Dr. S. R. Ranganathan, Father of Indian Librarianship, stated that any research starts with bibliography. Before starting a research, the scholar has to collect data related to his research topic and to review the existing literature. Review of literature is a significant part of any research study, reviewing related studies also helps to avoid duplication work that has already been done in that area. This type of analysis will help the researcher to identify the research gap or unexplored areas in the previous studies.

This chapter examines the review of works relating to various aspects of Scientometric Studies. It could be observed that there are various research studies highlighting the importance of scientometric analysis and their applications to library and information science. By considering the efficiency of various dimensions of bibliometric studies, the researcher has classified them into seven categories namely

- Studies on Bibliometrics and Scientometrics
- Studies on Bibliometric and Scientometric Indicators
- Studies on Authorship pattern
- Studies on Growth of Literature.
- Mapping of Subject Research
- Studies on Geographical distribution of Research

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Studies on Individual Journals

2.1 STUDIES ON BIBLIOMETRICS AND SCIENTOMETRICS

Hang Wen and Yi Huang (2012)\(^1\) carried out a research on oxidative stress publications published between 1991 and 2010 in journals of all the subject categories of the Science citation index. Publication trends were analyzed by the retrieved results in publication type and language, characteristics of articles outputs, country, subject categories and journals, and the frequency of title-words and keywords used. Over the years, there was a significant growth in article outputs, with more countries participating and collaborating. The seven major industrialized countries (G7) published the majority of the world articles while the USA contributed about one-third of the total. Chinese and Indian outputs grew much faster than those of other countries in the past five years. Oxidative stress research in food and environmental related fields gradually became the mainstream of the research. An analysis of the title-words, author keywords and keywords plus showed that antioxidants in human or rat cells were the hot topic in the field. In addition, “reaction oxygen species”, “apoptosis”, and “nitric-oxide” were major topics of oxidative stress research recently.

Inglesi-Lotz and Pouris (2011)\(^2\) investigated scientometrically the effect of the NRF on the output of the South African Social Science Researchers for the period 1981-2006. Their performance is measured by the number of research publication. The observation shows a positive impact of

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the NRF programme on the research output of Social Science researchers and the adaptation of the programme has greatly influenced in population of research articles by a healthy average of 24.5 percent.

Brahim Hamadicharef (2010) made a Bibliometric study of the Brain Computer Interface literature. In this study, the data are extracted Web of Science during the period 1990 to 2008. The study revealed that the total of 1081 publications were retrieved with 495 published in conference proceedings and 586 published in 178 journals, with a per capita authorship of 3.9. The growth of literature increased in the year 2001 onwards. 52.73 per cent of the Brain Computer Interface literature was never found cited and 14 key articles were found to have been cited more than 100 times. The authors also found that the BCI literature did not follow Lotka’s law. There were 10 core journals. IEEE Transactions on Neural systems and Rehabilitation Engineering published 8.51 per cent of the total literature, followed by IEEE Transactions on Biomedical Engineering with 5.09 per cent were found to be at the top. The impact factor varying from 0.88 to 5.69 and a mean of 2.52.

Zainab Awang Ngah (2008) observed the internationalization characteristics of two Malaysian journals, Bulletin of the Malaysian Mathematical Sciences Society and the Malaysian Journal of computer science. All issues for the year 2000 to 2007. This results indicate that both journals exhibit average internationalization characteristics as they are current in their publications but with between 19 per cent to 30 per cent intentional
composition of reviewers or editorials, publish between 36 to 79 per cent of foreign articles and receive between 60 to 70 of citations from foreign authors.

Swapan Kumar Patra and Prakash Chand (2007) This article looks at the growth over time of Indian AIDS research output based on bibliographic data from PubMed and Web of Science. Authorship distribution was examined using Lotka's law. Bradford's law of scattering was used to identify core journals. The study identifies active institutions and statewide distributions of Indian AIDS research output. The yearly analysis of data shows that there is a rapid growth of literature from 1992 onwards. Still, in an international sense, relative productivity of India is low and requires more focused research and development.

Antonio Pulgarín and Isidoro Gil-Leiva (2004) made bibliometric study of a corpus of 839 bibliographic references about automatic indexing, covering the period 1956-2000. We analyse the distribution of authors and works, the obsolescence and its dispersion, and the distribution of the literature by topic, year, and source type. We conclude that: (i) there has been a constant interest on the part of researchers; (ii) the most studied topics were the techniques and methods employed and the general aspects of automatic indexing; (iii) the productivity of the authors does fit a Lotka distribution ($D_{\text{max}}=0.02$ and critical value=0.054); (iv) the annual aging factor is 95%; and (v) the dispersion of the literature is low.
Jeevan and Gupta (2002) studied the quantitative profile of a research university, with a view to characterizing the performance and impact of research produced in each department and to comparing the impact of research in various departments. As a case study, examines the Indian Institute of Technology (IIT) in Kharagpur, which was set up in 1951 by the India Government as a national institute for the planned development of human resources in applied sciences and technology. The Institute offers 22 undergraduate, 50 postgraduate, and Ph.D. programs through its 18 departments, five centers, and two schools, and has a sanctioned strength of more than 500 faculty members. In 1996-1997 alone, about 50 sponsored and 120 consultancy projects were secured. The IIT Kharagpur is very active in the frontier areas of technology, as evidenced by the publications in national and international journals, and dedicated studies have not yet been conducted to assess the impact of these papers.

Daisy Jacobs and Peter Ingwersen (2000) reported the findings of the publication patterns and impact factor of South African scientists during 1981-1996. The findings obtained in this study point to a steady decline in productivity and World shares for most of the scientific fields, except for physics. However, the quality of the publications form South Africa, in terms of relative citation impact, is increasing since 1993 and may soon again reach the level obtained during the 1980s. Also the actual number of citations given to South African papers have grown to a maximum level obtained from 1992-1999, and the citation world share is quite stable from 1993.
Senapati (1995)\textsuperscript{9} presented a bibliometric study of articles published in the year 1988 to 1992 in Studies in Conservation. In this study, he analysed the articles according to year, subject areas, cited references etc. Some important findings in this study are, USA contributed majority of the articles. Single authorship, is accounted for 32.47 percent, average number of references was 13.88 percent; and average length of papers was 8.47 pages.

Cox et al. (1994)\textsuperscript{10} reviewed the distribution of citations in 278 anxiety disorder studies published in 14 journals in the year 1990 and 1991. The 278 anxiety disorder studies contained 3,199 references to articles from the 14 journals. The result was that a high percentage of "self-citation" in some of the journals and only limited evidence of citations across journal and author disciplines were found. Their findings suggest that anxiety disorder research findings were often not widely disseminated across disciplines.

Harter (1992)\textsuperscript{11} also analysed a bibliometric study on 9 volumes of JASIS 1972-1974, 1982-1984 and 1988-1990 to study variables such as the year of publication, number of citations, funding status of the work, funding agency. This study found that there was no relationship between the funding and the quality or utility of the article; and funding for information science research has declined over the years especially at the federal levels. More authors are coming from academic department in universities and fewer from information seekers.
Schubert and Glanzel (1987)\textsuperscript{12} reviewed the three parameters Irwin family of discrete distributions is proposed as a general framework for modeling frequency distributions in scientometrics and bibliometrics. This family includes most of the specific distributions so far used successfully for such purposes. The distributions of the Irwin family can be characterized by a linear relation between two truncated moments. This characterization may serve as a basis for graphical methods of classification, goodness-of-fit test, and parameter estimation. The use of a microcomputer for these statistical procedures is demonstrated on a citation analysis.

Kovas (1981)\textsuperscript{13} studied the Journal Medicus Universalisin the year 1979. Of the 77 articles, 55 reports contained 1115 citations, of which, 353 referred to reports published in Hungarian and 762 to paper to papers published in foreign languages. References to journal articles predominated with 815 (73\%) citations, and were followed in decreasing order by books and other documents. The top three countries in terms of productivity are Hungary (353), USA (237) and UK (194). Whereas in terms of language distribution English tops with 475 citations followed by German 225 citations. A negligible amount of citations goes to other languages.

2.2 BIBLIOMETRIC AND SCIENTOMETRIC INDICATORS

Egghe (2011)\textsuperscript{14} made a study on single publication H-index and the indirect H-index of a researcher. The single publication H-index, introduced
by A. Schubert in 2009 can be applied on all articles in the Hirsch-core of a researcher. In this way one can define the indirect H-index of a researcher.

**Karpagam et al. (2011)**\(^{15}\) carried out a research on Nanoscience and Nanotechnology research in India during 1999 to 2009. The data were extracted from the Scopus database. The study analyses various parameters like coauthorship, country growth rate, collaborative co-efficient, H-index, G-Index etc. USA, China, and Japan are the leading countries in nanoscience and nanotechnology research, followed by France, UK, and India, the countries very active in Nanotechnology research. While considering the criteria average citation per paper, the journal of Material Chemistry is ranked first (21.658) followed by Chemical Physics Letters (19.00) Inorganic Chemistry (16.781), Journal of Physical Chemistry B (16.714) and Journal of the America Ceramic Society (16.706).

**Tobias Opthof and Loet Leydesdorff (2010)**\(^{16}\) examined the Center for Science and Technology Studies at Leiden University advocates the use of specific normalizations for assessing research performance with reference to a world average. The Journal Citation Score (JCS) and Field Citation Score (FCS) are averaged for the research group or individual researcher under study, and then these values are used as denominators of the (mean) Citations per publication (CPP). Thus, this normalization is based on dividing two averages. This procedure only generates a legitimate indicator in the case of underlying normal distributions. Given the skewed distributions under study, one should average the observed versus expected values which are to be

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divided first for each publication. We show the effects of the Leiden normalization for a recent evaluation where we happened to have access to the underlying data.

Alexander Serenko (2010) presented ranking of 182 academic journals in the field of artificial intelligence. For this, the revealed preference approach, also referred to as a citation impact method, was utilized to collect data from Google Scholar. This list was developed based on three relatively novel indices: h-index, g-index, and hg-index. These indices correlated almost perfectly with one another (ranging from 0.97 to 0.99), and they correlated strongly with Thomson’s Journal Impact Factors (ranging from 0.64 to 0.69). It was concluded that journal longevity (years in print) is an important but not the only factor affecting an outlet’s ranking position. Inclusion in Thomson’s Journal Citation Reports is a must for a journal to be identified as a leading A+ or A level outlet. However, coverage by Thomson does not guarantee a high citation impact of an outlet. The presented list may be utilized by scholars who want to demonstrate their research output, various academic committees, librarians and administrators who are not familiar with the AI research domain.

Sagar Anil et al. (2010) performed a scientometric analysis of all Tsunami related publications as per the Scopus database during 1997-2008. A total of 4338 publications and 21107 citations to these papers were received. The parameters studied include growth of publication, country-wise distribution of publications, activity index of countries, most-frequently cited
publications, authorship pattern, co-authorship index, and distribution of keywords. United States of America, Japan, United Kingdom, India and Australia produced 54.20% of the total output. A spurt in number of publications was observed after the Indonesia's tsunami occurred on 26 December 2004.

Lutz Bornmann, Loet Leydesdorff and Peter Van den Besselaar (2010). Combining different data sets with information on grant and fellowship applications submitted to two renowned funding agencies, compare their funding decisions (award and rejection) with scientometric performance indicators across two fields of science (life sciences and social sciences). The data sets involve 671 applications in social sciences and 668 applications in life sciences. In both fields, awarded applicants perform on average better than all rejected applicants. If only the most prominent rejected applicants are considered in both fields, they score better than the awardees on citation impact. With regard to productivity, we find differences between the fields. While the awardees in life sciences outperform on average the most prominent rejected applicants, the situation is reversed in social sciences.

Liping Yu et al. (2009) identified a new method for indicator selection in panel data analysis and tests the method with relevant data on agricultural journals provided by the Institute of Scientific & Technical Information of China. An evaluation exercise by the TOPSIS method is conducted as a comparison. The result shows that panel data analysis is an effective method for indicator selection in scholarly journal evaluation;
journals of different disciplines should not be evaluated with the same criteria; it is beneficial to publish all the evaluation indicators; unavailability of a few indicators has a limited influence on evaluation results; simplifying indicators can reduce costs and increase efficiency as well as accuracy of journal evaluation.

Ming-Yueh Tsey and Yi-Jen-lin (2009)\textsuperscript{21} explores the characteristics of transport phenomenon literature from 1900 to 2007 based on the Science Citation Index Expanded database and its implication using two scientometric techniques, namely Bradford-Zipf's law and Lotka's law. The results of this work reveal that the literature on transport phenomenon grows exponentially with an annual growth rate of about 8.67\% for the last century. The document type and language distribution, country and institution productivity, core journals, journals with highly cited documents, most highly cited articles and leading authors on transport phenomenon are identified. The present study indicates that the journal literature on transport phenomenon confirms the typical S-shape for the Bradford-Zipf plot. The author productivity distribution however does not confirm with Lotka's law by the Kolmogorov-Smirnov (K-S) goodness of fit test. Scheubert (2009)\textsuperscript{22} explained using the h-index for assessing single publications; this index measures not only the direct impact of a publication but also its indirect influence through the citing papers

Romero et al. (2009)\textsuperscript{23} The practice of publishing clinical trials in scientific journals is common, although not without its critics. This study aims to measure the effect of clinical trials citations on several bibliometric

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indicators: citations per document (CD); journal impact factor (JIF); relative h-index (RhI) and strike rate index (SRI). We select all the citable documents published in the NEJM, Lancet, JAMA, AIM and BMJ, for the period 2000-2004, and record the citations received by those papers from 2000 to 2005. This results show that clinical trials have a CD significantly higher than those for conventional papers; JIF is lower when clinical trials are excluded, especially for NEJM, Lancet, and JAMA. Finally, both RhI and SRI seem to be unaffected by clinical trials citations.

Feng zhou et al. (2008) analysed of worldwide geostatistics research published during the period from 1967 to 2005. For authorship pattern, the 50 most productive authors were classified by CA into four groups representing different levels, and DA produced 92% correct assignment with high reliability. The top 50 most productive journals were classified into three groups with nearly 98.0% correct assignment, and its discriminate parameters were total citations, impact factor and ACCP. Moreover, this paper analyzed general patterns for publication document type, language, subject category, and publication growth.

Rodrigo Costas and María Bordons (2007) analysed the H-index other bibliometric indicators at the micro level Spanish CSIC scientists in Natural Resources, using publications downloaded from the Web of Science (1994–2004). Different activity and impact indicators were obtained to describe the research performance of scientists in different dimensions, being the h-index located through factor analysis in a quantitative dimension highly

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correlated with the absolute number of publications and citations. The need to include the remaining dimensions in the analysis of research performance of scientists and the risks of relying only on the h-index are stressed. The hypothesis that the achievement of some highly visible but intermediate-productive authors might be underestimated when compared with other scientists by means of the h-index is tested.

Sanz-Casado (2007) analysed and map the trends in research on prion diseases by applying bibliometric tools to the scientific literature published between 1973 and 2002. The data for the study were obtained from the Medline database. The aim is to determine the volume of scientific output in the above period, the countries involved and the trends in the subject matters addressed. Significant growth is observed in scientific production since 1991 and particularly in the period 1996–2001. The countries found to have the highest output are the United States, the United Kingdom, Japan, France and Germany. The collaboration networks established by scientists are also analysed in this study, as well as the evolution in the subject matters addressed in the papers they published, that are observed to remain essentially constant in the three subperiods into which the study is divided.

Rajendiran and Parihar (2007) identified various bibliometric indicators of articles published by the Indian researchers in the field of laser science and technology during the period 1995-2005. The data extracted from the Scopus database. The bibliometric techniques, such as Bradford’s law, Lotka’s law and the Subramanyam formula were employed respectively to

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measure quantitative distribution of literature in journals, author productivity and the degree of collaboration among authors. The study found that 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 per cent appeared as research articles. The log-log plot drawn for distribution of literature in various journals fits the typical Bradford S-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 is larger than 60% of original Lotka’s data. The degree of collaboration among authors is 0.94.

Swapan kumar patra, and Sarojmishra (2006)\textsuperscript{28} analysed the growth of the scientific literature in this area as available from NCBI PubMed using standard bibliometric techniques. Bradford’s law of scattering was used to identify core journals and Lotka’s law employed to analyze author’s productivity pattern. Study also explored publication type, language and the country of publication. Twenty core journals were identified and the primary mode of dissemination of information was through journal articles. Authors with single publication were more predominant (73.58%) contrary to that predicted by Lotka’s law.

Kumaravel (2001)\textsuperscript{29} analysed the data downloaded from Dialog’s Biotechnology and Chemical Engineering abstracts database for the period from 1988 and 2000. The population and GNP are taken out for a particular year and correlated with the research output. Research shows the collaborative authorship trend and that there is no significant relation between research
output and the total population or the GNP. Results shows the collaborative authorship trend and that there is no significant relation between research and the total population or the GNP

**Herubel (1994)** examined the bibliographic essays appearing in Journal of Library History (renamed Libraries and Culture) 1986-1990 to study the disciplinary nature of periodical containing articles devoted to American library history. The essays yielded 203 individual periodical titles and 1030 bibliographic citations. Each periodical title was examined for disciplinary affiliation and categorized accordingly. The 20 most cited periodicals in the field of library history was shown.

**Lifshin (1993)** examined the citation analysis of the Geochimicaet Cosmochimica Acta 1951-1960. It was found that 75% of the citations were journal articles followed by books and continuations. English language citations dominated in 1960 with a corresponding decrease in German language citation. Citations to the geologic literature dominated and increased with time from 40% to 58% while citations to the journal itself grew from 2 to 357 within ten years.

**Sievert (1989)** carried out an analysis of citation data of Elementary School Journal to study the influence of an editor on citation patterns. The study examines the editorial goals of each of the 3 editors in a 10-year period are found that while they agreed on several positions, the current editor stressed research more and was interested in rapid communication. The results

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showed changes in number of citations the journal received, the number of citations given, the immediacy index and the impact factor. There exists a positive impact between an editor and citation patterns of the journal studied.

Gupta (1978) studied the Journal of the Structural division of the American Society of Civil Engineers, New York 1974 to ascertain the active life of periodicals in structural engineering after taking into consideration the ageing factor, obsolescence factor, half life, mean life and utility factor on the basis of citations in periodicals. The paper concluded that periodicals in structural engineering lose their utility value after 8 years of their publications.

2.3 STUDIES ON AUTHORSHIP PATTERN

Jordi Ardanuy (2012) analyzed the level of co-authorship of Spanish research in Library and Information Science (LIS) until 2009, the chronological development that has taken place, and the level of local, domestic and international cooperation. This bibliometric study was made using the data retrieved from the Web of Knowledge (WoK) following a dual strategy on the one hand through the filter of the category Information Science & Library Science, and on the other hand through a subject search. In this way a significant number of works has been retrieved, some of which are in journals indexed in SCI or A&HCI and not in the SSCI. The results show a significant increase in all co-authorship, including publications in English and those involving international collaboration. As with the increase in Spanish participation in social science (WoK), this growth, coupled with the significant
increase in Spanish scientific production in the area of LIS, suggests that the discipline in Spain has entered a more mature phase—although so far it has focused particularly on bibliometric studies.

Liang et al. (2012)\textsuperscript{35} carried out a research on Chinese universities in enterprise–university research collaboration is investigated. This study focuses on a special aspect of the collaboration co-authored articles. The two cases are analyzed: (1) research collaboration between Baosteel Group Corporation and Chinese universities; (2) research collaboration between China Petroleum & Chemical Corporation and Chinese universities. The co-authorship data over the period 1998–2007 were searched from CNKI database, the largest Chinese publication and citation database. The main findings are as follows: the number of articles co-authored by enterprise and university scientists has been increasing rapidly; the share of co-authored articles has been growing; the authors from universities are more possible to be the first authors; as a whole, enterprise–university co-authored articles tend to receive more citations and get downloaded more frequently; a mathematical orientation emerges in the enterprise–university articles. To reveal and describe such a trend the methods of keywords analysis and co-occurrence analysis are applied. The Chinese government’s policy instruments and substantial supports for pushing and improving enterprise–university research collaboration are introduced and analyzed.

Kretschmer et al. (2012)\textsuperscript{36} analysed 14 journals of gender studies using several methods and indicators. The results confirm our expectation: the very
high position of women in co-operation is striking; female scientists are relatively overrepresented as first authors in articles. Collaboration behaviour in gender studies differs from that of authors in PNAS. The pattern of gender studies reflects associations between authors of different productivity, or ‘‘masters’’ and ‘‘apprentices’’ but the PNAS pattern reflects associations between authors of roughly the same productivity, or ‘‘peers’’. It would be interesting to extend the analysis of these three dimensional collaboration patterns further, to see whether a similar characterization holds, what it might imply about the patterns of authorship in different areas, what those patterns might imply about the role of collaboration, and whether there are differences between females and males in collaboration patterns.

Qi Yu et al. (2011)\textsuperscript{37} analyzed the research groups from the co-authorship network of oncology in China. By use of centrality, component analysis, K-Core, M-Slice, Hierarchical Clustering analysis, and Multidimensional Scaling analysis, Authors studied the data from 10 Core Chinese Oncology journals between 2000 and 2009, analyzed the structure character of the Chinese Oncology research institutes. This study advances the methods for selecting the most prolific research groups and individuals in Chinese Oncology research community, and provides basis for more productive cooperation in the future. This study also provides scientific evidences and suggestions for policymakers to establish a more efficient system for managing and financing Chinese Oncology research in the future.
Wakimoto Diana (2011) investigated collaboration in Library and Information Science doctoral education, in particular the extent and perception of collaboration between advisors and advisees, and the dissertation as a collaborative product. Design - Quantitative and qualitative analysis of questionnaire data. This analysis showed that more than 61% of the advisors reported collaborating with at least half of their advisees, while 58% of the advisees reported collaborating with their advisors. Both advisors and advisees defined collaboration mainly as publishing, researching, and presenting together. More than 50% of the advisors reported co-publishing with half of their advisees during the advisees' doctoral education. The advisors reported co-publishing with less than 30% of their advisees after the students completed their doctoral education. Advisees reported similar numbers: 44% and 31%, respectively. Following graduation, the majority of advisees (96%) planned to publish from their dissertations. Of these, 78% did not plan to include their advisor as co-author in these publications. 42% of the advisors reported that none of their advisees included them as co-authors, while 3% of advisors stated that their advisees always included them as co-authors.

Joanna Sin (2011) carried out a Biblimetric study on six LIS journals during 1980-2008. This study analyses 7489 papers published in six leading publications (ARIST, IP&M, JAMIA, JASIST, MISQ and Scientometrics). International Collaborative papers are more in disciplines like authors, countries, journals etc. In the year 1995 the international collaboration in
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Authorship is very high. The Northern Europe authors are comparatively more than the East Asia, Southeast Asian and Southern Europe.

**Susanta Koley and Sen (2006)**\(^{40}\) analysed 251 papers of Prof. B. N. Koley published during 1958-2001. On the basis of collected data, this study examined year-wise distribution of papers. Author productivity and productivity of Koley’s research group. In 251 papers published by Koley, he had published 189 papers as co-author and 62 single author papers. His productivity peaked in 1990 with 19 papers. Nearly 70 per cent of the papers had been published in serial publications. 25% of his papers were published foreign sources. Of all collaborative papers 139, were three authored papers, 45 were four authored papers.

**Goel (2005)**\(^{41}\) analyzed 1942 Indian papers to find out authorship patter, productivity of Indian Institutes, core journals, scattered papers and chronological research trend in discipline by using bibliometric techniques. It was observed that joint authorship was prominent with a 72 per cent contribution, while single author made only 28 per cent contributions. Indian universities and colleges were at the first rank with 42.84% papers and the Indian Institute of Management was to the bottom with 1.18% papers.

**Kannappanavar and Vijayakumar (2001)**\(^{42}\) carried out a study on the authorship trend in International Monetary Fund literature for a period from 1991-1998. They carried at a conclusion that collaborative research was in an
increasing trend ranging from 0.45-0.62. The average degree of collaboration was found to be 0.56.

**Parameswaran and Smitha (2001)** examined the 60 issues of LISA published from 1994-1998 were analysed manually using a specially prepared data sheet. This study reveals the collaborative authorship was measured using Subramanyam’s formula and the results helped the investigators to prove the hypothesis that the research papers by single authors were greater in number than collaborative work as covered by LISA.

**Gupta and Karisiddappa (1998)** carried out a study on collaborative pattern of scientific papers in theoretical population Genetics for a period ranging from 1956-1980. The study shows that the collaborative authorship pattern was increasing trend. United States contributed 41.66% of co-authored publications. It was among the countries with a significant percentage of co-authorship 47.02%. But it ranked in the low end in terms of overall percentage of publications involving international collaboration (11.53% during 1956-1960 to 15.81% during 1976-1980. The United Kingdom contributed 16.23 percent to the world’s international co-authored publications. It was among the countries with 32.15 per cent 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% during 1956-1960 to 24.13% during 1976-1980. Australia contributed 7.45% to the world’s total international co-authored publication. Their percentages of co-authored publications were 23.41 percent, but its contribution in terms of publications

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involving international collaboration decreased (from 50 per cent during 1956-1960 to 33.33 per cent during 1976-1980). Japan contributed to the world’s total international co-authored publications was 39.58 percent. Canada contributed 13.59 per cent to the world’s total co-authored publications and its percentage of co-authored publication was 43.05 percent.

Nisonger (1996) made a study of authorship pattern in Library Acquisitions: Practice and Theory 1979-1995. The study found that 80.6% of authors contributed a single article while 3.9% wrote four or more. 15.6% of the articles were collaboratively written by two or more authors, 65.4% of authors were academic librarians and 10.6% were vendors, 53.9% were male. The longitudinal analysis shows an increasing pattern of female authors, and 15.3% of authors were from outside the USA.

Wouters (1994) investigated bibliometric and social network analysis. This study analyses most of the articles published were single authored. The network of co-authorship is highly fragmented with most authors cooperating with not more than one or two colleagues.

Maheswarappa et al. (1984) examined 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. The findings revealed that two authored papers were maximum in Science and Technology as a whole. The single authored papers constitute more than one fourth of publications.
2.4 STUDY ON GROWTH OF LITERATURE

Peng Hui Lv et al. (2011) evaluated global scientific production and developing trend of graphene research. The data were collected from 1991 to 2010 from the Science Citation Index database, Conference Proceedings Citation Index database and Derwent Innovation Index database integrated by Thomson Reuters. The published papers from different subjects, journals, authors, countries and keywords distributed in several aspects of research topics proved that graphene research increased rapidly over past 20 years and boosted in recent 5 years. The distinctions in knowledge map show that the clusters distributed regularly in keywords of applied patents in recent 5 years due to the potential applications of graphene research gradually found.

Tsay (2011) conducted a bibliometric analysis and comparison of JASIST, IPM and JOD publications for volumes published from 1998 to 2008. The following conclusions may be drawn from this study: JASIST published more than twice of articles of IPM and JOD, both published approximately the same number of articles. Interestingly, JOD published more book reviews (54%) than journal articles. The average number of references cited per paper for JASIST and JOD is 38 and 40. It is significantly higher than that of IPM of 32. There is no significant difference between JASIST and JOD in terms of average number of references cited. In average, 9.3, 7.8, 4.1 books were cited per paper by JOD, JASIST and IPM, respectively. JOD cites books per paper most, while IPM cites least. JASIST has the highest self-citation rate of 17.46%, next by IPM of 14.11% and JOD has the least self-citation rate of.

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10.19%. Four of the top five highly cited journals are in common, i.e., Journal of the American Society for Information Science and Technology, Information Processing and Management, Scientometrics, and Journal of Documentation. On the other hand, the most cited three books in common for JASIST and IPM are Salton and McGill’s Introduction to Modern Information Retrieval, Van Rijsbergen’s Information Retrieval and Salton’s The SMART Retrieval System: Experiments in Automatic Document Processing. For the three journals under study, most of the top ten highly cited journals, contributing about 40–50% of cited journals, are information science journals indicating that the researchers in the information science field cite more research results in their own field.

*Sten Theander and Lennart Wetterberg (2010)*[^50] made a bibliometric study, and compare the quantity of publications on schizophrenia with the total medical literature in Medline during 57 years, 1950-2006. The annual additions of literature to Medline are continually increasing and form the Medline growth curve. Comparisons of the number of publications on schizophrenia, or any other disease, to this curve, may be used to estimate the research activity. Methods for the identification of relevant references to papers on schizophrenia were evaluated and three different samples were operationally defined, retrieved and counted. During 1950–2006, 16.28 million references were added to Medline. Nearly 68000, 0.42%, references were related to schizophrenia. The percentage of papers on schizophrenia among the psychiatric literature decreased from 5.2 to 2.6%. The present study

[^50]: Scientometric analysis of IEEE Transactions on Power Electronics
indicates that the number of references on schizophrenia in Medline has followed the general increase of medical publications. This pattern differs compared to some other research fields such as dementia, HIV, and peptic ulcer. Samples of references on schizophrenia may be retrieved in Medline by operational definitions of search methods. The quantity of schizophrenia research during 57 years has kept pace with the total medical literature. One interpretation of the results is that more resources are needed to enhance research activities on schizophrenia.

Ronald Kostoff (2008)\textsuperscript{51} The relative performance of science and technology (S&T) in the USA and PRC was compared in terms of quantity and quality, as reflected in their technical literatures. Three databases (Science Citation Index (SCI), INSPEC, Ei Compendex) were selected for the quantity comparison, and citation analysis in the SCI was used for the quality comparison. Thirty technology and research areas were compared for quantity production, and are presented in this paper. These 30 areas were selected based on our previous assessment of PRC S&T output, and represented areas of emphasis by the PRC in physical, environmental, engineering, and life sciences. In almost all technical areas, the USA had the quantity (number of papers) lead (for the period 2002–2007) based on the SCI results, although the PRC has made dramatic strides to overtake the USA. In most of the technical areas, by 2007 PRC had attained parity with, or exceeded, the S & T literature production of the USA in the Inspec database. The major exceptions were the biomedical field and some aspects of environmental science, where the USA
still had a large lead. For most technical areas, by 2007 the PRC had even higher relative S & T literature production, based on the Ei Compendex, compared to the INSPEC results. Moreover, the USA production appears to have peaked (in the Ei Compendex) in the 2005 time frame, despite increasing amounts of funding for S&T research. The PRC challenge in non-biomedical research and technology sectors becomes apparent in those databases that do not contain substantial biomedical research papers, and therefore remove a substantial intrinsic USA advantage. For quality computations, the publication and citation results were normalized to discrete slices of time, and are presented for nanotechnology only (for the period 1998–2003). While the USA held a commanding lead in quality over the PRC (and the other major nanotechnology producer nations as well) during the past decade, the PRC has increased the quality of its publications monotonically, and now appears to be competitive with France, Italy, Japan, and Australia, using the quality metric in this paper.

**Sangam et al. (2008)**\(^{52}\) analysed the growth pattern of Chemical Science literature in India in eighty subfields. SCI Finder Scholar - Chemical Abstracts online has been used for collected data from the period 1980-2005. This study also reveals eighty subfields of Chemistry are reduced into 13 major contributing fields by factor analysis, relative growth rate, and doubling time for Chemical literature. Fits both modified exponential curve and logistic curve for the original publications. Further identifies parameters and Fit Statistics subfield for Modeling the Growth.

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Kademani et al. (2007)\textsuperscript{53} analyzed the growth and development of science and technology (S&T) activities in India, as reflected in publication output covered by Science Citation Index (SCI) during 1990-2004. The Indian scientists published a total of 1,82,111 papers in SCI covered journals during the above period. The present study analyses the broad 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 broad and narrow subject areas of interests of Indian institutions and scientists.

Kademani et al. (1994)\textsuperscript{54} were analyzed Dr. C. V. Raman’s growth of publications, collaboration pattern channels of communications used, etc. The results indicated that the temporal variation of his productivity and of types of papers published by him was eminently qualified to be taken as a role model for the younger generations to emulate. He had to his credit 94 papers in ‘scattering light’, 55 paper in ‘acoustics’, and 66 papers in ‘optics’. The highest collaboration coefficient was 1.0 during 1936-40. Self citation rate for his publication was 15.05.

Rice (1990)\textsuperscript{55} assessed the adequacy of the library news coverage and analysed the contents of 661 library-related articles published in the Chronicle of Higher Education 1966-1988. The results showed that although coverage has increased dramatically over the past 25 years, the focus tends to be elitist. Nevertheless, the journal remains a significant source of academic librarianship for the higher education community.
Potapov and Kochetova (1984)\textsuperscript{56} focused Growth curves built upon scientometric data have often been used to make predictions about various quantitative indicators characterizing the development of science and its various subfields. The literature contains many predictions made ten to twenty years earlier about what the situation would be like in 1984. Abstracts journals, which concentrate the flow of scientific information, are of obvious value to scientometric research. Of particular importance in this regard is the subject indexes, whose headings contain in concentrated from all the information contained in the abstract and, ultimately, in the original scientific work itself. An analysis of the effectiveness of scientometric predictions is given from the results obtained.

2.5 MAPPING OF SUBJECT RESEARCH

Caputo et al. (2012)\textsuperscript{57} carried out a research in biology related domains in Venezuela is examined through the study of demographic, academic distribution, scientific output and productivity, for two sets of investigators that fit a profile outlined for life sciences researchers or scientists. The first group corresponds to biologists extracted from the ranks of the official Program for the Promotion of Researchers (PPI), the other, pulled out from those that publish in biologically oriented journals, indexed by the Institute of Scientific Information (ISI). Both sets of biology scientists, PPI researchers or Web of Science/ISI scientists, show similar characteristics. The number (absolute and relative) of PPI member that are supposedly dedicated to

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biological research but do not publish in ISI indexed journals was found to be very similar to the number of supposedly non biologist members of the PPI Program that do publish biological articles in ISI indexed journals. There is also an ongoing feminization process, of academic hierarchies. Female biologists predominate in lower academic ranks and in research cadres, as many as 70% in some areas of biology. This contrasts with the pattern of male predominance observed during the second half of twentieth century in the country. Productivity of Venezuelan biologists seems to depend on gender; men are more productive that their female counterparts. From the bibliometric standpoint, it is found that, on average, 30% of all publications produced in the country are related to biology (or life sciences). The Venezuelan biologists network qualifies neither as a ‘Small World’ nor it follows the ‘Scale Free’ model. Finally, in a country rich in renewable natural resources, it seems that the Venezuelan community of researchers in biology is in decline, despite the fact that they constitute its most productive group of investigators.

Bajwa et al. (2012)\textsuperscript{58} analysed the research trends in Pakistan in the field of nanoscience and nanotechnology. Starting with just seven publications in the year 2000, this number has steadily increased to 542 for the year 2011. Among the top 15 institutions with publications in nanotechnology 13 are universities and only two are R&D organizations. Almost 35% of the research publications are in the field of Material Sciences followed by Chemistry and Physics in that order. The growth in the publications for period 2000-2011 is studied through relative growth rate and doubling time. The authorship pattern

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is measured by different collaboration parameters, like collaborative index, degree of collaboration, collaboration coefficient and modified collaboration coefficient. Finally the quality of papers is assessed by means of the h-index, g-index, hg-index and p-index.

Yang and Lee (2012)\(^{59}\) assessed research patterns and trends of library and information science (LIS) in Korea by applying bibliometric analysis to 159 Korean LIS professors’ 2,401 peer-reviewed publications published between 2001 and 2010. Bibliometric analysis of publication data found an increasing trend for collaboration, robust publication patterns, increasing number of international publications, and internationalization of LIS in Korea. The maturation and internalization of LIS research was evidenced in increased number of publications in high impact journals (e.g., SSI, SSCI), growing participation in leading international conferences (e.g., ASIST, TREC), increasing proportion of Korean LIS faculty with international degrees, and high publication rates by professors with international degrees. Though limited in its evaluative power without citation data, publication data can be a rich source for bibliometric analysis as this study has shown. The analysis of publication patterns conducted by the study, which is a first step in our aim to establish a multi-faceted approach for assessing the impact of scholarly work, will be followed up in a future study, where the question of quantity versus quality will be examined by comparing publication counts with citation counts.

\(^{59}\)Yang and Lee (2012)
**Raja and Balasubramani (2011)** made a study on Malaria research literature output during 2003-2007 a total of 15685 papers were published by the scientists in the field of malarial research. The average Number of Publications produced per year was 20 percent. The highest number of Publications 3731 was produced in 2006. The most productive author is White N J with 136 papers dealing with malarial research and 0.9% of all papers published in this research field. The highest number of publication is accounted to 11758 (74.96%) Vs LCS 44000 as articles and lowest is as Bibliography - 1 Vs LCS 0. The highest number of publication is at USA and lowest number of publication is at West India.

**Ramasamy (2011)** investigated a study on Robotics research in India for the period 1999 to 2009. This study analyses 5911 records with 41047 citations. The maximum output was found in the year 2009 with 842 publications and this formed 14.24 per cent of the total output. 0.74 per cent records only originated from India

**BalaAdarsh and Gupta (2010)** analyzed the research profile of Biochemistry, Genetics and Molecular biology research in India during 1998-2007, country's performance based on its research output, its publication share and rank in global context, and annual publication growth rate. It also analyses the share of international collaborative papers in India's research output, the characteristics of research output of major Indian institutions, authors, and highly-cited papers. The patterns of research communication by Indian
scientists in most productive journals in this discipline have also been evaluated.

**Konur (2010)**\(^{63}\) explored the characteristics of the literature on the algae and bio-energy published during the last three decades, based on the database of Science Citation Index Expanded (SCIE) and Social Science Citation Index (SSCI). This study reveals that: 1) The literature algae and bio-energy has grown exponentially during the study period reaching 717 records. 2) Most of document type is in the form of journal articles, reviews and proceedings, constituting 98% of the total literature. 3) Most of the documents are publishing in English language (97.6%). 4) USA Contributing 26 per cent out of total publications and stands first, followed by China(8%), Germany (8%) and England (8%). 5) Bioresoruce Technology is the most publishing journal with 24 papers.

**KaurHar and Gupta (2009)**\(^{64}\) examined India's performance based on its publication output in immunology and microbiology during 1999-2008, based on several parameters, including the country's annual average growth rate, global publications share and rank, institutional profile of select top 15 institutions, international collaboration profile and major collaborative partners, patterns of communication in national and international journals, and characteristics of its top 15 most productive authors.

**Melih Soner Celiktas et al. (2009)**\(^{65}\) conducted to find out the development trends of the scientific studies in the field of renewable energies

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in Turkey. All the publications in the ISI Web database were screened using 36 different keywords in title or topics based on the affiliation addresses including the word “Turkey”. A total of 12,197 publications were processed article by article and as a result 1555 papers were found to focus on renewable energies between the years 1980 and 2008 with the contributions of 1605 authors. The results showed that 45.2% was experimental, 34.3% informational studies whereas 20.5% was available system analysis. Number of publications in biomass and conversion system (39.1%) and solar energy systems (20.0%) were dominating. Both number of publications and citations increased in the last decade and more than half of total contributions were published last four years. Results indicated that policy development studies (3.3%) were the weakest among the whole parameters investigated.

Kademani et al. (2006) analyzed quantitatively the growth and development of Nuclear Science and Technology research in India in terms of publication output as reflected in International Nuclear Information System (INIS) (1970–2002) database. During 1970-2002 a total of 55313 papers were published by the Indian Nuclear scientists in various domains: Physics (23033), Chemistry (16368), Life and Environmental Sciences (7203), Engineering and Technology (6960), Other Aspects of Nuclear and Non Nuclear Energy (981) and Isotopes and Radiation Application (768). Year-wise growth of publications and input of records to INIS database by India and other countries were analyzed. The total number of records input to INIS database by India was 30356 (54.88%) and by other countries and
international organization is 24957 (45.12%). The average number of papers published per year was 1676.15. The average Indian contribution to the world literature was 2.25%. Authorship and collaboration trend was towards multi-authored papers. Intensive international collaboration was found during the period and bilateral collaboration accounted for 80.06% of the total collaborative papers.

Carrasco-Rico et al. (2001) analyzed the research literature on hypertension published between 1990 and 2000 in Mexico and evaluated the congruency between epidemiologic publications and the perspective of health services of the public institutions in Mexico. They found that, Out of 71 publications, 43 were identified as clinical trials, 21 as epidemiologic studies, and remaining pertaining to studies of various topics related with hypertension. The researcher found that most of the studies were related to moderate hypertension and 40% of publications were found to be related with treatment.

Subbaiah Arunachalam (2001) analyzed in his study on Mathematics research in India, as reflected by papers indexed in Mathsci 1988-1998, is quantified and mapped. Statistics, quantum theory and general topology are the three subfields contributing the most to India's output in mathematics research, followed by special functions, economics and operations research, and relativity and gravitational theory. Indian Statistical Institute and Tata Institute of Fundamental Research are the two leading publishers of research papers. Unlike in many other fields, Calcutta publishes...
the largest number of papers in Mathematics, followed by Mumbai, New Delhi, Chennai and Bangalore. West Bengal, Uttar Pradesh, Maharashtra, Tamil Nadu and Delhi are the leading states. Researchers from 257 institutions spread over 134 cities/towns have published 17,308 papers in the 11 years. About 92% of these papers have appeared in 877 journals published from 62 countries. Journals published in the USA, UK and the Netherlands are popular with Indian mathematicians. Of the 36 journals that have published at least a hundred papers, 20 are Indian journals, of which only two are indexed in Journal Citation Reports. In all, about 38.5% of papers have been published in Indian journals, as against about 70% in agriculture, 55% in life sciences, 33.5% in medicine and 20% in physics. In the later years, there has been a moderate shift to non-Indian journals. Close to 78% of papers have come from universities and colleges and 13% from the institutions under science related departments. Almost all papers in high impact journals are physics related and most of them have come from institutions under the Department of Atomic Energy. Over 15% of the 9760 papers published during 1993-1998 are internationally coauthored. In all of science, as seen from Science Citation Index, 14% of Indian papers were internationally coauthored in 1991 and 17.6% in 1998. The USA, Canada, and Germany are the important collaborating nations, followed by France, Italy, Japan and the UK.


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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 with three authors and 19 with four authors. Interestingly, the single authorship was on the top only by the way of contribution, between the years 1955-75, while the following period demonstrated that multiple authorship was totally dominant. Area-wise publication analysis revealed the highly preferred areas and less preferred areas. The data was scattered in ten sub-fields, with overwhelming majority of four, viz. Chemotaxonomy, floral anatomy, embryology and systematic taxonomy with 162 papers. These trends may imply that scientific literature are inclined to have more collaborative research and scatter is highly concentrated in a few papers

Tsay et al. (2000) investigated a research on bibliometric study of Semiconductor literature. This data are extracted from the INSPEC database. The result of the research as follows: 1) The total records are 275574. After the year 1986, the literature grows approximately linearly with a growth rate of about 23000 items per year. 2) The USA is the predominant 50 per cent publishing in the country in semiconductor literature. 3) 49.9 per cent of authors contributed only one article. Moreover, the author productivity distribution does not fit the original Lotka’s law. 4) English is the most used language of articles on semiconductor (95.93%). 5) More than 8 per cent of the authors contribute more than 10 articles; The largest number of papers by one author is 564.
2.6 STUDY ON GEOGRAPHICAL DISTRIBUTION OF RESEARCH

Ehsan Mohammadi (2012) investigated the multidisciplinary patterns of Iranian research in NST based on a selection of 1,120 ISI-indexed articles published during 1974-2007. Using text mining techniques, 96 terms were identified as the main terms of the Iranian publications in NST. Then the scientific structure of the Iranian NST was mapped through multidimensional scaling, based upon the co-occurrence of the main terms in the academic publications. The results showed that the NST domain in Iranian publications have a multidisciplinary structure which is composed of different fields, such as Pure Physics, Analytical Chemistry, Chemistry Physics, Material science and Engineering, Polymer science, Biochemistry and new emerging topics.

Almeida et al. (2009) made an analysis of European science, investigating the way countries are joined in clusters according to their similarity. An extremely clear pattern arises, suggesting that geographical and cultural factors strongly influence the scientific fabric of these countries. Although it is seen that one of the major factors behind Science in Europe is, apparently, geographical proximity, bilateral cooperation between countries cannot fully account for the respective similarity. Long-term policies, planning and investment are also visible in the results.

Claude Robert et al. (2009) analyzed 2443 papers published in 2006 by European Union authors on pain-related research. Five EU countries (the UK, Germany, Italy, the Netherlands and France) each published more than...
200 papers while three countries (Cyprus, Malta and Estonia) published none, socio-economic indicators were related to each country’s productivity. The 2443 papers were published in 592 journals and Cephalagia, Pain and European Journal of Pain were the most prolific. Publications were also analyzed for intra-versus inter EU/non-EU collaborations and sub disciplines profiles in Clinical Medicine and the Life Sciences for the World, USA, EU and the top-four EU countries were compared.

Anastassios Pouris (2009) analysed that Africa produced 68,945 publications over the 2000-2004 period or 1.8% of the World’s publications. In comparison India produced 2.4% and Latin America 3.5% of the World’s research. More detailed analysis reveals that research in Africa is concentrated in just two countries i.e. South Africa and Egypt. These two counties produce just above 50% of the Continent’s publications and the top eight countries produce above 80% of the Continent’s research. Disciplinary analysis reveals that few African countries have the minimum number of scientists required for the functioning of a scientific discipline. Examination of the Continent's inventive profile, as manifested in patents, indicates that Africa produces less than one thousand of the world’s inventions. Furthermore 88% of the Continent’s inventive activity is concentrated in South Africa. The article recommends that the African Governments should pay particular attention in developing their national research systems.

Raut et al. (2008) carried out the study on the Strategic Management journal for the years 2005 and 2006. The results reveal the geographical
distribution of core journals of this literate, which are mainly concentrated on USA and UK. USA contributed more number of core journals than UK.

Modak Jayant (2008) analyzed the scientometric parameters for chemical engineering publications. In this study compared the number of journal publications and citations by various countries and institutions. The publication record in terms of quantitative aspects of the number of publications from China has increased exponentially over the last decade and has overtaken USA. However, the citation analysis indicates that there is ample scope for improvement. Thus, USA continues to maintain its leadership position with regard to impact in the field. This study also reveals the output of selected Indian universities/organizations against that of the top universities in the world, indicated that the records of top institutions from India are not comparable to the best universities in USA, but is comparable to the best in Asia and is significantly better than the best universities in China.

Guan and Nan Ma (2007) analyzed data in the semiconductor literatures indexed by the SCI-Expanded database of the five Asian countries and region during the time span 1995-2004. The analysis shows that there have been significant changes in the number of publications and connectivity of these countries during the recent 10 years. The study has generated an enormous amount of empirical data related to the publication characteristics and research performance of the five Asian countries and region in the field of semiconductor. Based on the analysis, the following conclusions have been drawn: 1) China has greatly increased it scientific activities in the
semiconductor-related field. The influence in the region has increased significantly in the recent 10 years. And it was proven that some fast growing developing countries, like China, can catch up in scientific activities rapidly in a new emerging science discipline. 2) China closely followed the trends in Asia, with a large proportion of papers published in USA, England, Netherlands and Switzerland. Papers published domestically have increased from 1995 to 2004 and the growing number of Chinese domestic papers are included in the ISI databases. The scientists in Japan, China and South Korea preferred to work in large groups with more than 4 fellows. 3) Generally speaking, Asian countries have still a long way to go with respect to research impact compared with western countries, as reflected by some indicators based on “Times Cited”. The average citation rate of China was not as high as half of the Germany’s and one third of the USA’s. Similar findings of contrast in numbers of publications and citations in the Essential Science Indicators developed by ISI also indicated that, China ranked 9th by publications and 19th by citations over the period 1993–2002. It is also concluded from JIN & ROUSSEAU (2001) that low citation counts suggest Chinese science still being at the periphery of world mainstream research. 4) The analysis indicates that Japan is leading in semiconductor research in both publication number and research impact among the Asian countries (region). The percentage of highly cited papers in China was relative low, and the percentage of highly cited papers published in Chinese domestic journals was even lower.
Furthermore, over one third of the papers by Chinese scientists received no citations during the period.

Csajbok et al. (2007)\(^{78}\) presented a ranked lists of world’s countries - with main focus on EU countries (together with newly acceded and candidate countries) - by their h-index on various science fields. As main source of data Thomson Scientific’s Essential Science Indicators (ESI) database was used. EU countries have strong positions in each field but none of them can successfully compete with the USA. The modest position of the newly accessed and candidate countries illustrate the importance of supportive economic and political background in order to achieve scientific success. An attempt is made to fit a recent theoretical model relating the h-index with two traditional scientometric indicators: the number of publications and the mean citation rate.

Matthew et al. (2006)\(^{79}\) carried out a research on tropical medicine. Using the PubMed and the Institute for Scientific Information (ISI) “Web of Science” databases, they retrieved articles from 12 journals included in the “Tropical Medicine” category of the “Journal Citation Reports” database of ISI for the period 1995-2003. Data on the country of origin of the research were available for 11,860 articles in PubMed (98.1% of all articles from the tropical medicine category). The contribution of different world regions during the studied period, as estimated by the location of the affiliation of the first author, was: Western Europe 22.7%, Africa 20.9%, Latin America and the Caribbean 20.7%, Asia (excluding Japan) 19.8%, USA 10.6%, Oceania 2.1%,

\(^{78}\) Csajbok et al. (2007)

\(^{79}\) Matthew et al. (2006)
Japan 1.5%, Eastern Europe 1.3%, and Canada 0.6%. The contribution of regions, estimated by the location of the affiliation of at least one author of the published papers (retrieved from the ISI database), was similar: Western Europe 36.6%, Africa 27.7%, Latin America and the Caribbean 24.4%, and Asia 23.3%. The mean impact factor of articles published in tropical medicine journals was highest for the USA (1.65). Our analysis suggests that the developing areas of the world produce a considerable amount of research in tropical medicine; however, given the specific geographic distribution of tropical diseases they probably still need help by the developed nations to produce more research in this field.

Alfaraz and Calvino (2004) made a study on bibliometric analysis of the scientific production in the food science and technology (FST) field for the period 1991-2000, in Iberian-America (IA). Eight selected IA countries contributed 97.6% of the IA production and accounted for a 6.6% of the world production. The most frequent document type is journal article published in English. Retrieved records display characteristic authorship patterns and preferred subject areas. Spain, Brazil, Mexico, Argentina and Portugal determine the IA pattern of sources of publication. The fifty top ranked journals, 80% of which were indexed by the SCIE, encompass two-thirds of the IA production. The comparative production of IA countries, with linguistic, social and economical differences showed clear and striking trends. Quantitative different profiles of sources of publication were observed. The IA profile on the top 50 sources was largely determined by the average of Spain
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(68.3%), Brazil (62.2%), Mexico (46.2%), Argentina (60.0%) and Portugal (57.5%). Chile and Venezuela exhibited percentages lower than the average. Instead, Cuba showed the highest percentage (79.3%) of their publications included in the top fifty sources and this is due to the high frequency of publication in the first ranked source, Alimentaria. Food research reflects a typical collaborative pattern with four or less co-authors.

Ugolini et al. (2002) 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) and is based on the country of origin of all of the contributors. The study compares 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. The aim of the study was to compare two different methods used to evaluate research productivity in order to understand the extent to which the results are influenced by the methodology adopted. 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

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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. Some hypotheses are advanced, and care in the scientometric interpretation of data is urged. 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 are reported. As was expected, many categories other than oncology were represented (biochemistry, haematology, pathology, etc.).

**Tijssen and Van Wijk (1999)** performed a bibliometric analysis of Information and Communication Technology (ICT) during 1993-1996 by analysing CWTS database (based on the SCI). The result of the analysis was that USA was the leading country in both computers and data processing and telecommunication Technology with European Union countries and Japan following the suite. Of all the European countries UK is the topper of the list. Corporate sector contributed a sizable number of research papers in International Scientific and Technical Journal.

**Subbaiah Arunachalam and Kailash (1986)** made a study on scientometric analysis of papers published over a two-year period from the five Asian countries, viz. Indonesia (182) Malaysia (452), the Philippines (241), Singapore (258) and Thailand (447), and covered in Science Citation Index 1979 and 1980, and citations to them in the international literature of science as seen from SCI 1979-1983 reveals that despite the relative economic affluence, science in these countries is still on the periphery. Except in the

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Philippines, thrust in these countries seems to be in medical research as is evident from the large number of papers published in medical journals. In Philippines, medicine comes a close second to agriculture, which leads, largely thanks to the contributions of the International Rice Research Institute. Prolific authors, and institutions and journals often used by ASEAN Scientists, and the better-cited papers are identified. Most papers are published in low-impact journals and are rarely cited.

Subbaiah Arunachalam and Singh (1985) focused small countries practicing science rarely graduate to the level of performing quality research in sophisticated areas. An analysis of 130 papers on superconductivity published by Israeli researchers and indexed in Physics Abstracts 1971-82 reveal that Israel does pretty well in this area. Many of the papers appeared in high impact international journals, with Physical Review B (26), Journal of Low Temperature Physics (11) and Solid State Communications (10) leading the field. Israeli papers in superconductivity seem to belong to the mainstream literature in the area as seen from their decent citation record, which is better than that of Canada and almost close to that of the USA. Most of these papers are theoretical/computational and about 30% of them are experimental.

2.7 STUDIES ON INDIVIDUAL JOURNALS

Jeyachitra (2009) made a Scientometric study on Biomedical Science for the period of 1998-2007. In this study analyses growth literature, authorship pattern, country wise distribution, citation analysis etc. Some

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important findings were: 1) The study has examined that totally 785 articles have been published for the span of 10 years. 2) This study brings out clearly that the high level prevalence of collaborative research in the field of biomedical sciences. 2) This study examined totally 33611 citations published for the study period. 3) The overall journal citation is calculated the journal self-citation is 24.46 percent. This shows that this journal attracts article from other journals or other sources.

Shanthi (2009) investigated 935 articles in IEEE Transactions on Control System Technology for the period 1998 to 2007 collected from IEEE database. The articles were analyzed to study authorship patterns, year wise distributions of articles, author’s productivity and prominent contributors, country wise distribution of journals etc. Some important findings were: 1) The study has examined that totally 935 articles have been published for the span of 10 years. 2) The study examined totally 20579 citations published for the span of 10 years. 3) The findings of journal articles cited as references is 48.91% . The other form of references is 51.09%.

Aryati Bakeri and Peter Willet (2008) analyzed Malaysian Journal of Library and Information Science (MJLIS) from 2001-2006, and compares the results with those obtained in an earlier study by Tiew et al. (2002) covering the period 1996-2000. This results show that the number of publications has increased from the 76 articles in the Tiew study to 85 articles here, with statically significant changes in the types of article, in the numbers of references per articles and in the length of the articles. The complete set of

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161 articles attracted a total of 87 citations, 52 of which were self citations, with 14 per cent of the MJLIS articles having been cited at least once.

Kumar Anil et al. (2008)\textsuperscript{88} focused on publishing trend; impact factor; authorship pattern; types of articles; institutional collaboration of authors; affiliated institutions of authors; countries of contributing authors; keyword analysis, and referencing pattern. The number of articles being published in Pramana and its ISI impact factor are increasing. There is an upward trend in number of collaborated papers. Authors from University of Delhi, Delhi; Bhabha Atomic Research Centre, Mumbai; Physical Research Laboratory, Ahmedabad; Institute of Physics, Bhubaneswar; Indian Institute of Science, Bangalore; Tata Institute of Fundamental Research, Mumbai etc. contributed most number of articles. One fourth of the total articles published in Pramana are from outside India, the host country of the journal and the number of articles submitting from other countries is also increasing. The average number of references per article is found as 21.85 and it is 104.4 when the average is taken only for review articles.

Peter Willett (2007)\textsuperscript{89} reviewed the articles published in Volumes 2–24 of the Journal of Molecular Graphics and Modelling (formerly the Journal of Molecular Graphics), focusing on the changes that have occurred in the subject over the years, and on the most productive and most cited authors and institutions. The most cited papers are those describing systems or algorithms, but the proportion of these types of article is decreasing as more applications of molecular graphics and molecular modelling are reported.

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Biradar (2006)\textsuperscript{90} studied the references used in articles published in Indian Journal of Environmental Protection volumes 14, 19 and 24 for the years 1994, 1999 and 2004. This journal is published by Scientific Publishers and indexed by the Science Citation Index.

The study found that most articles were jointly authored rather than single authored papers. The degree of collaboration varies from year to year and is found to be 0.78 to 0.95. The overall degree of collaboration is found to be 0.85. Articles in the journal on an average had 11.59 references. Authors affiliated to universities were the major contributor (31.62\%) followed by colleges (24.05\%) and research institutions (23.78\%). The proportion of single-authored papers have decreased from 20.29\% in 1994 to 4.76\% in 2004.

BharviDutt et al. (2003)\textsuperscript{91} explored the Scientometrics of the International Journal Scientometrics. An analysis of 1317 papers published during 1978-2001. In this study following findings are noted: 1) Scientometric assessment constitutes about 34 per cent of the total output of the records which is highest among all the subject wise distribution. 2) The contribution of USA papers in the Journal Scientometrics is constantly decline, while the share of the Netherlands, India, France, Spain and Japan is on the rise. 3) The pattern of Co-authorship indicates the domination of single authored papers. 4) Scientometric research is highly scattered as indicated by the large number of publishing institutions spread over fifty countries. This is also reflected by the average number of papers per institution which is 0.85. 5) International collaboration is very high.
Halkar et al. (1998)\textsuperscript{92} made a bibliometric study on the Journal of Family Welfare drew the following conclusions: Maximum number of articles published in 1993 was the same as in 1997, \textit{i.e.} 37 (13.40\%). Authorship pattern showed that most of the papers were contributed by single authors (52.18\%) and went on decreasing by two and more authors. India contributed the maximum number of articles that is 80.07 per cent since the journal under coverage was from India. The average length of the papers was between 4 and 9 pages constituting 60.05 per cent.

Alemna (1996)\textsuperscript{93} analysed 69 papers published in the African Journal of Library, Archives and Information Science during 1990-1995 indicates that an increase in the number of publications from Africa, and also in the number of female contributors. It is also indicated that the major areas of interest are information technology and rural libraries.

Ramesh et al. (1996)\textsuperscript{94} investigated 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\%) and the degree of collaboration over this period varied from 0.90-0.95. The length of the articles between 1-5 pages were found to be at the maximum with 78.3 per cent.
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Scientometric analysis of IEEE Transactions on Power Electronics


