceptual and theoretical context. When looked at that way, almost no topic is so new or unique that you can't locate relevant and informative related research. Literature review will help to find and select appropriate measurement instruments. It enables to see what measurement instruments researchers used themselves in contexts similar to yours. The literature review will help you to anticipate common problems in your research context.

EARLY BIBLIOMETRIC STUDIES

Cole and Eales\textsuperscript{23} made a pioneering effort in the Bibliometric oriented growth analysis of literature. They analysed the literature on comparative

anatomy covering the period 1550-1860. They identified the fluctuations of interest and distribution of literature among the countries. The study is significant as the authors chose a retrospective period for their analysis.

Louttit\textsuperscript{24} identified the language preference of writing research papers by Psychologists, Chemists and physicists. It was observed that reference made by writers in English language journals were 92.5 percent in English, in German journals 91 percent German and in French journals 64.6 percent French. Further it was said that numerous studies in Social Sciences show reference in American sources having around 90 percent in English.

Simonton\textsuperscript{25} identified that in two English language source journals in the field of Fine Arts, more than half the references were the materials in foreign language references.

One of the earliest studies was undertaken by De Solla Price\textsuperscript{26} who in one of his investigations reports that the incidence of collaboration had increased steadily over time and has been rapidly growing since the beginning of this (twentieth) century.

At the same time, the rate of increase in multiple authorship varies from one subject area to another. In Physics the proportion of the single-author papers have fallen from 75 percent in the 1920s to 39 percent in the 1950s. The corresponding figures for psychology are from 84 percent to 55 percent, reports

\textsuperscript{24} Louttit C.M., The Use Foreign Languages by Psychologists, Chemists and Physicists, American Journal of Psychology, .70 (2), 1957, Pp 314-316.
Since then, a series of studies have shown that an increase in collaborations is evident in most areas of science and technology and that the extent of collaboration varies from one discipline to another. Clarke\textsuperscript{28} in his study on Bibliometric papers criticized the view of price and concluded with a generalization as regards the increasing trend towards multiple authorship is not valid for science as a whole.

Zuckerman\textsuperscript{29} examined the research output contribution of 41 Nobel laureates. The result indicated that there was high degree of collaboration and productivity among them.

Heussman and Pulmer\textsuperscript{30} analysed the literature kept in the general library catalogue of Michigan University. It was noted that out of the total literature, 89.52 percent were in English.

Ozinonu\textsuperscript{31} made an early survey relating to growth of Basic Science in Turkey. The author identified the growth of manpower and frequency of publications in Mathematics, Physics, Astronomy, Chemistry and Bio-Science for the period 1933-1966. This study covered a wider range of subjects, though the trend today has narrowed down to a specific subject or a even field in a subject.


\textsuperscript{31} Ozinonu, K., Growth in Turkish Positive Basic Science 1933-1966. Ankara: Middle East Technical University, No.17, 1970.
Turkeli\textsuperscript{32} examined the post doctoral productivity of Turkish Physicists along with related social and environmental factors.

There has been consistent trend towards increased collaboration in all major branches of sciences over the years in the present (twentieth) century reports Meadows\textsuperscript{33}

Heffner\textsuperscript{34} identified the relationship between collaboration and financial support for research in four disciplines relating to Political Science, Psychology, Biological Science and Chemistry. In all these disciplines financial support for research was associated with an increase in the total number of persons involved in the production of knowledge. His inference is an indirect indication of the relationship between the GNP and research output.

Rangarajan and Poonam Bhatnagar\textsuperscript{35} analysed the Bibliometric data compiled from Physics Abstracts on research papers published in the field of Mossbauer effect studies over a period of two decades from its discovery in respect of media choice. The findings indicated that there was a world–wide trend to publish in journals outside the country of origin of the research work.

Maheswarappa et al\textsuperscript{36} analysed the collaborative research in Indian Science and Technology based on authorship data collected from the Indian Science Abstracts covering the periods 1965-70, 1975-80 and 1980-83.

\textsuperscript{34} Heffner, A.G., Funded Research Authorship Pattern and Sub-authorship Collaboration in four disciplines, Scientometrics, 31 (1), 1981, Pp 5-12.
findings revealed that two authored papers were maximum in Science and Technology as whole. The single authored papers constitute more than one fourth of publication.

Using a set of measures developed by Egghe\textsuperscript{37}, the collaboration profiles of the four Indian physicists were calculated and it was found that while that collaboration measures increased over time, as is normally expected, there were decades where the number of publications decreased but the collaboration measures continued to be significant. Further these decades corresponded with the decades in the life of these physicists where they were busy establishing institutes for physics research.

Maheshwarappa and Savadatti\textsuperscript{38} worked on the authorship pattern and collaborative research in plant breeding during 1984-89, collecting data from the plant Breeding abstract. They concluded that there were 75 per cent multi-authored papers in 1989 in comparison to 21 per cent in 1994. In IASLIC Bulleting, there were three out of 16 in 1984 and four out of 14 in 1988 were in total 21 multi-authored papers to 70 single authored papers for the period of 5 years (1984-88).

White and Griffith\textsuperscript{39} tried to study the linkages of writing in three different fields: studies of science, technology and society. The data was compiled from 71 authors during 1972-80. The study turned out to be highly patterned when

data on author co-citations were statistically analysed and mapped. For both authors and specialists, the maps reveal structure of subject matter and intellectual impact.

Chakravarthy\textsuperscript{40} studied the patterns of multiple authorship. It is proved to be the trend for geology from 1946 to 1979 ranging from 84.9 per cent in single authors to 44.36 per cent, rest being two authors and multiple authors. The Indian contribution gained 76.74 per cent in 1940, 52-56 per cent in 1970 from the single authors.

Maheshwarappa and Mathias\textsuperscript{41} have studied the multiple authorship, authorship patterns and research collaborations in biological sciences as a whole and in different disciplines of applied sciences in India during 1965-83. The findings revealed that proportions of single authored papers declined from 36.07 per cent in 1965 to 14.31 per cent in 1983 while multiple authorship showed increasing trend from 63.3 per cent to 85.69 per cent with an increase in average numbers of authors per paper from 1.92 to 2.25. The variation in the degree of collaboration and the average number of authors per paper was found in different disciplines, thus indicating the variation in the extent of collaboration in biology, botany and zoology.

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\textsuperscript{40} Chakravarthy, A.R., Trend Towards Team Research in Geology, IASLIC Bulletin, 26(3), 1987, p93.
\textsuperscript{42} Louttit C.M., The Use Foreign Languages by Psychologists, Chemists and Physicists, American Journal of Psychology, 70 (2), 1957, Pp 314-316.
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BIBLIOMETRIC STUDY FROM 1990 TO MILLENIUM

Many studies have been reported in the literature on the nature of collaboration among scientists in different disciplines. Klaic\textsuperscript{46} examined the research activity of chemists from the Rugjer Boskovic, Yugoslavia during 1976-1985 covering 2018 research papers of scientific work. The papers were classified according to subfields used in the Journal Citation Reports.

Bankapur\textsuperscript{47} analysed all the scientific publications of Indian Institute of Horticultural Research, Bangalore. He identified a steep growth in contributions and contributions which was 17 and 2 in 1968 to 165 and 246 in 1981 respectively. He identified that most of the contributors were foreigners and less were Indians.

Banker investigated, bibliometrically, the patterns of scientific contributions made by the scientists of CIFA, Hyderabad in the field of agriculture. By subject analysis of these papers, the data was spread over in nine subjects, with production technology, fish genetics and soil water environment accounting for 70.7 per cent of all papers. By authorship 64.14 per cent accounted for multi author contributions.

Gaddagimath and Kalyane analysed the contributions made by Prof. L. Narayan, a leading Botanist and his contributions formed the source of data. The analysis indicated a total of 175 contributions, of these 26 were single authored papers, remaining were a result of multiple authorship 86 with two authors, 44 were three authors and 19 with four authors. During 1955-75, the single authorship was on the top only way of contribution, while the following period demonstrated that multiple authorship was totally dominant.

Upadhyaya and Kaur surveyed the publications of Jute Technological Research Laboratories, Calcutta. The study aimed at an analysis of author, journal and subject dispersion patterns of 930 papers. The subject wise distribution identified subject categories representing the higher and lower concentration areas. In terms of paper contributions, most of the papers (494) emerged between 1974-88 than since 1940. While single authorship earlier was the dominant pattern, but since the growth in the size of contribution, multiple authorship became the major trend in research (299-949).

Parvathamma and Gunjal\textsuperscript{51} examined the growth of Indian Earth Science literature during the period 1978-88 and found that the doubling time was 4.8 years.

Harsanyi\textsuperscript{52} examined the authorship pattern of publications in Library & Information Science and considered the methodological impact of various ways of allotting “credit” for multi-authored works and relationships between multiple authorship and other publication variables such as quality and impact. Given the complex relationship between collaboration and productivity, the concomitant use of non bibliometric methods of studying collaboration, as well as the application of meta-analysis is suggested

Nederhot et al\textsuperscript{53} made a Bibliometric study to assess the performance of departments in the field of Natural and Life sciences, the social and Behavioral sciences and Humanities. The result explains that nearly one third of the departments publications were not covered in the Science Citation Index.

Braun\textsuperscript{54} classified all the scientific publications in the basis of the data obtained from the Institute for Scientific Information, Philadelphia. All countries which published at least 50 first authored papers in the field in question during the study period were included. The sources journals during the period 1980-84 and 1985-89 were considered as source items and citations to


them were counted for the periods 1980-89 respectively.

Oser, Anita Kathrina\textsuperscript{55} studied the characteristics of map librarianship. The sample used for the study consisted of 1,744 source articles and 9,461 cited documents. The characteristics of the literature of map librarianship reflect a maturing of the discipline. The findings show that the majority of source articles (1) were the product of a male author who was associated with an academic institution, contributed one article, and had no co-author; (2) addressed topics concerning map libraries and collections, cartographic materials, and cataloging and classification; (3) did not include references, were written in English, and appeared in a journal published in an English-speaking country; and (4) had characteristics similar to those of the articles published in C & RL.

Changes that have occurred included (1) a decrease in the multiple publication of an article; (2) an increase in the number and recency of references; (3) an increase in collaborative authorship; (4) an increase in the range of topics discussed; (5) an increase in the use of English; and (6) an increase in the representation of female authors.

For the cited documents the findings show that the majority of the documents

(1) were written in English and were published in an English-speaking country;

were from the fields of map librarianship, cartography, and library science;

(3) were published in journals;

(4) were cited only once; and

(5) were less than ten years old.

Compared to the cited literature in C&RL, more of the citations were subject specific, were written in a foreign language, were published in a foreign country, and were older. Both cited journals most frequently. Changes that occurred included an increase in the number of citations from (1) the fields of history, science/technology, and geography; (2) documents in English and published in an English-speaking country; (3) journals; and (4) current literature.

Campbell documented and explained the process of scientific paradigm change and cross-cultural scientific communication using the growth and origins of the literature on non-Western medicine from 1966 to 1993. He has tested a series of theoretical assumptions about paradigm change. Bibliometric analysis of growth of the literature and content analysis of televised interviews, content analysis of published interviews, and journalists' reports on non-western and alternative medicine were used to support a series of theoretical assumptions taken from the literature on scientific paradigm change and the sociology of science.

Content analysis of medical research articles coded by MEDLINE as

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Campbell, Barbara Ruth., Growth of the Medical Research Literature on Non-western Medline as indexed by the National Library of Medicine from 1966-93: An example of a Scientific Paradigm Change, Rutgers, New Brunswick: The State University of New Jersey, 1995.
having specific MESH headings on philosophy and medical models coupled with analysis of all the clinical trials as well as selected journal articles published in referred serials yielded confirmation that a paradigm change in biomedicine is in progress. 15,561 references were downloaded in MEDLARS format from the CD-Plus version of Medline recoded and graphed. Findings indicate a 1,582 percent increase in the number of articles on non-Western medicine from 1966 to 1992. It was found that because biomedicine lacks an underlying theory of how the body works one sees a crumbling of the biomedical model itself as anomalies such as acupuncture treatment cannot be explained. The main catalyst for change is initially triggered by external factors not internal ones and it was possible to identify specific events mentioned in the literature.

Cross-cultural exchanges and fact gathering missions were published serving to motivate more and more researchers to investigate new models and question the prevailing paradigm. Debate occurs along a continuum. Shifts occur when the new paradigm is found to solve more problems than the old. Allegiances are formed almost immediately and rival camps are often adversaries who resent the attention the other group receives.

Change takes place over decades. Skeptics do not accept results until they are verified outside of the field in question. Proponents are influenced by political propaganda and economic factors. Language, culture and one's own personal experiences all serve as barriers to scientific communication.
Mary Ellen Chudyk\textsuperscript{57} investigated to describe, analyze, and compare the status of professional nutrition literature in the fields of medicine, nursing, nutrition/dietetics, and health education. Diffusion theory was used as a framework to conduct a descriptive, retrospective, bibliometric analysis. A sample of nutrition articles was selected from general, high-circulation, professional journals representative of one of the four fields published from January, 1990 through December, 1994.

The results of this investigation substantiated the complex and multifaceted nature of nutrition and the journals themselves, showed it is difficult for a provider to get adequate and consistent knowledge about nutrition from the professional journals in their own field, and suggested professionals expand their journal reading habits to include journals outside their own field.

Dhruv Raina\textsuperscript{58} and others have studied the evolution of collaboration in four sub-disciplines of Physics for the period 1800-1950. They have reported that

1. The overall evolution of physics publications in India reveals a remarkable break with the past in the decade 1920s onwards. In fact the growth rate enters a new face after this time. Furthermore, these growth rates exhibit quasi-doubling.

2. The collaboration coefficients taken decade wise are strongly

\textsuperscript{57} Chudyk, Mary Ellen, Interdisciplinary Diffusion of Nutrition Directives: A Bibliometric Analysis of Literature in Medicine, Nursing, Nutrition/Dietetics, and Health Education. Kent: Kent State University, Ph.D., thesis, 1995, p 206.
correlated with the total number of publications taken decade wise. This conforms with increasing collaboration as the number of publications increases.

Chemical Index (CI) and Current Contents (CC) had been used to investigate the nature of collaboration characteristics of the sub-disciplines. It was found that 1920 onwards the collaboration measures showed an increasing trend, and that trend is uniformly reflected across sub-disciplines.

Furthermore, the increased collaboration is also a reflection of the presence of strong leaders in the field, leaders who were subsequently responsible for the institutionalization of the discipline in the country.

Humayoon Kabir\textsuperscript{59} made a Bibliometric study of bibliometric literature and reported that solo research predominates and degree of collaboration ranged from 0.20-0.35. Bibliometric literature is doubling in every 10 years.

Deborah Lynn Orin\textsuperscript{60} carried out a bibliometric investigation of epidemiologic research. The research was based on 758 dissertation abstracts originating from four Canadian and twenty-one American universities providing doctoral education in epidemiology. Abstracts written between January 1982 and December 1992 were selected from within the Dissertation Abstracts International database, and were included in the study only when the content

described epidemiologic research examining illness outcomes. Other areas of epidemiologic research were excluded. Study designs were classified using a taxonomy developed for this project, and research topic areas were split into nine chapters. These variables were examined collectively and across four time periods to determine whether time trends were evident. Unlike a majority of bibliometric studies, this one has covered doctoral dissertations in its data and hence is considered a rare species. The analysis presented the following results:

- Case-control studies were often used in epidemiology dissertations (32.7%).
- Intervention studies were infrequently used, accounting for roughly 5% of abstracts.
- Although the relative frequencies of study designs were found to vary across time, consistent trends were not evident.
- The research topic area of greatest activity was neoplasm’s (22.8%). As well, dissertation research described infectious and parasitic diseases (11.5%), maternal and infant health disorders (11.6%), diseases of the circulatory system (10.9%), mental disorders (7.7%) and injuries (6.9%).
- Observational research methods were predominant in epidemiology dissertations.
- Case-control design was the most common. A diversity of research topic areas was addressed, however, diseases of primary concern to the population were often examined.
- To effectively communicate the methods and findings of epidemiology dissertations, it is recommended that graduates prepare a structured abstract. Using this source, future trends in epidemiologic research may
be evaluated.

Kehoe, Cynthia Ann⁶¹ studied the dynamics of knowledge diffusion involving a new type of organization—the industrial research and development (R&D) consortium. The particular organization studied is the Microelectronics and Computer Technology Corporation (MCC) and the important findings were

- MCC's work does have a significant influence on the work of researchers at other institutions.
- Its publications are cited by people representing a diverse group of organizations, academic and corporate, in the United States and many other countries.
- MCC's patents are contributing to the U.S. technical base.

The diverse links for diffusion suggest that MCC may be a valuable node for information exchange between its shareholders and other researchers.

Kundra⁶² investigated the collaborative research trends in Indian Medical Sciences 1900-1945 and drew general and broad conclusions.

1. There is a perceptible increase in the collaborative research and substantial decrease in the single-authored papers in medical science in India during the period 1925-45. In 1900, not a single collaborative papers was reported. But by 1925, 12.4 percent collaborative papers were reported and the single-authored papers were 87.57 percent. The figure rose to 33.6 percent co-authored papers in 1945 while the single-authored papers

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declined to 66.36 percent. There was almost three times increase in collaborative research.

2. Of the total number of co-authored papers published in the 1900-45, 21.95 percent collaborative papers were from basic research while 7.63 percent were from applied research. This confirms the findings of Frame and Carpenter.

3. A rise is not only seen in the collaborative papers but also in the nature of collaboration. In 1925 only 22.9 percent authors participated in collaborative research which rose to 49.7 percent in 1945, a two fold increase.

4. The collaborative authorship pattern steadily increased from 1.00 per paper in 1900 to 1.39 per paper in 1945. But the average authorship remained 1.2 author per paper.

The growth pattern suggests that a large proportion of co-authored papers in a discipline or a journal depends to some extent on the type of research and the discipline involved. As a result, it is not impossible to have a relatively lower proportion of collaborative papers in a particular sample, even when collaborative research overall has become the normal practice.

The collaborative and authorship trend discussed in the study suggests that medical science was still in the developing stage in India in the period 1900-1945, and there was possibility of its expansion in the
Ravi\textsuperscript{63} analysed the nuclear science research productivity of Indian scientist and found that

- Nuclear science research papers were published mainly in journals.
- Among the international sources of publications United States and United Kingdom predominated in publishing Indian nuclear science research papers.
- Two authored and three authored papers were more than the single authored and other multi authored papers.

Wilson, Concepcion Shimizu\textsuperscript{64} made an analysis of the underlying concepts, viz. 'document', 'selection', 'collection comprehensiveness', 'topic', 'research topic', and 'on' and 'relevant to' a research topic. An important distinction was drawn between graphical and semantic attributes of documents, and between their modes of analysis. He developed a general procedure for forming a well-defined collection of documents on a research topic, which is suitable for bibliometric analysis. The procedure is applied to one research topic in Library and Information Science, Bradford's Law of Scattering.

\textsuperscript{63} Ravi, S., Nuclear Science Research Productivity of Indian Scientists : A Bibliometric Analysis, Chidambaram: Annamalai University, Ph.D., thesis, 1996.
\textsuperscript{64} Wilson, Concepcion Shimizu., The Formation of Subject Literature Collections for Bibliometric Analysis: The Case of the Topic of Bradford's Scattering, New South Wales, Australia: University of New South Wales, Ph.D., thesis, 1996.
Gupta and Karisiddippa\textsuperscript{65} have studied the collaborative pattern of scientific papers in theoretical population Genetics for a period ranging from 1956 to 1980 and concluded that

- The United States contributed 41.66 percent to the world's total international co-authored publications. It was among the countries with a significant percentage of co-authorship (47.02 percent), but it ranked in the low end in terms of overall percentage of publications involving international collaboration (11.53 percent during 1956-60 to 15.81 percent during 1976-80). This occurred solely as a result of its large publication base.

- The United Kingdom contributed 16.23 percent to the world's international co-authored publications. It was among the countries with 32.15 percent of its total publications appearing as co-authored publications, but ranks in lower end in terms of its overall percentage of publications involving international collaboration (6.25 percent during 1956-60 to 24.13 percent during 1976-80).

- Australia contributed 7.45 percent to the world's total international co-authored publications. Its percentage of co-authored publications were 23.41 percent, but its contribution in terms of publications involving international collaboration decreased (from 50 percent during 1956-60 to 33.33 percent during 1976-80).

- Japan contributed to the world's total international co-authored publications and its percentage of co-authored publications was 39.58 percent.

percent.

- Canada contributed 13.59 percent to the world's total co-authored publications and its percentage of co-authored publication was 43.05 percent.

Many studies have been reported in the literature on the nature of collaboration among scientists in different disciplines.

Halkar et al.\textsuperscript{66} made a bibliometric study on the Journal of Family welfare and drew the following conclusions:

- Maximum number of articles published in 1993 was the same as in 1997 i.e, 37.(13.40 percent).

- Authorship pattern showed that most of the papers were contributed by single author (52.18 percent) and went on decreasing by two and more authors.

- India contributed the maximum number of articles i.e, 80.07 percent since the journal under coverage was from India.

- The average length of the papers was between 4 and 9 pages constituting 60.05 percent.

Pulla Reddy and Sharma\textsuperscript{67} in their research paper analysed the distribution of publications according to time, number of authors, on various systems, classes of agents, in various forms of literature in different periodicals and finally by institutions. The publication of Environmental Mutagen Society provided a data of 491 publications. The collaborative authorship pattern has


been found as the dominant pattern of contributions. The drugs and higher plants were most preferred areas of interests in the subject fields.

Uzun, Ali\textsuperscript{68} surveyed the social sciences journal literature for the decade period 1987-1996 looking for papers with authors, or at least one co-author giving an address from an institution in Turkey. The number of such papers had nearly tripled from 1987 to 1996. It was found that the papers were scattered into 341 journals and almost one third of all papers went to nine journals, each of which contained an average of a least one Turkish paper per year. Only two of these journals, on archaeology and anthropology, happened to be of high citation impact. Psychology and psychiatry, combined with business and economics were found to be the most productive subjects accounting for about half of the publication output.

A vast majority of the papers were articles in English, and in an average article contained about 24 bibliographic references. The number of Turkish papers in nine major journals were somewhat correlated with their availability in local libraries. The number of co-authors per paper had nearly doubled over the period surveyed, reflecting increased interaction among scientists. About half of the authors were affiliated with three universities in Ankara and Istanbul, indicating a heavier concentration of social sciences research in the main metropoles of the country.

Cano\textsuperscript{69} reviewed 17 years of research in Library and Information Science in Spain for a period from 1977 to 1994. He identified that the Spanish research in Library and Information Science had concentrated more on information retrieval, description of services and studies of scientific communication. Authorship pattern suggested prevalence for individual authorship (68\%). The report of this study got published in 1993 and one of the striking features of this study is that individual authorship was found to be dominant even during 1993 in a western country like Spain, though the significance of collaboration was felt in general much earlier.

Ramakrishna and Pangannaya\textsuperscript{70} applied a key word search on four databases Derwent Biotechnology Abstracts, Biosis, Investext and Casea’rch and analysed the relative growth rate and doubling time of the journals covered in these databases. The keyword used was “Biotechnology” for the data download. The studies indicated that within equal economic, intellectual and environmental conditions, literature on different subjects follow a similar growth trend. Downloading large amount of data either from the net or the CD ROM Databases has become the order of the day. Similarly this project also has downloaded the required data from the BIOLOGICAL ABSTRACTS in CD-ROM Database for the investigation.

Suresh Kumar, Praveen Sharma and Garg\textsuperscript{71} have contributed a study which aims at determining the applicability of Lotka's Law, negative binominal distribution and lognormal distribution for Institutional productivity, in the same way as it is to authors and their productivity in the field of engineering sciences and the patterns filed by industrial firms in laser S&T. The study indicates that none of the three distributions for institutional productivity in engineering sciences. However, Lotka's law holds good for full as well as truncated set of data for the patents filed by industrial firms.

Joglekar and Sen\textsuperscript{71} identified 15 information science e-journals and presented some bibliometric data on them. According to their definition, an e-journal contains original work which is subject to a peer review process, and is published only on the Web at no cost. Jacsó (2001) studied the coverage of e-journals (he prefers the term "digital journal") in databases covering library and information science. His definition of an e-journal is similar to that of Joglekar and Sen. Jacsó chose 10 information science e-journals and reported on their coverage in six online databases.

Koehler et al. (2000) compared some of the bibliometric characteristics of three information science e-journals and a leading print journal, Journal of the American Society for Information Science (JASIS). They found that JASIS articles tended to have more citations, and its articles were typically longer than e-journal articles. They also observed that JASIS and Information Research (IR) seem to be perceived by authors as archival journals, while the other two e-journals they studied tended to publish reports of work in process. In addition,

\textsuperscript{71} Suresh Kumar, Praveen Sharma and Garg, K.C., Lotka's Law and Institutional Productivity, Information Processing and Management, 34 (6), 1999, Pp 775-783.
they reported that JASIS authors were mostly from North America, and IR authors, originally mainly of UK origin, have become more geographically dispersed. Koehler et al. suggested that this means that IR was becoming a more mature journal.

Mahapatra and Bhagavan Doss\textsuperscript{72} also have found out that collaborative research has a positive growth trend varying from 0.65-0.81 by studying five selective journals in geology covering a period from 1987-1996. They have also concluded that the growth of publications in geology is gradually reducing towards the end of the period.

Henk F. Moed\textsuperscript{73} studied nine research departments in the field of biotechnology and molecular biology. In his study the indicators of research capacity, output and productivity were calculated, taking into account the researchers’ participation in scientific collaboration as expressed in co-publications. In a quantitative approach, rankings of departments based on a number of different research performance indicators were compared with one another. The results were discussed with members from all nine departments involved. Two publication strategies were identified, denoted as a quantity of publication and a quality of publication strategy, and two strategies with respect to scientific collaboration were outlined, one focusing on multi-lateral and a second on


\textsuperscript{73} Moed, Henk F., Bibliometric Indicators Reflect Publication and Management Strategies, Scientometrics 47 (2), February 2000, p.323-346.
bi-lateral collaborations. The findings suggested that rankings of departments may be influenced by specific publication and management strategies, which in turn may depend upon the phase of development of the departments or their personnel structure. As a consequence, differences in rankings cannot be interpreted merely in terms of quality or significance of research. Hence it was suggested that the problem of assigning papers resulting from multi-lateral collaboration to the contributing research groups has not yet been solved properly, and that more research is needed into the influence of a department's state of development and personnel structure upon the values of bibliometric indicators. A possible implication at the science policy level is that different requirements should hold for departments of different age or personnel structure.

Ramesh et al\textsuperscript{74} analysed the papers published in Oryza the Quarterly International Rice Journal from 1986-1995. The analysis showed that multiple author contributions constituted the maximum proposition (87.82 percent) and the degree of collaboration over this period varied from 0.90-0.95. The length of the articles with 1-5 pages were found to be at the maximum with 78.3 percent.

Gusmão Regina\textsuperscript{75} used the collaborative authorship trend as indicators for policy making in Science and Technology. He identified that European Union research programmes play an increasingly important role within the research and


\textsuperscript{75} Regina, Gusmo., Developing and Using Indicators of Multilateral S&T Cooperation for Policy Making: The Experience from European Research Programmes, Scientometrics, 47 (3), March-April 2000, Pp.493-514.
innovation systems of Member States. Collaborative study has become essential indicator for decision-making for science policy makers at the national level. EU science policy responds to not one but a number of objectives, while one country or one laboratory's participation in European S&T co-operation is likely to manifest a number of particularities, and be quite different from another's.

Arvanitis Rigas, Waast Roland, and Gaillard Jacques\textsuperscript{76} made a bibliometric study on Science publications in Africa and found that the current decade is one of crisis in African research. However, developments are highly contrasted, depending on the discipline and the regions. Nigerian science is in quite the contrary situation, imploding. In the rest of Africa, classification of countries brings to evidence very striking changes in order. Basic science declines. The Agricultural and the Medical sciences are stagnating. Conversely, the Engineering sciences are growing, in particular to the North of the Sahara.

Seglen and Aksnes\textsuperscript{77} analysed the relationship between research group size and scientific productivity within the highly co-operative research environment, characteristics of contemporary biomedical science. They made an investigation in Norwegian Microbiology. They found out that most of the Norwegian microbiological research (73 percent of the microbiology articles) appeared to be performed by specialist groups (with $\geq 70$ percent of their production as microbiology), the remainder being published by groups with a


\textsuperscript{77} Seglen, Per O., and Aksnes, Dag W., Scientific Productivity and Group Size: A Bibliometric Analysis of Norwegian Microbiological Research, Scientometrics, 49(1), 2000, Pp125-143.
broader biomedical research profile (who were responsible for 95 percent of the non-microbiological articles). There was no correlation between group size and productivity.

**AFTER MILLENIUM**

Amit Kumar Bandyopadhyay\(^78\) analysed the references appended to 92 doctoral theses submitted to department of Mathematics, Physics, Mechanical Engineering, Philosophy and Political Science, University of Burdwan. The findings of his analysis are

- Authorship collaboration is high in physics. Moderate collaboration exists in mathematics and mechanical engineering. The collaboration is very low in political science and philosophy excluding psychology. It is highest in nuclear physics followed by optics.

Although the multiple authorship trend has increased steadily through decades (1950-1990) in all the branches of physics and mathematics and also in psychology: in mechanical engineering, philosophy excluding psychology and in all the branches of political science the multiple authorship trend has declined for certain periods.

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Kamlesh Goel\textsuperscript{79} studied the authorship pattern, areas of research, journals, institutions and regions covered in the social science citation index (SSCI) pertaining to the year 1998. The following are his findings

1. The number of highly productive research and academic institutions were almost the same. The highly productive institutions produced about 33 percent of the total Indian output in social sciences.

2. Research in sociology received maximum attention followed by psychology, economics, planning and development.

3. Most of the findings were published in journals from the West. However, most commonly used journals were from India.

Kannappanavar\textsuperscript{80} and Vijayakumar made a study on the authorship trend in international monetary fund literature for a period from 1991-1998 and concluded that collaborative research is in an increasing trend varying from 0.45-0.62. The average degree of collaboration was found to be 0.56.

Macias-Chapula and Muangos-Nolasco\textsuperscript{81} analysed the AIDS documents as produced on Sub-Saharan Africa and found out that the main countries participating in aids research were Democratic Republic of Congo and Cameron. The results indicated a high pattern of collaboration through multiple

\textsuperscript{79} Kamlesh Goel, Bibliometrics of Social Science Research in India, University News, 39(15), 2001, Pp.9-11.
authorship. The subject content of the documents were found to be focused mainly on epidemiology, complications and prevention and control issues of AIDS.

Macias-Chapula\textsuperscript{82} also studied the literature on Health system reform in Latin American and the Caribbean through the web as well as the databases on CD ROM. The results in his webometric and bibliometric no comprehensive databases in terms of time, document type and content coverage. The results indicated the need to organize and administrate the existing literature on healthcare reform so as to transfer it into the knowledge demanded by the user community.

Sridhar\textsuperscript{83} in order to verify the question of whether the field of OO is growing at a rate that is sufficiently high for it to be deemed to be an emerging technology used bibliometric analysis. His research also examined the ontological, epistemological, and methodological dimensions of both OO and the traditional approach (e.g., structured) to software development, with a view to establishing their paradigmatic differences.

Kuhn's model of paradigms was the conceptual basis for this research. Author Co-Citation Analysis (ACA), a form of bibliometrics, was used in this study. A total of 31 authors was used in the study and co-citation counts for each author pair, during the period 1980-1993, were obtained. The frequency of co-citations between authors was used as a measure of the degree of consensus.


Cluster analysis, factor analysis, and multidimensional scaling (MDS) were used to validate the cluster compositions. The results suggest that OO is conceptually different from structured methods.

The proposition that OO is an emerging technology was tested independently on two sources of data. The growth rate of OO indicated in this study suggests that OO is no longer in the preparadigmatic phase, but is now normal science. The implications and challenges of a new paradigm are explored. Suggestions for extending the study and directions for future research are also presented.

Subbiah Arunachalam and Subbiah Gunasekaran\textsuperscript{84} made a bibliometric study on tuberculosis research in India and China identified that there is a tremendous mismatch between the share of the burden of the disease and the share of research efforts.

Suresh\textsuperscript{85} studied the growth and collaboration trends in AIDS research literature output. The findings revealed that there is no relationship between the economic growth of a nation and its research literature output. The trend analysis of authorship pattern revealed that there will be a steady fall of single authorship and collaborative authorship is the trend of the day.

\textsuperscript{84} Subbiah Arunachalam and Subbiah Gunasekaran, Tuberculosis Research in India and China: From Bibliometrics to Research Policy, Current Science, 82 (8), 2002, Pp 933-947.
Ugolini et al\textsuperscript{86} analysed the distribution of Oncological papers published in 1995 by authors from the European Union (EU) in any journal of all the Subject Categories of the Science Citation Index compiled by ISI (Institute for Scientific Information, Philadelphia, USA) Their analysis was based on the country of origin of all of the contributors. The study compared the results with those of a previous study dealing with publications in journals of the ISI Oncology Category based on the country of origin of the corresponding author.

Data on the number of published papers for each country, ratio between the number of occurrences of papers and country population and gross domestic product (GDP), and mean Impact Factors (IF) were compared. While findings on the number of published papers (United Kingdom (UK), Germany and France ranking best), source country population (Sweden, Denmark and the Netherlands ranking best) and gross domestic product (Sweden, Finland and the Netherlands ranking best) showed no important changes, the mean IF value result was, for some countries, very different from the previous study. In particular, while Germany, Belgium, Portugal and France fared well, Norway, Sweden, Austria and Spain showed poorer results. An analysis of the journals in which EU authors published their articles was also carried out and the main SCI categories to which the journals belong were reported.

Grossi et al\textsuperscript{87} we studied the geography of publications in clinical cancer research from 1995 to 1999. A Medline search was performed to retrieve papers

\textsuperscript{86} Ugolini et al., Assessing Oncological Productivity is One Method Sufficient, European Journal of Cancer, 38 (8), 2002, Pp1121-1125.

in clinical Oncology reporting phase I, II and III studies published between 1995 and 1999. Only studies reporting antiballistic chemotherapy had been considered, either alone or in combination with other treatments. For each country, the total number of papers, the total Impact Factor (IF), and the mean IF were determined. Similar calculations were performed to compare the European Union versus North America. 3142 papers were identified. The United States ranked first by number of papers (37.7% share), followed by Italy (9.8%), the United Kingdom (8.5%) and Japan (6.9%). Investigators at European institutions published a higher number of papers compared with their North American colleagues (1362 versus 1288). Still the mean IF of North American papers is higher than the papers with a European address (3.54 versus 3.14). The majority of phase I studies were performed in North America, while most of phase III studies were performed in Europe. These results provide information on the geography of clinical cancer research worldwide, which may reflect the human and economic resources involved in this field.

Collaborative contribution is the result of Team Research and Team Relay Research. Collaboration has existed in science since its beginning, however, the first collaborative publication was published in 1655. Since then, the number of collaborative publications has increased, initially slowly, and then dramatically faster after the middle of 18th century. The extent of collaboration further increased towards the end of this century and the trend continues.
Grossi, F. et al\textsuperscript{88} studied the geography of publications in clinical cancer research from 1995 to 1999. A Medline search was performed to retrieve papers in clinical Oncology reporting phase I, II and III studies published between 1995 and 1999. Only studies reporting antiblastic chemotherapy have been considered, either alone or in combination with other treatments. For each country, the total number of papers, the total Impact Factor (IF), and the mean IF were determined. Similar calculations were performed to compare the European Union versus North America. 3142 papers were identified. The United States ranked first by number of papers (37.7% share), followed by Italy (9.8%), the United Kingdom (8.5%) and Japan (6.9%). Investigators at European institutions published a higher number of papers compared with their North American colleagues (1362 versus 1288). Still the mean IF of North American papers is higher than the papers with European address (3.54 versus 3.14). The majority of phase I studies were performed in North America, while most of phase III studies were performed in Europe. These results provide information on the geography of clinical cancer research worldwide, which may reflect the human and economic resources involved in this.

Ying Ding, . et al\textsuperscript{89} analysed the collaborative authorship pattern of articles on Information Retrieval research from Social Sciences Abstracts for a period of 11 years from 1987-1997. The level of

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\textsuperscript{89} Ying Ding et al Bibliometric cartography of information retrieval research by using co-word analysis: Information Processing & Management, Volume 37, Issue 6, November 2001, Pages 817–842.
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collaboration, journal collaborative distribution, disciplinary collaborative distribution and country collaboration are probed according to IR collaborative research. Findings were discussed from the above perspectives in detail. In particular, this study reveals a perceptible upward trend of collaborative IR research with the results of these research efforts being reported in all major core IR journals.

The inter-disciplinary and intra-disciplinary scholarly communications in collaborative researches are very much in evidence and cover broad areas like psychology, and computer and medical sciences, respectively.

Thomaidis, Nikolaos S., et al\textsuperscript{90} evaluated the research activity in the Balkan and East Mediterranean countries on the basis of publications appeared in Analytical Abstracts (AA) during the cumulative 8-year period of 1994–2001. This was accomplished by assessing the scientific publication productivity in analytical chemistry as the number of publications from each country and the number of publications per population unit. To assess the impact in the scientific community, the mean impact factor for each country was calculated. The publication productivity trend was recorded for the 7-year period 1994–2000. Moreover, the preference to publish in specific journals per country was appraised. According to the total number of publications, Egypt (765 publications) and Greece (717 publications) are the most productive countries, while Slovenia showed the highest number of publications per million of

Scientists from Israel published their work in the highest impact analytical journals with a mean impact factor of 2.02, followed by Slovenia (mean impact factor of 1.67) and Greece (mean impact factor of 1.53). Studies of scientists from different countries do not show any obvious preference to a single specific journal. It is interesting to note that preference for journals revealed the research interests of scientists from each country for sub-fields of analytical chemistry.

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scientists from each country for sub-fields of analytical chemistry.

Halder, Sambhu Nath and Suvra Chandra\(^92\) highlight the growth patterns of Library and Information Science literature on the basis of bibliometric study. Effort have been made to analyze the articles of IASLIC Bulletin published from the year 2003 to 2007. The investigation focuses on distribution of contributions, authorship pattern of contributions, distribution of references, analysis of length of literature, distribution of illustrations used, state wise distribution of contributions and subject trends of the articles, etc. Different graphical representations have been used as and when needed to reveal the real field scenarios. The findings were:

- The number of papers in various volumes in IASLIC Bulletin from 2003-2007, is more or less consistent as it varies from 22 (in volume 52) to 28 (in both volumes 49 and 50).
- The average number of contribution per volume in the studies is 5 volume is 25.2.
- Single author papers are the most (56.59%) followed by double author papers (30.75%), three author papers (7.94%) and more than three author papers (2.38%).

Monawwer Eqbal and Masoom Raza\(^93\) conducted a bibliometric study on Personnel Attitudes and Job Satisfaction. The aim of this study

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was to identify country, language, form, yearwise distribution and authorship pattern, ranking of authors and journals. Data was collected from Psychological Abstracts published from 1992-2001. The study reveals that USA has contributed highest number of papers, i.e., 59.53% and most dominant language was English and maximum number of articles were written by two authors. Most productive journal was Journal of Organisational Behaviour and maximum number of articles were published in 1992 and most of the article dealt with Organisation Behaviour.

Anil Kumar Dhiman$^{94}$ analysed the theses awarded by Indian Universities in the field of Library and information science during the period from 2006 to 2010 and found that majority of the theses comprise of Bibliometrics and Library Management and so forth. Digital libraries, institutional repositories and open access fields are the least considered fields where very few studies have been conducted. So these areas need the attention of LIS scientists along with other studies like – the online use of documents by the users. Lastly, at present more than 100 universities are engaged in teaching LIS education and 53 universities are conducting research activities. Other universities must also think to start Ph.Ds or research activities in their departments to uplift the standard of LIS education in general and of research in particular.

Mohd. Nazim and Moin Ahmad
den presents a bibliometric analysis of scientific output in the area of 'Information Literacy' (IL), the aim being to offer an overview of research trends in this field and characterize its most important aspects and their evolution over the last quarter of the 20th century. The analysis makes use of LISA Plus database, the search being restricted to published journal articles and which contain the terms 'Information Literacy'. The various analyses focus on the presentation of publications, frequencies and percentages, as well as the application of Bradford's law of scattering and Lotka's law. The findings are

1. Interest in the subject of IL grew considerably during the last quarter of the 20th century, particularly since 1980s and beginning of the 21st century saw a proliferation of such studies;

2. After applying Bradford's law of scattering the 158 journals obtained were distributed into three zones. The core zone contained eight most productive journals publishing 199 articles on the subject IL. According to Bradford's law of scattering this distribution fits 1:n: n2, such that the most peripheral zone should contain a greater number of journal titles;

3. The number of authors contributing to each article ranges from one to eight, however, most articles involved collaboration between two or three authors. There is only one paper that contributed by maximum eight authors;

4. Author productivity was not found to exactly fit to Lotka's law with a value of n=2, indicating that there a few highly productive authors and a great majority who contribute only occasionally to IL research;

5. The literature on IL was published in 18 languages; however, English was found to be the most favourite language of authors in the subject, publishing 536 (88.30% of the total) articles; and

6. Analysis of the global distribution of journals shows that 32 countries publishing journals that included articles on the subject IL. USA is the leader in the field of IL published 311 articles in 54 journals; followed by UK and Germany with 75 and 51 articles in 38 and 9 journals respectively; the rest 450 articles were published in 57 journals by 29 countries.

Keshavi, Hittlamani and Gowda⁹⁶ conducted a study to determine the growth of literature in the field of sociology and the related authorship pattern; value of group co-efficient for collaborative research and geographical distribution of papers during 1999-21003. The study shows that the highest number of papers (86) were published in 2001 and 2003. The number of single author papers is higher at 84% out of a total of 475. The value of group co-efficient (gp) was only 0.16. The degree of collaboration among the co-authors was minimum (0.02) in articles written by five authors and maximum (0.12) in two author papers.

Pati⁹⁷ analysed the articles published in the Herald of Library Science. Editorials, book reviews, report and communications are excluded from the study. Citations are not used for analysis. The study has analysed various aspects such as authorship pattern, degree of collaboration among the authors


and geographical distribution of papers. The year-wise distribution of articles in Herald of Library Science shows that the highest number 34 (13.66%) articles of total output 249 have appeared in the year 1995. Maximum number of articles i.e. 174 (69.88%) have been contributed by single authors. This shows that collaborative research work were low among the contributions made to the Herald of Library Science. This has been further testified with the degree of collaboration. The degree of collaboration in Herald of Library Science is 0.30 which clearly indicates its dominance upon multi authored contribution. The geographical distribution of papers highlights that the journal is dominated by the host country (i.e. India) as most of the articles are contributed by the professionals from India. The results further reveal that the contribution by Andhra Pradesh is the highest in India.

Gururaj S. Hadagali, B.D. Kumbar, and D. Sumana\textsuperscript{98} analysed the citation pattern in Current Science, a premier periodical in science published in India, for the years 2005 and 2006. The study is based on the 16,404 citations given in the articles published in the 48 issues. Authorship pattern, types of publications, language-wise distribution, highly productive institutions, and periodicals preferred by cited scientists are examined. Two-authored papers constituted 26.4% with 4332 citations. Current Science ranked as the number one periodical among the citations with 508 citations.

Prince Ajay Agashe and Rajyalakshmi focused on the research productivity of Science, Pharmaceutical Sciences and Home science departments in Nagpur University, during the 2000-2002. In this paper, study is carried out year-wise, department-wise and guide-wise distribution of Ph.D. theses. It highlighted the significant contributions in research productivity. It was found that among thirteen departments studied, Chemistry, Pharmacy and Home Science, stand on the higher position with 14 students being awarded doctorate degrees during the period. Next in the order is Zoology with 11 doctorates followed by Physics department with 10 doctoral degrees. The study shows that these departments have actively been engaged in guiding research projects in Nagpur University.

Sambhu Nath Halder and Suvra Chandra highlights the growth patterns of Library and Information Science literature on the basis of bibliometric study. Effort have been made to analyze the articles of IASLIC Bulletin published from the year 2003 to 2007. The investigation focuses on distribution of contributions, authorship pattern of contributions, distribution of references, analysis of length of literature, distribution of illustrations used, state wise distribution of contributions and subject trends of the articles, etc. Different graphical representations have been used as and when needed to reveal the real field scenarios. It contains details findings of the entire study and ends with

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Zafrunnisha and Pulla Reddy\(^{101}\) present the result of the citation analysis study of Indian Journal of Marketing. The major objectives of the study are to find-out the authorship pattern, Bibliographic form, Subject, Language, Country and rank wise distribution of citations of articles appeared in IJM XXX VI published in the year 2006 i.e., January to December 2006. Total 74 articles were published in these issues. Overall 701 citations featuring 752 authors have been made. The results indicate that 40.94% articles published in these issues are single authored. The results reveal that a book source is predominant with 40.51% of total citations. The findings are:

- Authors of Indian Journal of Marketing have mostly cited book source for their research.
- In IJM journal the single authorship is high compared to multiple authorship.
- The authors of IJM have cited Indian Journal of Agricultural Economics and Journal of Marketing more number of times for their research.
- According to subject wise distribution of journals they have cited marketing subject more number of times.
- Authors of IJM have preferred US publications more in number comparatively other countries publications.
- The degree of collaboration of authorship is 0.46.

IJM authors have cited predominantly in English language publications.

Chellappandi. presents a Bibliometric study of the Literature output in the field of Herbal literature covered in Biological abstract CD ROM from 1990 - 2004. Biological abstract CD ROM covered the maximum of 3401 records on Herbal Literature during the study period. India ranks first in the herbal research literature output. Herbal research literature output is found to be in 22 different language of which English ranks first forming 86.15 percent of the total output. Journal articles rank first forming 92.15 percentage of the total output with 3134 items. Journal-of-medical-and-aromatic-plant-sciences scores the first rank having produced 13.91 percentage of the total herbal research literature output.

The result of research invalidated Bradford's Law of distribution. The majority of the herbal research is carried out by research institutions.

Herbal literature published in different languages from various countries ranked from less than 10 pages up to 200 pages.

References.


Ankara: Middle East Technical University, No.17, 1970.


17. White, H.D., and Griffith, B.C., Authors as Makers of Intellectual


30. Harsanyi, Martha A., Multiple Authors, Multiple Problems - Bibliometrics and the Study of Scholarly Collaboration: A Literature


34. Campbell, Barbara Ruth., Growth of the Medical Research Literature on Non-western Medline as indexed by the National Library of Medicine from 1966-93: An example of a Scientific Paradigm Change, Rutgers, New Brunswick: The State University of New Jersey, 1995.


36. Dhruv Raina, B.M.Gupta and Rohith Kandhari : Collaboration In Indian Physics: A Case Study of the Macro And Micro


42. Wilson, Concepcion Shimizu., The Formation of Subject Literature Collections for Bibliometric Analysis: The Case of the Topic of Bradford's Scattering, New South Wales, Australia: University of New South Wales, Ph.D., thesis, 1996.

43. Gupta, B.M. and Karisiddippa, C.R.,: Nature Of Type Of Collaborative Research As Reflected in Selected Theoretical


51. Moed, Henk F., Bibliometric Indicators Reflect Publication and


59. Macias-Chapula. Cesar A., and Muangos-Nolasco, Acacia,


