Chapter 2

Review of Literature
CHAPTER – 2
REVIEW OF LITERATURE

2.0 INTRODUCTION

The issue of publication and observance of its method for publication has been the subject matter of scrutiny and exploration for its better representation at various levels. These issues constitute a part of the larger field of study known as Bibliometric studies.

This chapter seeks to examine the exhaustive literature pertaining to Bibliometric studies. The review literature helps to understand the comprehensive overview of the past, present and future trends as well as to identify the research gap in the previous studies. To study and analyze the literature pertaining to the study i.e. “Research Output of Library and Information Science Faculty: A Bibliometric Study of Select North Indian Universities”, the researcher has reviewed wide range of sources including books, journals, conference proceedings, abstracting & indexing database as well as full text databases. Review of related studies further avoids the duplication of already work done in that area. The bibliometric study is helpful to examine the different aspects of a problem. It enables the researcher to identify the unexplored areas in order to create new grounds for research. The studies reviewed by the researcher to identify the gap in the literature and proceed further, has been discussed below in chronological order:

Varlejs & Dalrymple (1986) examined the publication output of the Library School Faculty. In the year 1983, Association for Library and Information Science Education (ALISE) directory was used to obtain the names of full-time faculty. There were 68 Institutional Member Schools with master programs accredited by the American Library Association (ALA) in the year 1982-83. A total of 725 visiting faculty and professors Emeriti appeared in the regular alphabetic sequence of full-time names which were included in the study. Each name was searched in the 1983 cumulative volumes of the Library Literature Index (LLI), Information Science Abstracts (ISA), and the Library and Information Science Abstracts (LISA). It was observed that women faculty members were less prolific publishers and less oriented towards Information Science than their counter parts. It was also found that they were
less successful in soaring through the academic ranks as compared to the men faculty members. The study revealed that 43% of the women faculty members produced 32% of the publication whereas men constituted 57% of the total faculty produced 68% publications.

Zachos (1991) evaluated research performance of the two Greek Universities Departments of Mathematics. For this study, the publication period was from 1975 to 1984 and the citation counting period was from 1975 to 1987. The study included faculty of two departments named Loannina and Patra excluding the visiting staff. The total research output of the departments named Loannina and Patra had 240 and 100 publications respectively. The Mathematical Reviews and Science Citation Index were used to collect the data. It was found that publication productivity in Loannina group was higher than Patra group but the impact and visibility produced by all publication output of Patra was higher at international level than Loannina. It was also observed that Patra group had a higher percentage of foreign citations than Loannina group i.e. 68% and 57% respectively. The researcher concluded that citation productivity (citations per scientist) were almost equal between the two groups.

Kim (1992) studied publication productivity of 556 part-time faculty members at the Schools of Library and Information Science in the 1988-1989 directories. Author searches were performed on each name in March 1990 updates of three CD-ROM databases: Library and Information Science Abstracts (LISA), Library Literature Index (LLI), and the Online Computer Library Center (OCLC)'s Search CD450 version of Education Resource Information Centre (ERIC). It was observed that out of total 1034 publications, only 48% of part-time faculty had at least one publication indexed in the above mentioned three databases. The study further observed that 44 % had at least one non-review item for a total of 817 items, and 39 % had at least one article for a total of 698 items.

Dalrymple & Varlejs (1995) evaluated the research output of faculty in the American Library Association (ALA) accredited master programs at three points i.e. 1978, 1983, and 1988. The study included different variable like rank and sex, determination of per capita publication rates and examination of proportions of the Library Science and Information Science literature for distribution of publications. In the years, 1978 and 1988 Association for Library and Information Science Education (ALISE) directories were used to obtain names of full-time faculty at the full
institutional members' schools. In the years, 1978, 1983 and 1988 the total faculty were 691, 725 and 644 respectively and publications were 539, 857 and 831 respectively. It was found that there was an increasing collaboration of Information Science and Library Science in the literature. It was also observed in rank-wise distribution that there was a statistically significant difference in the number of LIS male and female faculty. The highest productivity rate was found in the year 1988 i.e. 2.47. The authors concluded that LIS faculty productivity increased from 0.78(1978) to 1.29 (1988) publications, despite the fact that their total output fell between the years 1983 and 1988.

Sudhier (1997) discussed the scientific and technical research conducted in the research institutions at Kerala during the years 1979-1994. The researchers used Indian Science Abstract (ISA) to retrieve data for the study and got 86827 total numbers of papers and out of these 1582 papers belonged to Kerala. It was observed that there was a three-fold increase in the annual contribution of 15 year period. The authors also discovered that the subject field of agriculture was the preferred area in Kerala. There were maximum two or more authored publications. The researchers concluded that the bibliographic control of Science &Technology literature of Kerala was an ignored field.

Ho (1998) investigated the measurement of the publication outputs among the three faculties of Business, Education, Humanities and Social Sciences in the 6 universities of Hong Kong. The data was collected from the Annual Reports (1990-95) of research and publication outputs of every University. The author divided the universities under study into two groups on the basis of their publication i.e. a high group and a low group. The author examined that the academics in the Faculty of Education were more productive than in Business, Humanities and Social Sciences. The researcher highlighted that there was a fluctuation between these 5 years in the publication output of universities under study. It revealed that the average annual publication outputs of an academic in the six universities during the period 1990–1995 were 7.4. The author concluded that a lecturer had 6.8 average outputs of an article in a local journal per year.

Bandyopadhyay (1999) scrutinized 92 doctoral dissertations submitted to the University of Burdwan, India (1981-1990) by the scholars of Mathematics, Physics, Mechanical Engineering, Philosophy and Political science. A total number of 11,228
references were appended to the theses under the study, out of which 6844 were journal articles. The study revealed that Bradford Multiplier for Mathematics, Physics, Philosophy and Political Science as a whole were 4.32, 6.62, 5.21 and 6.36 respectively. The study concluded that Bradford law was fitted well in many humanities and Social Science subjects but could not be incorporated in Science subjects.

Garg & Padhi (2001) analyzed collaboration in Laser Science and Technology. The data for the study was collected from Vol. 27 i.e. May 1990 to April 1991 of the Journal of Current Laser Abstracts (JCLA) published by Laser Focus, USA. 3174 papers were published in journals in the field of Laser Science and Technology. The researcher revealed that out of total 3174 publications, there were only 401 single-authored and 2773 were multi-authored publications. Only 687 publications out of 2773 publications written in local, domestic and international collaboration. The author observed that Japan, France, Italy, and the Netherlands contributed more multi-authored papers whereas Canada, China, and Australia contributed highest single-authored papers. The values of collaborative co-efficient and co-authorship index revealed that theoretical laser research had less collaboration as compared to experimental and application oriented laser research. Academic institutions were the biggest collaborators in this field of science and technology.

Al-Ghamdi (2002) analyzed the factors associated with research and publication productivity of library and information studies’ faculty in Saudi-Arabian universities. Two techniques of survey research were used in this study: The questionnaire and the interview. The study gathered its data from (56) LIS faculty and (4) the Deans of the Deanships of the Scientific Research Departments in Saudi Arabian universities. All the full-time faculty members who held a Ph.D. degree were included in the study regardless of their rank in the department. The study indicated that the higher the rank of the faculty members, the greater their research and publication productivity. The faculty workload was significant in influencing the research and publication productivity levels of LIS faculty members at Saudi Arabian universities.

Kannappanavar, Swamy & Kumar (2004) highlighted productivity of information generators in the field of Chemistry. The study undertook Indian Science abstract (ISA) as the database for collecting data from 1996 to 2000. There were
13587 total numbers of papers. The authors revealed that majority of papers were multi-authored. The degree of collaboration and team work in the discipline was maximum i.e. 0.83. The average number of authors per paper had increased from 7.52 in 1996 to 8.39 in 2000. In 1998, the average number of authors per paper was maximum i.e. 13.97. The researchers concluded that the trend towards collaborative research was increasing in the Chemical Science.

**Sivaraman (2004)** revealed the research output of faculty members of Tamilnadu Universities in the field of Science and Technology. The study covered the period from 1991 to 2002. The study examined the total of 5051 research output. The data for the study was gathered from Science Citation Index (SCI). The findings of year-wise distribution of total research output of Tamilnadu Universities brought out the fact that the scientific publication output by universities was with the pace of gradual growth trend during the study period, which was accounted from 278 to 546 over the study period. The University of Madras shared the highest per cent of research output performance over the study period. Journals were most preferred form of publications. The highly concentrated subject area of faculty members was chemistry, physics and their sub fields which record 35.71 and 31.52 per cent respectively. Among the total science publications of Tamilnadu universities, multi-authored papers dominate with the high per cent of 94.50. The Bradford's distribution was not applicable.

**Kademani, Kumar, Kumar, Sagar, Mohan, Surwase, & Gaderao (2005)** analyzed the 475 papers published by the Bio-Organic Division of Bhabha Atomic Research Centre (BARC) during 1972-2002 in various domains. The source of data collected was BARC Annual Progress Reports. The highest number of publications in a year 2001 was 38. The average number of publications per year was 15.3 and the highest collaboration coefficient 1.0 was found in the years 1972, 1976-1977, 1980-1985, 1987, 1989-1990 and 1993. A. Banerji (125) was the most prolific author. Indian Journal of Chemistry (56) was the highly preferred journal.

**Patra & Chand (2006)** carried out a bibliometric study of Library and Information Science research literature in India. The data for the study was collected from Library and Information Science Abstracts (LISA). The study covered the period from 1967-2004 and downloaded 3396 total number of publications. Bradford’s Law of Scattering was used to identify core journals of Library and Information Science. It
was found that core journals were mostly of Indian origin. Lotka Law was applied in the study. Indian authors’ contribution in international journals was very low. The study also found that majority of publications were single authored i.e. 75% and list of authors who had published 10 and more papers under study were 37 (1.35%).

Sevukan, Nagarajan, & Sharma (2007) analyzed research output in Plant Sciences of the faculties in central universities of India. There is the total of 348 bibliographic records of Plant Sciences retrieved from ISI Science Citation Index Extended (SCIE) for a period of 10 years from 1997-2006. The results of the study revealed that the Plant Science literature had grown steadily during the study period except for 1997-2002. The study revealed that the journal articles occupy the highest percentage of output i.e. 95.34%. The Participative Index (PAI) of Jawaharlal Nehru University (JNU) was 23% of total research output of specified universities during the period of study. The productivity of authors was found to be fitted Lotka’s distribution and scattering of journal articles did not fit into Bradford’s distribution. The study concluded that there was no upward sight of collaboration at national and international level. Major individual contributions were from Banaras Hindu University. Faculties preferred to publish their papers in international journals from foreign countries.

Yazit & Zainab (2007) attempted to measure research output of Malaysian Library and Information Science. The study covered the publications produced from 1965 to 2005 by Malaysian authors published in Malaysia as well as abroad. The data were collected from seven online databases and well-established library online public access catalog (OPAC) which were expected to hold current library and information science publication. The results indicated that Malaysian LIS authors preferred to publish in journals. The study revealed that a total of 506 authors contributed 1,045 publications. Management of library and Information services were preferred subject area of research. The multi-authored work was gradually increasing each year even though single-authored still dominate the authorship pattern.

Al-Jaradat (2008) analyzed the published output of the faculty members of the Jordanian Government Universities, specifically in the fields of Science and Technology (1995-2005). The collected data included 5880 references published in 524 journals. The data for the study had been collected from comprehensive and appropriate sources of literature in the field of Science and Technology. It was found
that faculty members of Jordanian Universities preferred to publish in the periodicals issued from Jordan itself. 'Dirasat' published from the University of Jordan occupies the first position amongst the top seven core periodicals. It was found that their total contribution in 1995 was 384 and 789 publications in 2005. The study showed that the first rank was occupied by Jamal R. Qasem (Department of Agriculture, University of Jordan) with 36 publications. The results indicated that the faculty members of Jordanian universities preferred to work usually independently, as 48% of publications under study showed single authorship.

**Kumbar, Gupta, & Dhawan (2008)** conducted the study which indicated the research output of scientists at the University of Mysore in Science and Technology. There were total 1518 research papers retrieved from Scopus during 1996-2006. The authors analyzed the international collaborator’s share of research output at the overall level as well as across various subjects also indicating the major countries involved in international collaboration. The international collaboration research activity in the university was very less i.e. 14%. The authors concluded that research activity in the University of Mysore in Science and Technology was growing by an average rate of 23% per annum. The USA contributed maximum publications in collaboration with university of Mysore.

**Sevukan & Sharma (2008)** scrutinized the research output of Biotechnology faculties in central universities of India from 1997-2006. The data used for the study was retrieved from two database sources, namely, PubMed, National Centre for Biotechnology Information (NCBI) and ISI Web of Science database—Science Citation Index Expanded (SCIE). Out of the total 345 records, 16 records found duplicate and were deleted. Therefore, total numbers of records for the study used were 329. The results indicated that the growth of literature in biotechnology had steadily increased from 15 articles in 1997 to 43 articles in 2006. The study indicated that the two-authored publications predominated amongst the pattern of authorship. It was observed that faculties in central universities of India preferred to publish in journal form. Babasaheb Bhimrao Ambedkar University (BBAU) contributed highest publications i.e. 43%. Lotka Law was applicable in the study whereas Bradford Law was not fit to the study.

**Jahan (2009)** analyzed the Scientific Research (Life Sciences, Physical Sciences and Health Sciences) in central universities of Northern India during the
period 2000-2008. The data for the present study was retrieved from SCOPUS database. There were total 16317 articles in Science Literature under the period of study. The research output of the universities under study in scientific literature was increasing every year in an average of 303 papers per year. University of Delhi (DU) (7,031) is the most productive university. Jawaharlal Nehru University (JNU) and DU had highest inter-university collaboration. The study indicated that out of the top ten most preferred periodicals authors from Aligarh Muslim University (AMU), Allahabad University (AU) and Banaras Hindu University (BHU) preferred to contribute articles both nationally and internationally, whereas authors from DU, Jamia Millia Islamia (JMI) and JNU preferred periodicals of foreign origin. The most prolific author in all six central universities was Anil Kumar Singh (144), Dept. of Chemistry, DU. The study concluded that the exception of BHU, none of the universities in this study was currently accredited by National Assessment and Accreditation Council (NAAC).

**Krishnamoorthy, Ramakrishnan, & Devi (2009)** scrutinized the diabetes literature (97454) found in the MEDLINE database for the period 1995-2004. It was observed that a maximum number of records i.e. 13244 were during 2003, followed by 12690 in 2002 and 11061 in 2001. The study revealed that 81% were journal articles. The Relative Growth Rate (RGR) had decreased from 0.74 (1995) to 0.10 (2004). The Doubling time had increased from 0.94 (1995) to 7.13 (2004). The most preferred journals were Diabetes Care and Diabetes from the USA. The Trend of research publications confirmed the implication of Bradford’s Law.

**Sarala (2009)** analyzed the Scientific Productivity of faculty members of Kerala Agricultural University. The data gathered from national & international databases, Annual Reports, and through the questionnaire. The period for the study were from 1998 to 2008 (11 years), a total of 2506 publications were taken as the baseline data. It was observed that in agricultural science, contributions as conference papers formed the main vehicle for information transfer. This study also revealed the fact that the trend was towards multi-authorship. The study showed that for the first five years of the study 1999-2003, the mean doubling time was 3.06, and for the last five years from 2004-2008, it reached to 5.88. The findings indicated that the intensity with which authors were involved in the scientific activity, measured in terms of publications, was not distributed in a Lotka’s pattern. The researcher concluded that
the most prolific authors identified in this study were holding important positions in the University.

Sharma (2009) analyzed research articles published by the scientists of the Central Potato Research Institute (CPRI) during 1991 - 2007. There were 2603 research publications found from annual reports of CPRI and Journal of Indian Potato Association. The study showed that the majority of the scientists preferred to publish research papers in joint authorship. It was observed that the year 2003 was the most productive year in the whole study i.e. 294 (11%). The highest degree of collaboration (DC) were in 2007 i.e. 0.97. The study further showed no uniform pattern of literature growth.

Kaur & Aggarwal (2010) undertook a bibliometric study of research publication of the Department of Chemistry, Guru Nanak Dev University, Amritsar (2002-2006). The data was collected from Science finder. It studied 269 research publications from a total of 84 journals. Amongst the total publications of the department during the period of study, 86 % of publications were contributed by 46 journals and remaining 14% of publications were contributed by 38 journals. The department published 40 papers in science journal in the year 2002 which rose to 69 papers in the year 2006. Organic Chemistry was the most preferred area publications. It was found that faculty members preferred to publish in the collaboration with department faculty only. The majority of papers published had three-authored i.e. 32% publications.

Kumar & Naqvi (2010) carried out a bibliometric analysis of the research output of Jamia Millia Islamia University, New Delhi, in the field of Natural Sciences. A total 1313 records in the form of journal articles (984), conference papers (273) and books (56) were analyzed for the period 1971-2007. The data for this study were collected from bio-data of authors, databases, and annual reports. Bradford’s Law and Lotka’s Law were tested and found applicable to the data. The authors rejected the hypothesis that the scholarly journal article was no longer the single most valid way of judging the research performance of the faculty. It was found that the research output of the faculty of Jamia had increased since 1988 after it was made a Central University. It was also found that the collaborative patterns were more prominent in Physics, Chemistry and Biosciences and less in Mathematics, Geography and Computer Science.
Okafor & Dike (2010) analyzed the research output of academics in the Science and Engineering faculties of Federal Government Universities in Nigeria. The study covered the period from 1997 to 2006. Data was collected through a questionnaire survey of the academics. The study revealed that a total of 2769 journal articles were published by 291 academicians. The results of this study showed that the academics publish more in local journals than in overseas journals. The study revealed that 31% of the academics published between 0-4 journal articles that only 3% of them published 30 or more journal articles during the period, and 42% of the academicians did not have any article in overseas journals and 13% academicians did not have any article in local journals. The Journal of Mathematics Society of Nigeria was the most preferred local journal and Journal of Bioresearch was the most preferred overseas journal.

Ahila & Nagarajan (2011) screened the research output performance on Pharmacology. A total of 22,065 research articles published under study. The data for the study was collected from the Web of Science. The study covered period from 1999 to 2010. The study found that till 2007 the publication output was 71% and the balance 29% output was only during the last 3 years. The average publication per year showed that it decreased to 27 during the period 2002-2004 and improved in the 2008-2010 period to 374. Only 1.5% of the articles were contributed by authors in India and ranking 11th among 15 countries. The study indicated that there were 54% publications contributed by more than three authors. Among the 12 years of contribution of articles degree of collaboration varies from 0.82 to 0.87.

Sudhier & Abhila (2011) analyzed the research productivity of social scientists at the Centre for Development Studies (CDS), Thiruvananthapuram, during 1998-2008. The data was collected from the Annual Reports of CDS. There were 599 research articles published by the CDS researchers. 38% of research articles were published in the category of journal. In the subject-wise distribution Kerala’s developmental issues (32%) and industry, technology & development (26%) were the preferred areas of research. The respondents contributed maximum publications as Single-authored publications. The degree of collaboration was found to be 0.43. More than 66% of journal articles published were in Indian journals and 33% were published in foreign journals. Economic and Political Weekly was the most preferred journal (34%) The journal distribution pattern of the CDS publications did not fit
Bradford’s distribution pattern. The authors concluded that the productivity of the social scientists of CDS showed substantial growth both quantitatively and qualitatively with the development of the institution.

**Sundararajan & Ponnudurai (2011)** analyzed the research output belongs to Fauna of Marine Biology. The data on Fauna of Marine Biology research publications were gathered from Aquatic Sciences & Fisheries Abstracts (ASFA) database (1980 - 2004). There were 270855 publications retrieved. It was observed that relative growth rate (RGR) decreased gradually from 0.57 in 1980 to 0.01 in 2004. The study period recorded the mean relative growth rate of 0.14. Contrarily, the doubling time (DT) of publication of Marine Biology research output had increased from 0.89 in 1980 to 69.30 in 2004. The DT time for publications at the aggregate level had found 11.11 years. However, RGR had shown a declining trend, which means the rate of increase was low in terms of proportion, and this had been highlighted by the DT for publications, which was more than the RGR.

**Baby & Kumaravel (2012)** examined bibliometric analysis of relative growth rate and priority index of the Journal of Clinical Microbiology. The study considered bibliographic features of the articles published in Journal of Clinical Microbiology (JCM) from 2006 - 2010. 3443 articles were published within 5 years. The highest percentage of articles was published in the year 2010(21.55) and 2006 (21.46). The average number of article publication was 688 articles per year. The most popular subject category among the authors of clinical microbiology was Bacteriology. In the years 2008 and 2009 only 3 subjects had higher priority. The study preference showed that multi-authored distribution occupies a very high level compared to single author contribution. The study revealed that a maximum number of issues (327) had published in the month of November. The finding of the overall growth rate of publication had shown more or less a similar trend.

**Baby & Kumaravel (2012)** focused on the research productivity of Periyar University faculties in Tamilnadu, India. The data used for the study were retrieved from the Scopus database i.e. 322 publications. The time span was 13 years (1998 - 2010). The laws of Lotka and Bradford were tested and found not applicable to the study. The results indicated that the growth of research had steadily increased from 01 article in 1998 to 102 articles in 2010. The relative growth rate and doubling time were 0.45 and 2.27 respectively. The study noted that the respondents preferred to
publish as three-authored publications amongst the pattern of authorship. The journals were the most preferred category. The degree of collaboration, coefficient collaboration and collaborative index were found to be 0.98, 0.34 and 3.25 respectively.

**Rajeshwari & Nagarajan (2012)** brought out the contribution of arts faculties of Annamalai University, Tamilnadu. The study used 5 years publication output data from 2006-2010. The data for the study was taken from the annual reports of the university. There were 2299 publications under study. The results showed that there was significant growth of research productivity in the faculty of arts from 180 in the year 2006 to 775 in the year 2010. The department of Commerce had highest 607 (26 %) publications. Out of total publications, 1010 (44%) publications were distributed as the journal article. The authorship pattern showed that there were highest single-authored papers (1647, 72%) than multi-authored. The Degree of Collaboration of publications was 0.28.

**Sevukan & Arivoli (2012)** revivied the research trends among academics of Pondicherry University during the period 1998-2009. The data used for the study were obtained from Science Citation Index Expanded, Social Science Citation Index, and Arts & Humanities Citation Index. A total of 704 records were retrieved for a period of 12 years. The authors used statistical tools and techniques to calculate the Relative Growth Rate (RGR), Doubling Time (DT), etc. The highest output was observed in 2009 (11.36 %).The mean relative growth rate for the periods were 1998-2003 (0.73) and 2004-2009 (0.19).The mean doubling time for the two periods (Phases) were 1.12 and 4.78. It was observed that Chemistry occupies highest publications 181 (25.71%).It was found that two authored papers rank first with 216 papers (30.68 %).The degree of collaboration for the period (1998 to 2003) was 0.97 and (2004 to 2009) was 0.93.The results showed that faculty in Pondicherry University preferred to publish their research contributions through the international sources rather than Indian sources.

**Suradkar & Khaparde (2012)** scrutinized the subject library management covered 11 volumes of LISA for the period of 10 years i.e. (2000-2009) and gathered 12263 articles. The year 2004 contributed highest number of publications i.e. 1412 (11%). The mean for Doubling Time (DT) for the first five years was only 1.55 which was increased to 5.64 during the last five year. The mean value for the overall
Collaborative Co-efficient (CC) and Degree of Collaboration (DC) for the year 2000-2009 was found to be 0.16 and 0.28 respectively. The respondents preferred to publish their research work in the category of journal i.e. 9048 (74%). UK ranked 1st by contributing 2310 (19%) of records whereas India ranked 3rd among other countries by contributing 1774 (14%) of records.

Yang & Lee (2012) assessed the research patterns and trends of Library and Information Science (LIS) of 159 Korean LIS professors’ 2,401 peer-reviewed publications (2001-2010). The data were collected from Korean Research Information System, National Research Foundation and databases. The year 2009 contributed highest publications i.e. 325 (14%). The researcher revealed that LIS faculty in Korea published on average 1.5 papers per person each year, 1.4 of which was domestic and 0.1 was international. The Journal of Korean Library and Information Science Society (559) stood 1st in the list of top domestic journals, preferred by faculty to publish their research articles. The Journal of the American Society for Information Science and Technology (15) was most preferred journal in the list of International journals. In the category of conference proceedings (CP), proceeding of the American Society for Information Science and Technology was the most preferred CP with 19 papers.

Ahmad & Warraich (2013) analyzed the literature produced by faculty and students of Library and Information Science schools in Punjab, Pakistan from 2007 - 2012. The data gathered were 170 articles during the study period. The respondents were contacted via e-mail, telephone and personal conversations. The majority of articles had been written by two authors. The study depicted that there were 55 (32%) papers got published in Pakistani journals and 115 (68%) in international journals. “Library education” was the preferred area by researcher’s i.e.54. The author concluded that LIS faculty and students in Punjab now preferred to work in the category of two-authored articles i.e. 91 (54%).

Aswathy & Gopikuttan (2013) scrutinized the publication pattern of faculty members working in all the 3 universities located in the state of Kerala, covering the study period over the span of 5 years i.e. 2005 to 2009. The data for the study (734) had been collected through annual reports and websites of the aforesaid universities. The University of Kerala (UOK) contributed highest publications i.e. 966 as compare to other 2 universities. In year-wise publication, again UOK had contributed highest publications in the year 2007 i.e. 238. Amongst the 3 universities, UOK had
maximum degree of collaboration i.e. 0.93. It was found that Lotka Law was not applicable to the study. The study also concluded that experience and productivity did not mean much.

Baskaran (2013) analyzed the research productivity of Alagappa University during 1999-2011. The study was based on the data retrieved from Web of Science. The total publications produced during the study period accounted for 776. The Relative Growth Rate (RGR) was found to be a fluctuating trend during the study period. The Doubling Time (DT) was also found to be fluctuating trend in this study. The degree of collaboration and its mean value was found to be 0.96. The respondents preferred to publish in multi-authored papers 750 (96.64%). South Korea ranked 1st by producing 7.61% of collaborative papers out of total research output. The subject-wise contribution of research publications by the researchers from Material Science showed number of papers with 172 (22.26%) from the research output. The study revealed that the top 3 institutions with Alagappa University were Central Electro Chemical Research Institute, National Cheng King University, and Anna University.

Bathrinarayanan & Tamilzhchelvan (2013) examined the bibliometric analysis of the MEMS output in Scopus database during the year 1988-2012. A total of 86978 records were retrieved and analyzed. There were maximum publications in 2010. The study also observed block year-wise research output. 2008-2012 showed a large part of the total output i.e. 36918 (43%). It was observed that journals were most preferred form i.e. 56402 (65%). The study revealed that 20925 (24%) of the total articles were contributed by the authors from the USA. Among the 16 countries India positioned itself in 9th place with 1684 publications. The contribution of India was found to be nearly 2% of World Output.

Dwivedi (2013) investigated research activity in 3 sub-disciplines of Chemistry of 3 central and 3 state universities of Uttar Pradesh during 2000-2009. The data for this study was obtained through questionnaires and from the official websites of the concerned universities. The numbers of total publications were 2164. Analysis of data indicated that central universities published more papers as compared to the state universities. Aligarh Muslim University produced the highest number of papers among all universities i.e. 674 (31%). In block-wise distribution of publications, 2005-2009 hold highest publications i.e. 1290 (60%). The pattern of output during the period of the study did not follow any trend. The activity profile of
different universities indicated that Organic Chemistry was the preferred sub-
discipline of research i.e. 827 (38%).

Okpe, Simisaye, & Otuza (2013) investigated the patterns of research output
publications of the faculty of Babcock University, Nigeria (2001-2012). The author
adopted survey design as a method of data collection. The study consists of 154
faculties of Babcock University. Data was retrieved using questionnaire. It was found
that male faculty members (62, 55%) had more publications as compare to female
faculty members (51, 45%). The author in the study adopted 3 categories: single
authored, joint authored and multiple authored. It was found that single authored
publications were highest i.e. (85, 76%) closely followed by joint authored
publications (82, 73%). Male faculty members had more publications in text book
(55%), edited works (58%), workshop papers (70%) and seminar/ conference papers
(59%) except journal articles (45%). In journal articles female faculty members (60%)
had more publications as compare to the male faculty members.

Kavitha & Ponnudurai (2013) analyzed growth of Indian health science
publications. For this study, the literature on health sciences data gathered from
Scopus (1970-2012). A total of 2,234 data was found. It was observed that among 25
countries, 89% publications were from health science, out of which India occupies the
tenth position with the contribution of 2%. The study observed that during the last 6
years there was a substantial increase in the publications. It was observed that the
majority of the health science literature was published as the journal article (70%). All
India Institute of Medical Sciences was on the 1st position. Environmental Monitoring
and Assessment (124 articles) and Asian Journal of Microbiology Biotechnology and
Environmental Sciences (85) journals were the major contributors in health sciences.
It was found that only 12% publications were single authored and 78% publications
were in collaborations. Relative growth rate was linear in nature.

Khaparde & Pawar (2013) examined the 12 volumes and 132 issues of
Library and Information Science Abstract (LISA) from 2000-2009. The study
contained total 17917 articles. The year 2000 had highest publications i.e. 2513 (14%)
and lowest publications contributed in the year 2007 i.e. 1310 (7%). The average
number of authors per article was 1.80. In the study, the degree of collaboration (DC)
during the overall 10 years (2000-2009) was 0.71 but the year wise DC was almost
same in all the years and the mean value of DC was 0.49. In the 10 years of the
period, the multi-authorship articles were higher and predominant on single authorship. The mean relative growth rate (MRGR) showed progress. The MRGR for first 5 years were 0.28. On the other hand, the MRGR for the last 5 years reduced to 0.59.

Maharana & Sethi (2013) dealt a bibliometric assessment of scientific research output of Sambalpur University. The data was drawn from Web of Science database (2007 to 2011). The author retrieved 170 publications belong to Sambalpur University. The study found that there were a maximum number of 4 authored papers (29%) published which was followed by 3 authored (29%), two authored (17%) etc. A total of 707 authors contributed 170 number of papers out of which 317 authors were affiliated to Sambalpur University. Average author per paper (AAPP) was highest in 2009 (2.52) and Productivity per author (PPA) was highest in 2011 (0.64). Authors preferred to publish their paper in collaboration. There was only one paper published as single-authored. It was analyzed that Chemistry was the most preferred research area followed by Physics (24%), Astronomy and Astrophysics (11%).

Panneerselvam & Saravanan (2013) analyzed the research output of B.S. Abdur Rahman University from 1996 to 2011. Bibliographic data were collected from Web of Science for this study. The study revealed that total of 455 authors had contributed 140 articles. The authors examined that the highest number of publications 22 (16%) found in the year 2008. About 74.29% (104 articles) were published in Journals. Results of study indicated that highest numbers of papers had written by co-authors. The highest articles were two-authored (46, 33%). Multi-authored contributions were more than 98%. The degree of collaboration was found to be 0.09. Shanmugam was the most prolific author (11, 8%).

Pillai & Priyalakshmi (2013) scrutinized the research publication trend among the scientists of Central Tuber Crops Research Institute (CTCRI). The study highlighted the bibliographic details of 1076 research articles during the period of 2000 to 2010. The researcher collected these details from the annual reports of CTCRI and analyzed it. It was found that the highest numbers of 169 papers were published in the year 2006 and the average numbers of publications per year were 97.82. The scientists under study preferred to publish their research in the authorship pattern of multi-authored (87.68%). The degree of collaboration of scientists of CTCRI was 0.87 and most of the articles published by the scientists were in the international journals.
Journal of Root Crop published by Indian Society of Root Crops topped the list with the highest number of articles 125 (39.30%). Bradford’s Law did not fit in this study.

Singh (2013) assessed the Physics output during 2001-2010. The data presented in this paper was accessed from Web of Science. The study evaluated 744 research outputs of various Indian Universities especially in the field of Physics. The global share of publication in the field of Physics showed that out of total publications (183754), 2.9% were contributed by India (5429). During 2001-2010, USA contributed 35.2% followed by Japan (11.2%), and Germany (11%). India ranked at 12th position among the top 25 countries. The Physical Review letters were the most preferred journal by Indian Universities (119, 16%). The authors concluded that the USA ranked at the top position with 64,826 publications while Austria ranked at the bottom position with 1,833 publications. The author, S. Banerjee was the most prolific author among Indian Universities.

Sankari & Chinnasamy (2013) examined bibliometric analysis of the Journal of Biomedical Engineering during the period 2000-2005. For this, the relevant data were gathered, recorded, tabulated and analyzed for making observations. Total data collected was 462. It was observed that highest number of articles were published in the year 2001, i.e.83 (17.97 %). The overall study period had witnessed a mean relative growth rate (0.27). Significantly, the doubling time for article output had decreased from 0.36 during 2000 to 2002 and to 0.19 in the year 2003 to 2005. The whole study period had witnessed the mean doubling time for article output as 2.57. The study revealed that out of 462 Research Articles, 132 (28 %) contributed by single author and the rest 330 (71 %) research articles were contributed by multi authors. It was found that the 763 authors produced 462 articles with an average of 1.66 authors per article.

Singh (2013) analyzed the Scholarly Physics Output of Central Universities of Uttar Pradesh and Delhi. The data for the study was retrieved from Web of Science (2006-2010). The author studied about the 1936 publications output of Indian Central Universities namely University of Delhi (UOD), Banaras Hindu University (BHU), University of Allahabad (UOA), Aligarh Muslim University (AMU) and Jawaharlal Nehru University (JNU)) in the field of Physics. It was found that the research output of Indian Central Universities indicated a continuous growing trend. UOD had topped
in the rank list followed by BHU and UOA etc. The authors examined that Indian author of central universities preferred to publish their papers in foreign journals. The maximum publications were published in the year 2010 (509, 26%). The author R. Kumar (78) was the most prolific author affiliated to AMU.

Sivakumar & Sivaraman (2013) scrutinized the fitness of Lotka’s Law on the Biology and the growth of publications in the field of Biology of central universities in India. The data used for the study were obtained from the ISI Web of Science-Science Citation Index Expanded (SCIE). The whole data of study was based on SCIE in 19 central universities in India (1999-2012). A total of 8820 records of various types comprising articles, meeting abstracts, reviews, bibliographic items, editorial material, letters, corrections and news items were gathered. The University of Delhi contributed highest publications among the universities under study (1984, 23%). It was observed that there were 6793 authors contributed only 1 paper followed by 1796 authors contributed 2 papers. The results of analysis brought out a fact that when the number of contributions increased, the number of authors decreased. The author used the inverse square law of scientific productivity to find the validly of Lotka law. It was found that Lotka law did not applicable in this study.

Thirummagal (2013) analyzed the bibliometric study on the publication of ‘Osteoarthritis’ research. The records data was collected from PubMed resource MEDLINE (2001-2012). The total numbers of records for this study were 31465. In authorship pattern, respondents preferred to publish in the category of 4 authored (4859, 15.4%) closely followed by 5 the category 5 authored (4737, 15.1%). The year-wise degree of collaboration ranged from 0.84 to 0.94. The study revealed that relative growth rate decreased from 0.72 to 0.14. The doubling time increased from 0.95 to 5.12 over the time span of 12 years. In the country-wise distribution of publications, The USA was at the 1st position with 12238 records. Journal article contribution was 66%. “Osteoarthritis Cartilage” journal got the 1st rank.

Barik & Jena (2014) analyzed the growth of Library and Information Science (LIS) research articles in India. The data was collected from the Scopus database using "Library and Information Science" and "India" as the keyword for search. A total of 385 articles were gathered for the period of 2004-2013. All the bibliographic data of the retrieved data were recorded in a MS excel spreadsheet and the analyses of recorded data were done by simple statistical percentage and average. The year-wise
growth of publications showed that the highest contributions were found in the year 2013 (80, 21%). The respondents preferred to publish their article in the authorship pattern of two-authored. Lotka’s inverse law was applied and found that the numbers of authors observed were different with the numbers of authors expected. The mean degree of collaboration was 0.32. Social sciences were the most preferred area by authors. B.S. Kademani was the most prolific author. The Average Authors per Articles (AAPA) was found to be 1.96 and Productivity per Authors (PPA) as 0.5.

Chaurasia & Chavan (2014) highlighted the research output of Indian Institute of Technology Delhi (IIT Delhi). The study covered research publications of various departments/centres i.e. 6109 of IIT Delhi from 2001 to 2010. The data was retrieved from Institute for Scientific Information (ISI), Web of Science database-Science Citation Index Expended (SCIE). The journal articles were found to be the most favored document type with 5731 (94%) documents. It was observed that the faculties of IIT Delhi preferred the foreign journals to publish their articles. The average growth rate was found 10.37. Three–authored was the most preferred pattern of authorship (2061, 34%). The mean average publication per author was 0.31. The degree of collaboration of IIT Delhi was 0.96. The research output of faculty members of IIT Delhi showed substantial growth both quantitatively and qualitatively with the development of the institution. Journal of applied polymer science was the most favored journal and M.N. Gupta was the most prolific author in the study.

Ghosh (2014) analyzed research publications of Council of Scientific & Industrial Research (CSIR) – Indian Institute of Chemical Biology (IICB), Kolkata (2001-2010). Data on research output in terms of publications was collected from Web of Science (WOS) and Annual Reports published by CSIR-IICB. On 31st May 2001 there were 108 scientists at CSIR-IICB and reached to 71 on 31st March 2010. There were 1228 documents published in the form of scholarly output. It was observed that there was a steady growth in a number of publications during 2001 – 2006 which gradually decreased except the year 200. Out of 1228 research publications, a maximum of 1041 documents were published in the form of research articles. It was observed that out of total 447 journals preferred by scientists, Journal of Neurochemistry ranked 1st (27, 2.20%). Leishmania was the major area of research preferred by scientists (223, 18.16%). papers. In authorship pattern, the highest papers were published as 4 authored (241, 20%).
Gopikuttan & Aswathy (2014) evaluated the research productivity of the University of Kerala based on the data collected from Web of Science (2000 - 2012). There was 1068 number of articles during the study period. In year-wise productivity, there were highest publications in 2011 (126, 12%). Biology was the most preferred subject (274, 16%). Dr. T.S. Anirudhan was the most prolific author affiliated to chemistry department of the University of Kerala. 873 (82%) articles were published in Indian journals. The subject-wise distribution of authorship pattern of teachers of the university of Kerala revealed that in Biology, Mathematics, and S&T, there were 7 single-authored papers while in Physics, Geology and chemistry the single-authored papers were 1, 2, and 4 respectively. The value of Collaborative Coefficient (CC) varied from discipline to discipline. The chemistry had the highest CC i.e. 0.37 and the Mathematics had lowest CC i.e. 0.22.

Hadagali (2014) explored the contribution of scientists and researchers from Karnataka (India). The study presented the growth of literature published by the scientists of Karnataka. The data was collected from Web of Science. A total of 44,446 publications and 3,56,323 citations were received during 1999-2011. Among the different states in India, Maharashtra topped the list with 53,414 publications in all disciplines. The results of the study showed that the highest number of publications were 5576 (12 %) in 2011, while the average number of publications per year was 3418. The highest number of citations i.e. 36,059 (6 %) occurred in 2004 and the lowest (5168 citations) for the year 2011. Relative Growth Rate (RGR) decreased from 2000 (0.73) to 2011 (0.14) whereas Doubling Time (DT) increased from 2000 (0.94) to 2011 (4.95).

Jeyshankar, Nageswara, & Vellaichamy (2014) analyzed the research output of food and nutrition literature in India. A total of 1291 Indian contributions covered in SCOPUS database were analyzed the academic productivity of food and nutrition scientists in India during the period of 1960-2011. The analysis showed the declining trend during 1982-1986, and thereafter there was an increasing trend. The growth rate was found to be maximum during the period 1972-1976 and the minimum during the period 1982-1986. The average growth rate was found to be 0.58. The most preferred bibliographic form was articles (1012, 78%). The study revealed that among the single, double and multiple authored publications. Multiple authorship forms 56% of the total research literature output. The authors revealed that the degree of
collaboration in authorship trend works out to be 0.50. The out of the total 1291 journals, the Journal of Food Science and Technology was ranked 1st with 8% of the total periodical literature output during the period under study.

**Khan, Jan, & Amin (2014)** evaluated research trends in select faculties of the University of Jammu in various subject fields of Sciences, Life Sciences and Mathematical Science. In this study, the data was obtained from the Scopus database during March 2011-May 2011. The study exposed that 1237 research contributions were published during the 39 years (1972 to 2011) by the 15 departments under study. It was found that Physical Review C Nuclear Physics (60) was the most preferred journal by researchers. The faculty preferred to publish their research in the category of journals (1132, 92%). 1982-1991 was the most productive decade of the study with growth 145%. It was analyzed that 97% of publications were co-authored (1196). Among the various subjects, Physics & Astronomy topped the list with 477 (25%), followed by Chemistry and Material Science with 363 (19%) and 176 (9%) publications respectively. There were 3 departments which contributed more than 100 publications and 5 departments above 50 publications respectively.

**Maharana & Das (2014)** evaluated Library and Information Science research by Indian researchers. The data was collected from Social Science Citation Index (SSCI) during the period of 1999-2013. Out of the 140 publications by Indian authors, the most of the publications were journal articles (125, 89%). In authorship pattern, Indian researchers preferred to publish as two authored (57, 41%) closely followed by single authored (51, 36%). The most productive Indian researcher was found to be M. P. Satija. The degree of collaboration was 0.64. Lotka’s law of scientific productivity was applicable in the study. It was found that 273 authors contributed total 140 publications with an average author per paper (1.95) and productivity per author (0.52).

**Mani (2014)** represented a bibliometric study of Malaysian Journal of Library and Information Science. A total of 575 authors, contributed 279 articles over the period of 17 years (1996 – 2012). The highest number of research articles 28 (10%) were published in 2011 by different countries. Average Authors per Paper (AAPP) for the study period was 2.06. The majority of the papers were contributed as two-authored, in authorship pattern (111, 40%). The most prolific contributor was A.N.
Zainab (42). The degree of collaboration was 0.64. Malaysia topped the list with 239 publications whereas India ranked 2\textsuperscript{nd} with 126 publications.

Meera, & Sahu (2014) highlighted the research output of University College of Medical Science (UCMS) in different areas or subfields of medical and health sciences. The data of UCMS’ research output were collected from the SCOPUS database by using different research techniques. A total of 2557 research papers were gathered from 1975-2013. The outcome of this study showed that the highest contribution of 26\% of total publications was made by 3 authorship collaboration. The researchers were interested in collaborative research and the collaboration was made in various ways via inter-departments and inter-institutes. The degree of collaboration was 0.92. It was found that most of the research papers were of interdisciplinary nature. A majority of papers 2121 (83\%) was related to Medicine. The 1st highest ranked author was B D Banaerjee. The USA was the most preferred country by the researchers for research collaboration.

Nagarkar (2014) carried out the analysis of the research contributions made by the faculty members of the Department of Chemistry at the University of Pune. The data set was collected from the Web of Science for the period of about 14 years (1999-2012). The data highlighted that 30 faculty members had published 811 papers in 258 journals. The highest publications were in the year 2012 (96, 12\%) and the lowest publications were in the year 2000 (2\%). The Journal of Physics Chemistry A was the most preferred journal (41, 17\%). Physical chemistry was the favored area of research by the researcher (196, 24\%). Authorship pattern indicated that highest numbers of papers were written by 4 authors in collaboration.

Navaneethakrishnan (2014) depicted the authorship patterns and degree of collaboration of Sri Lanka in humanities and social science research. There were total 1795 publications authored by 3521 authors during the period 1960 – 2012 collected from SCOPUS database. Bibliometric analytical software namely Bibexcel used in the study. The analysis of publications revealed that journal articles occupy predominant position sharing 77\% (1383). It was observed that 50\% of entire publications output brought from 1961 to 2006, and the balance 50\% were published from 2007 to 2012. The highest publications were in the year 2010 (169, 9\%). It was found that the majority of the publications were contributed by single-authored (625). The degree of collaboration for the study period was 0.65.
Vivekanandhan & Bathri (2014) examined the scientometric analysis of research publication productivity of the Bharathiyar University. The data was retrieved from the Scopus database from 2009 – 2013. Among the 1576 papers published in the span of 5 Years, the highest number of 452 papers was published in the year 2013. The majority of the Bharathiyar University research outputs were published in joint authorship (99%). The average degree of collaboration was 0.99. A major subject area covered was Chemistry (389, 14%). Journal articles were the most favored form to publish articles (1419, 90.04%). The majority of publications were affiliated to Bharathiyar University (1569, 77.75%).

Aswathy & Gopikuttan (2015) investigated the publications of teachers belonging to physics department of the 3 universities of Kerala namely University of Kerala (UoK), Mahatma Gandhi University (MGU) and University of Calicut (UoC). The data was derived from annual reports and the university websites. The study confined to a period of 5 years from 2005 to 2009. There were 217 publications gathered for the study. The UoC had highest publications among universities under study (86). In year-wise distribution, the highest publications were in 2007 (27). And the lowest publications were in 2005 (11). It was found that all the 3 universities had maximum publications in the category of more than 3 authored publications. The maximum degree of collaboration was 0.98 of UoK. The study also found that collaborative index for MGU was 0.177, which was the highest as compare to other 2 universities. The mean relative growth rate of all the universities were 0.43 (UoK), 0.68 (MGU) and 0.51 (UoC) whereas doubling time of above universities were 3.03 (UoK), 1.925 (MGU) and 2.03 (UoC). The Lotka law did not fit to UoK and MGU.

Devalingam, Babu, & Suresh (2015) expounded that the research productivity in the field of Plastics Technology during the period from 2010-2014. There were 8928 publications retrieved from Scopus. It was found that the journal articles topped the list of the type of documents with 4276 publications. The relative growth rate (RGR) was 0.73 in 2011 which decreased to 0.24 in 2014. The mean RGR for the periods of 2010 to 2014 was 0.33. The study period proved that the mean Doubling time of total output was 1.58. The Author L. Hua was the most prolific author published the highest number of articles for the period under study. China had contributed the highest publications 2037 (22.81 %) and occupied the 1st position.
India was on the 6th rank in the list of top 10 countries in the field of plastics Technology.

**Gourikeremath, Kumbar, Hadagali, & Hiremath (2015)** analyzed the contribution of 15 universities accredited with Universities with Potential for Excellence (UPE) status in India pertaining to the period from 1999-2014. The writers had collected data from ISI web of science – Science Citation Index Expanded (SCIE) i.e. 56178. Only 5 universities out of 15 universities excelled than average output i.e. 3745. It was concluded that the most productive year in terms of publication count was 2014 i.e. 5686(10.12%). It was found that Relative Growth Rate (RGR) had decreased from 0.67 (1999) to 0.1 (2014). On the contrary to it, doubling time (DT) had increased from 1.03 (1999) to 6.93(2014). The authors found that Acta Crystallographica Section E-Structure Reports online (USA) journal was most commonly accepted journal for publications (1353, 2.41%). In the list of prolific authors, Ashok Kumar affiliated to Banaras Hindu University ranked 1st (835).

Grace & Jeys Shankar (2015) revealed the research productivity in the field of infertility and the data was retrieved from the Scopus database for the period of 1985-2014. A total of 1764 publications of Infertility literature output by Indian scientist were collected. In the block-wise distributions of publications, the highest publications were in 2010-2014 and the lowest publications were in 1985-1989. The relative growth rate (RGR) had decreased from 0.81 (1985-1989) to 0.16 (2010-2014) and correspondingly doubling time (DT) had increased from 0.86 (1985-1989) to 4.43 (2010-2014). It was found that the total authors involved in the publications of 1764 papers were 7078. The modified collaboration coefficient (MCC) was found to be 0.6 to 0.67 under the study period. During the study periods, the most of the publications (1315, 74.5%) were found as articles. The journal of Human Reproductive Sciences was the most preferred journal by scientists (87, 0.05%).

Joshi, Mamdapur, & Rajgoli (2015) analyzed the research output for literature related to ‘Stellar Physics’. The material for the study was collected from Web of Science Core Collection database for the period concerning 1988-2013 in the English language. The 2738 articles were located from 188 journals. The highest number of articles i.e. 254 (9.28%) pertained to the year 2013. The authors noticed that the Astrophysical Journal topped as the most productive journal (895). The mean relative growth rate was 0.23. The mean doubling time was 4.45. In this analysis,
Bradford’s Law of Scattering was applied and observed that the percentage of error was very high and hence the data of Stellar Physics literature did not fit Bradford’s Law of Scattering. The Leimkuhler model was also applied to verify Bradford’s Law of Scattering. It can be noted from the calculations that the percentage of error was very negligible and Bradford’s Law of Scattering fitted very well in the data.

Kumar, Dora, & Desai (2015) analyzed the research publications of Gujarat University during the period of 2004 to 2013. The data for this study was retrieved from SCOPUS. A total of 760 publications were recorded by authors affiliated to Gujarat University. Maharaja Sayajirao University of Baroda (MSUB) had highest publications during the period of study (2533, 54.7%). It was observed that in the both blocks (2004-2008 and 2009-2013) the trend in authorship was in favor of moving away from single-authors papers. It was found that the year 2012 was the best year for collaboration, based on modified collaboration coefficient (MCC) (0.70) and the year 2010 was the best year in terms of degree of collaboration (DC) (1.00). The journal Acta Poloniae Pharmaceutica-Drug Research was the most preferred journal (30, 4.75%). The analysis of the research productivity of Gujarat University concluded that there was an overall trend of growth in research publications during the period of 10 year period.

Madhu (2015) scrutinized a bibliometric analysis of Indian Journal of Agriculture research. The study covered three volumes 46-48 published during the period of 2012 – 2014. There were 221 total numbers of articles in the study. The majority of research articles were published during 2013 (84, 38%) as compare to 2012 (59, 26.69%) and 2014 (78, 35.29%). The author V.K. Sharma was at 1st rank to contribute the highest number of publications (4, 1.80%). Agricultural researchers preferred to publish their research in the form of journal articles (1315, 37.98%). Astronomy was the most preferred subject in the subject-wise distribution (23, 10.4%).

Meena, Kumar, & Jain (2015) analyzed the contributions made by Indian scientists to International Lentil research during the period 2000 to 2008. The data was retrieved from the International Crop CD database. Out of 2770 contributions, India had contributed 899 (32%) research paper in the study. It was found that Indian scientists had contributed a very high percentage of publication shares in Lentil research & obtained 1st rank. The growth rate had decreased from the year 2001 to
2008 & consequently doubling time had increased. The authorship pattern revealed
the high level of collaboration with 92% joint author’s papers on the topic with the
degree of collaboration (DC) (0.92) & collaborative index (CI) (3.39). Out of 1305
authors contributing 899 articles, 731 (56%) had contributed only one single article.
The study also revealed journals as communication channel was more than 92%
articles & 99% in the English language. There was only one journal with 47 articles
published in it while on the other hand, 15 journals published only 1 article each
during the study. This study had identified ‘Indian journal of Agronomy’ as core
journals on the topic under study.

Mishra, Sahu, Brahma, & Mahapatra (2015) analyzed bibliometric data
collected from an Indian Medical College i.e. Institute of Medical Sciences and SUM
hospital, Bhubaneswar from 2009 to 2013 to assess research productivity. The study
gathered and synthesized the number of publications (207) of 34 departments of
the institute. It was found that there were maximum publications in the authorship pattern
of more than four authors. Designation wise research output the Assistant Professor’s
had maximum publications during the study period. The highest numbers of
publication were published (89) in the area of Medicine. The degree of collaboration
was highest in 2012 i.e. 0.86. Bradford’s Law of Scattering was found to be fit in the
study. The journal, International Journal of Pharma and Bio-Sciences was found to be
the most preferred journal (24, 11.60%).

Pathak, Sengar, & Rai (2015) described the scientometric assessment of
publication productivity of Indian Institute of Science Education and Research
(IISER) Bhopal. The data for the research was retrieved from the Scopus database
from 2009-2014. A total of 330 records were collected. The year 2014 was the most
productive as regards to the number of publications (125, 38%). The study revealed
that most of the scholarly communication of scientific research was published in
journals (291, 88%). The authorship patterns highlighted that majority of the IISER,
Bhopal faculties/Researchers preferred to publish the research outcomes in joint
authorship (93.03%). The degree of collaboration (DC) during the study period was
0.93. The most significant author was D. Chopra, who ranked 1st in the author list
with 34 papers. Faculties and Researchers of IISER, Bhopal preferred to publish their
research papers in international journals.
Satpathy & Sa (2015) brought about the bibliometric analysis of research output (490) of Odisha's state universities during 2010 to 2014. The data for the study was retrieved from SCOPUS Database. In the year-wise distribution of publications, the highest publications were in the year 2011 (170, 34.69%) and the lowest publications were in the year 2014 (25, 5.10%). It was found that Utkal University was the most productive among Odisha Universities with 37.76% of total publications and growth rate of publication of the study was 106%. Physics and Astronomy was the most preferred subject area (98, 20%). The most preferred journal for publications was Optics Communications and Indian Journal of Physics with 2% of contributions each and R.K. Mishra was the most productive author (15, 3.06%). The number of publications by multiple authors was 96.73% more than publications by single author. The degree of collaboration of the study was 0.97.

Siwach & Kumar (2015) examined the research contributions of Maharishi Dayanand University, Rohtak in terms of its publication output during 2000-2013. The data was collected from Scopus database. The 14 years (2000-13) study examined the total number of 1247 papers in the form of journal articles and reviews along with articles in the press. The study indicated that the highest numbers of papers (219, 17.56%) were published in the year 2013 and least number of papers (30, 13.20%) in 2001. During the last 4 years, the authors observed growth in the research publications of MDU. Guru Jambeshwar University, Hisar was the main collaborator with 66 papers. In the subject-wise distribution, Chemistry was the most favored research subject (455, 6.09%). The journal Indian Journal of Heterocyclic Chemistry was the most preferred journal (71). Among the productive authors, C.S. Pundir of the Department of Biochemistry contributed the highest number of publications (141).

Rai, Sengar, & Pathak (2015) scrutinized research papers published by visiting associates of Inter-University Centre for Astronomy and Astrophysics (IUCAA). The study covered the period 2003-2013. All the bibliographical details of publications of IUCAA Associates gathered from Annual Reports and Astrophysics Data System (ADS). The highest publications were in 2001-2012 (144, 14.27%). The most of ICCAA associates preferred to publish their research in collaboration. Out of 1009 articles, 950 (93%) were joint works while only 68 (7%) were single authored works. The degree of collaboration was also quite high i.e. 0.93 among the associates working therein. The most renowned author was Debnath, U, who topped
the list with 109 papers. The Astrophysics and Space Science was the most preferred journal with 88 papers.

Tamizchelvan & Dhanavandan (2015) evaluated research output by the Gandhigram Rural Institute (GRI). The data was retrieved from Scopus database. It was found 1328 publications were published from 1968-2015. The rate of growth (RoG) was maximum (3.00) for the years 1977, 1987, 1993 and 1996. It was observed that the RoG was between 0.11 and 2.50. The relative growth rate (RGR) value was between 1.10 and 0.01. Doubling Time value (DT) (13.32) was high in the year 1992. It was observed that single-author publication was 48 and two-author collaboration of publication was very high and showed an increasing trend. Collaborative Index (CI) was 3.60 and 3.08, 3.00 in the years 1998, 1997 and 1990 respectively. It was observed that collaboration coefficient and Modified collaboration coefficient were growing after the year 1990. Balasubramaniam had the highest number of publications and also highest citations but Meenakshi was in the 5th ranks on the basis of total publications and secured 2nd position on the basis of citations. It was observed that Chemistry got the 1st position with 381 (16%) publications.

Vellaichamy & Jeysankar (2015) assessed the publication pattern of Pondicherry University. The data for the study was retrieved from Scopus database over a period of 27 years (1987-2013) and 2348 records were gathered. It was found that a maximum number of articles (1041, 44%) were published in the year of 2011-2013. The study highlighted that majority of the researchers preferred to publish their research papers on the two-authorship pattern (772, 32.88%). and the degree of collaboration ranges varied from 0.61 to 0.96 and its mean value was 0.88. The study also analyzed that the subject Physics and Astronomy produced a larger number of papers (564, 14%). The study showed that S.A. Abbasi was the most prolific author (132 articles). The researchers mostly preferred to publish their work in the journal of Acta Crystallographic a Section E Structure Reports Online (51, 2.17%).

Abu (2016) analyzed the growth of research publications in the field of Screen Technology in India. A total of 600 records were retrieved from Web of science database for the period of 20 years (1996-2015). The highest number of publications was in the year 2013 (103 records). The RGR was highest in the year 1999(0.48) and lowest in the year 2014(0.15). The Doubling time was highest in the year 2010 (4.33) and lowest in the year 1996 (1.14). Aiyer, R. C. had published the maximum number
of publications (9). The journal “IPPTA: Quarterly Journal of Indian Pulp and Paper Technical Association” ranked 1st (13) in the list of journals. The findings revealed that U.S.A had the maximum number of collaboration with India (35 records).

Azmi (2016) analyzed research output of Geology department of Delhi University by faculty members. The data for the study was gathered from Scopus database over 15 years (2001-2015). There were total 337 publications contributed by faculty members of Geology Department. The study revealed that maximum publications were published between 2012-2015 (156, 46%). The average growth rate of publications was 38 (11%). Out of top 10 productive authors, T. Ahmad ranked 1st (39, 12%). Articles were the most preferred type with 277 (82%) publications. The analysis revealed that Journal of Geological Society of India was the most preferred journals with 44(24%) publications.

Babbar & Tripathi (2016) highlighted the research output of the Brazil, Russia, India, China and South Africa (BRICS) nations during the 5 years, 2010-2014. The data for the study was downloaded from Web of Science. It was observed that in the year 2014, BRICS share was highest (623), whereas, in the year 2010, it was the lowest (383). The study highlighted that China was the most productive country (1313, 51.87%). The journal Scientometrics was the most preferred journal (330). The United States of America (USA) was at the 1st position (26185, 55.08%), while India was at the 16th position. The scientist preferred to communicate their research as articles (2234, 88.26%). There were 6976 authors who contributed 2531 publications. Out of which, the highest publications were contributed by 3 or more authors (994). The topic of Knowledge Management was ranked 1st among the most preferred subject (84).

Chakravarty & Sharma (2016) analyzed research output in the discipline of Library and Information Science at Panjab University (PU), Chandigarh and Guru Nanak Dev University (GNDU), Amritsar till 31 December 2014. The curriculum vitae (CV) and publication details of faculty members of Department of Library and Information Science (DLIS) were gathered by the personal visit to universities. The study contained 152 publications of PU and 111 publications of GNDU, in the field of LIS. It was found that PU published articles in journals (78, 51%), whereas GNDU published articles in journals were (66, 59%). In the case of conference proceedings (CP), PU contributed articles in CP (56, 37%), while GNDU contributed in CP (27,
The study found that GNDU had more publications as single-authored (90, 81%). In the case of double-authored PU published number of articles (80, 53%). The mean relative growth rate (RGR) of PU was 0.14 and 0.16, while mean RGR of GNDU was 0.07 and 0.10. The mean doubling time (DT) of PU was 3.35 and 4.88, on the other hand, DT GNDU was 6.64 and 18.78. The degree of collaboration (DC) of PU (0.61) was found to be higher than that of GNDU (0.28).

**Hiremat, Gourikeremath, Hadagali, & Kumbar (2016)** highlighted publication growth in Science and Technology. The data was downloaded from Web of Science for the period 1989-2014. There were total numbers of 59465 publications in the study. The highest number of publications was published in the year 2014 (5851, 9.84%) and the lowest publications were in the year (1139, 1.92%). The USA ranked 1st in the list of highly productive countries in science and technology (4, 32,093). It was found that the relative growth rate (RGR) of publications decreased from 0.62 (1990) - 0.10 (2014). The Doubling time gradually increased from 1.12 (1990) to 6.69 (2014). The journal Current Science (India) was the most preferred journal (14,245). The highest numbers of papers were published by Bhabha Atomic Research Centre, Mumbai (4117, 6.92%).

**Jeyshankar & Vellaichamy (2016)** analyzed the research productivity on information technology in India during the period 2001 to 2015. The study gathered total 43043 records from Scopus database. It showed that highest publications were contributed in 2015 (8445, 20%). The highest relative growth rate was in the year 2011 i.e., 7.64 and doubling time was lowest in year 2011 i.e., 0.09. Similarly, lowest relative growth rate was in the year 2015 i.e., 0.22 and doubling time was highest in the same year i.e., 3.17. The majority of publications were two-authored. The degree of collaboration varies from 0.71 to 0.95 over the period under study and the mean value was found to be 0.82. It was observed that S. Misra ranked 1st with (167, 0.39%) in the top 10 list of most productive year. Out of top 10 most preferred journals, International Journal of Applied Engineering Research was ranked 1st with 1539 (3.58%). The study depicts that in the subject –wise distribution, 28093 (65.27%) papers were published in the Computer Science.

**Palaniappan & Vijayakumar (2016)** scrutinized the growth and the contribution of research output by the scientists of Periyar University (PU). The data was retrieved from Web of Science database during 2005 – 2014. The highest number
of publications were produced in the year 2014 (148, 22%) and the least number of publications were produced in the year 2006 (12, 2%). The study revealed that a mean Relative Growth Rate of 2005-2009 and 2010-2014 was 2.59 and 0.67 respectively. The mean Doubling Time (DT) for publications for the periods of 2005-2009 and 2010-2014 was 1.04 and 2.67 years respectively. Dr. V. Krishan Kumar ranked 1st in the list of top 20 prolific authors with 111 publications. It was found that out of 680 contributions, a total of 210 (31%) publications were contributed by three-authors. Modified Collaborative Coefficient (MCC) varied between 0.67 for the block year 2005 and 0.80 for the block year 2014. Lotka's law was applicable in the study.

Ramiah (2016) highlighted the publication growth of nuclear physics. The data was collected from Web of Science database. A total of 32286 publications were published during the period 2004-2013. It was observed that conference proceeding was the preferred form of publications (17275, 53.51%). The highest publications were in the year 2012 (5407) and the lowest publications were in the year 2004 (1678). The average number of publications published per year was 3228.6. The highest value of collaboration coefficient (CC) was recorded 0.62 in 2008. The study revealed that 93% of contributions were multi-authorship and 7% of contributions were single-authors. M. Wiescher was the most prolific author affiliated to the University of Notre Dame, USA (65, 0.20%). The USA ranked 1st in the list of highly productive countries (10734, 33.25%). Physics and Astronomy was the most preferred subject (23413, 72.53%). Istituto Nazionale Di Fisica Nucleare, Italy was the most productive institution (1212).

Velmurugan & Radhakrishnan (2016) analyzed research publications on Journal of Information Literacy. The data was gathered from the official website of the Journal of Information Literacy from 2008-2012. There were total 61 articles in the study. It was observed that the highest publications were in the year 2014(14, 22.96%) and the lowest publications were in the year 2011 (10, 16.39%). The authors observed that the relative growth rates (RGR) decreased from 2009 (0.65) to 2012 (0.26) in the span of 4 years. The doubling time (DT) was increased while calculated year-wise i.e. from 1.06 in 2009 to 2.66 in 2012. The study revealed the degree of collaboration in this journal ranged from 0.23 to 0.47. The degree of collaboration (DC) was 0.47. The highest numbers of papers were published as single-authored (32,
It was found that the average authors per paper (AAPP) were 1.80 and the productivity per author (PPA) was 0.55.

**Velmurugan & Radhakrishnan (2016)** analyzed the research outputs on nanotechnology. The data for the study was retrieved from Web of Science (WoS). It was found that there were 20825 scholarly communications during the period between 1989 and 2014. The primary sources were articles (14564, 65%). The world outputs ranged from 4 papers (0.019%) in the year 1990 to 2560 papers (13%) in the year 2014. The 5 block-wise values were measured in relative growth rate (RGR) in which in 1st block (0.64) in 1990-1994 and the 5th block was 1.94 and the average value of all the blocks was 1.32. The USA was ranked 1st in the list of top 25 country-wise productions (7269, 34.91%). Based on the scientometric observations ‘Anonymous’ authors were published highest publications (348, 1.67%). The Chinese Academic Science, China was ranked 1st in the list of organizations in nanotechnology research. Chemistry was the most preferred research area (6570, 31.55%).

**INFERENCES FROM REVIEW OF LITERATURE**

Many bibliometric studies had been carried out on research output of faculty members in various countries with the aim to assess the status of research output in different disciplines. In India also, numerous bibliometric studies had been conducted in the different disciplines including Arts, Humanities and Social Sciences as well as Sciences. Several such studies were based on published literature in Library and Information Science based on data collected through databases like Library Literature & Information Science Index, Information Science Abstracts (ISA), Library and Information Science Abstracts (LISA), Scopus and Web of Science, etc. A few of the bibliometric studies are based on individual author’s publications. The review of literature reveals that some studies focus on papers published in specific journals in various discipline including library and information science.

The review of literature reveals that several bibliometric studies, confining to the discipline of library and information science, have been conducted by research scholars of countries other than India. In their theses, they have used the survey method wherein the data was collected from the authors through questionnaire.
Interestingly, in India, a lot of Ph.D. theses pertaining to bibliometrics studies have been produced from the state of Tamil Nadu. In these studies the researchers have collected data through databases as well as primary sources including Curriculum Vitae (CV) and annual reports. The disciplines covered under these studies have been Science & Technology, Life Sciences, Physics Science, Health Science, Agricultural Sciences, crop science, food & nutrition etc.

In one of the study reviewed by the researcher, the research output of three central and three state universities of Uttar Pradesh was analyzed wherein the author has adopted the questionnaire as data collection tool. Another study which focused on publications of universities in Kerala during 2009 to 2013 was based on Scopus database. However, the researcher could not find any significant study in which the data was gathered directly from the respective authors/ faculty members.

The review of literature indicates that Relative Growth Rate (RGR) and Doubling Time (DT) were the most preferred indicators in studies. Very few studies were based on other collaborative measures like Collaborative Index, Collaborative Coefficient and Modified Collaborative Coefficient. Based on the above facts, it can be inferred that there exists a research gap in the area of research pertaining to bibliometric studies specifically in the discipline of library and information science of north Indian universities wherein the data have been collected directly from the authors i.e. faculty members.
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