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Literature Review of the Related Studies

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Literature Review of the Related Studies

2.1 Introduction

Literature is the body of thought expressed in published writings. The primary role of literature is to record and transmit ideas or discoveries that bring in advancement of knowledge. Review of literature is an early step for conducting research. It plays a crucial role in any kind of research and enables to avoid the duplication of research work and glimpses into the earlier studies for the understanding of the research work. Goal of the review of literature is to make the reader up-to date with current literature on the topic and form the basis for some forth coming research. The literature review is a critical look at the existing research that is significant for the work. It evaluates the existing work and it shows the relationship between different works, and how it is related to the present work that is under investigation.

Literature review on a particular subject allows the researcher to have clear concepts and theories which are related to it and it gives an opportunity to the researcher to learn more on the topic. It informs the researcher about the recent research studies and findings on the topic which enable the researcher to find alternative research designs. Further, it provides an opportunity for researcher to assess the strength and weakness of each design so that he/she can choose an effective design for his/her own.

The chapter makes a sincere attempt to explore some significant studies though a large number of studies which have been conducted in the field of Library Science. Even a reasonable number of Bibliometric analyses on Social Science are being traced out during the literature survey. However, it is most appropriate to mention here that some studies, more precisely four studies, have been found on Women Studies. The literature reviewed in this chapter has been divided into the following sections.
I. Conceptual Review

Just like conceptual research, conceptual review of literature deals with the study of literature in any field related to its abstract idea(s) or theories. It is generated by philosophers or thinkers to develop a new concept or to reinterpret existing ones. So this section attempts to make a literature review of those works which deal with various ideas, concepts or theories related to Bibliometrics.

II. Empirical Review

Like empirical research, empirical review relies on experience or observation alone, often without due regard for the system or theory. It is observation/study based review, it is appropriate when proof is sought with certain variables that affect other variables in some way.

2.1.1 Bibliometrics

It is peculiar nowadays to seek relationship between ideas, concepts and problems in sciences and social sciences by several ways. The traditional way is to seek views of small number of experts (peer review). Bibliometric research is another way of seeking relationship from quantitative perspective. It is devoted to quantify study of various aspects of literature of subject and is used to identify the pattern of publication, authorship, citations and/or secondary journal coverage in the hope that such regularities can be given an insight into the dynamics of the area under consideration. This consequently leads to better organization of information resources, which is essential for effective and efficient use. Bibliometric studies can be applied to any discipline to find out trends and growth of literature and to assess the quality, maturity and productivity of a journal.

2.1.2 Conceptual Review of Bibliometrics

Pritchard (1969)[1] who first used the word "bibliometrics" described it as "The application of mathematic and statistical methods to books and other media of communication".

Pritchard explained Bibliometrics as the "metrology" of the information transfer process and its purpose is analysis and control of the process. He based his interpretation upon the fact that measurement is the common theme through, definitions and purposes of Bibliometrics. The things that we measure when we carry
out a Bibliometric study are the process which is variables in the information transfer process.

Cole & Eale's (1917) study entitled *The History of Comparative Anatomy: A Statistical Analysis Pt.1*, is considered to be the first Bibliometric study, where for the first time in 1917 the expression 'Statistical Analysis' has been used. He studied the contributions in the field of anatomy by counting the number of publications produced by different countries, covering a period of more than three hundred years (1543-1860). This count included books and journal articles.

Hulme (1923) used the phrase 'Statistical Bibliography' to describe the study of use and non-use of information. He studied author and journal entries in the *International Catalogue of Scientific Literature*. It ranked the results according to the country of origin and it has established that Germany ranked at the top position in the production of scientific literature during the period of 1900-13.

Henkle (1938) has used the term of 'Statistical Bibliography' in his paper entitled *The Periodical Literature of Bio-chemistry*. The term was further been used in 1943 by Gosnell in his dissertation and later in 1984 in his article. Later, the term of 'Statistical Bibliography' was used in 1948 and 1949.

Ranganatan (1948) profound the concept Librametry on the lines of Bibliometry as many matters connected with library work and services involved large numbers.

Hawkins (1977) defined Bibliometrics as 'quantitative analysis of the bibliographic features of a body of literature'.

Sengupta et al. (1980) According to them Bibliometrics is the ‘Organisation of classification and quantitative evaluation of publication patterns of all macro and micro communications along with their authorship by mathematical and statistical applications and calculations’

Potter (1981) stated that "Bibliometrics is the study and measurement of the publication pattern of all forms of written communication and their authors". Schrader (1981) also defined that Bibliometrics as "the scientific study of recorded discourse".

Hertzel (1987) defined that Bibliometrics, the source of recorded discourse, which uses specific methodologies, mathematical and scientific, in its research - is a
controlled study of communication. It is the body of a literature, a bibliography quantitatively or numerically or statistically analyzed - a statistical bibliography in which measurements are used to document and explain the regularity of communication phenomena".

Egghe (1988) [10] stated that Bibliometrics is the development and application of mathematical models and techniques to all aspects of communication.

Diodato (1994) [11] defined it as the "study of publications and communication patterns in the distribution of information by using mathematical and statistical techniques, from counting to calculus."

Reitz (2002) [12] explained; "The uses of mathematical and statistical methods were to identify the patterns in the usage of materials and services within a library or to analyze the historical development of a specific literature, especially its authorship, publications, and the growth.

2.1.3 Empirical Review of Bibliometrics

2.1.3.1 Bibliometric Studies in Women’s Studies/Issues

Ann (1994) [13] studied selected journals of Social Work from 1982-1991 to determine the coverage of women’s issues. Findings indicate that less than 10% of the articles focused on women’s issues. Women authored over 75% of the articles and books on women’s content, but only about 15% of the women authors write on women’s issues.

Cronin, Davenport and Martison (1997) [14] examined articles in three top Women’s Studies journals which were published in the three journals from 1975 to 1994. Feminist Studies, Signs: Journal of Women in Culture and Society and Frontiers: A Journal of Women’s Studies. They (Cronin, Davenport and Martison) revealed that on average, 90% of the scholarly articles published in Feminist Studies, Frontiers, and Signs are solo authored. No less striking is the consistency of the practice across the three journals: the percentage of single author papers was 94%, 90%, and 86%, respectively. They identified a total of 1,504 authors associated with all the (1,302) articles. Feminist Studies had 377, Frontiers 251 and Signs 674 articles. Single author papers (1,163) were the norm – 94% for both Feminist Studies and Frontiers and 84% for Signs. Approximately 93% (1,079) of the authors were female and 6% (76) were male. In eight cases, the author’s gender could not be
determined. The female/male author ratios for each journal differed appreciably: for *Feminist Studies* it was approximately 14:1, for *Frontiers* 17:1, and for *Signs* 9:1.

Usmani (2000)\[15\] carried out a bibliometric study on violence against women. This study concluded that growth of literature has gradually been increasing in general study, Foeticide, Child Abuse, Domestic Violence, Dowry, Wife Battering and Rape. But it shows a decrease in literature on Sexual Harassment during 1985-89, 0.39% and increase again during 1980-84, 1.31% and 1990-94, 1.83%.

Marshakova-Shaiekevich (2004)\[16\] carried out a study on the journal co-citation analysis in the field of Women’s Studies. Authors discovered three clusters of journals within the *Journal Citation Reports*. These journals included 30 articles on average, but *Journal of Women Health* claimed 88 articles and in the number of citations with an average 289 and the record of 1877 of Journal Sex Roles. The total number of citations was 7224.

Zainab’s (2007)\[17\] reveals the growth of literature on Women Studies published in Malaysia, a total of 3346 publications, which constitute 80% of the total publications produced between the pre 1970 years and 2004; the most productive year was 1999 with 296 publications. Clearly academic institutional collaboration is possible in the case of Women’s Studies in Malaysia, in the period 1990 to 2004, 38% (1271). The rest were also churned out from academic research activities in the form of journal articles and conference papers (40%) and books and book chapters (20%). Authorship pattern revealed that about 87% of total publications produced were by single authors. Most of the publications which were authored by 5 or more authors were in the field of “health and welfare of women in Malaysia”. Only 32 (4%) titles were jointly authored by 2 or more authors (32 out of 790 published works). The majority of works were single authored. The other types of publications produced by rank order were conference proceedings 22%, journal articles 18%, books 12% and book chapters 10%.

2.1.3.2 Bibliometric Studies in Social Science

Vijaylakshmi (1992)\[18\] investigated the trends of articles published in *Indian Journal of Social Work* from 1971-1990. Analysis of 194 articles revealed that most articles were contributed by male social work educators, about 50% of the articles were empirical and focused upon family and child welfare, community development,
personnel management and core social work. There was slight increase in non-empirical studies over the years and less than 15% of the articles were devoted to women’s issues.

Halkar, Senapati and Chand (1998) \[19\] conducted a bibliometric study of ‘Journal of Family Welfare’ for the period of 1990 to 1997. They examined the year-wise, country-wise, institution-wise, authorship pattern and subject-wise distribution of the articles. More than 52% articles were contributed by single author, 30% by two authors and 9.8% by three authors. An average of 17.76 references appeared in articles in the *Journal of Family Welfare*.

Glanzel et al. (1999) \[20\] analyzed references in the SSCI, using them to attempt to classify papers based on the subject classification of journals they referenced. The authors counted references to journals that had been classified into Business, Economics, Law, and Political science, Psychology and Sociology or Information & Library science. The field referenced most often was used as the new classification of the paper if its share of references exceeded 50%. If there were no references to these fields, or no field gathered 50% of the references, the paper could not be classified. In all, 28% of the papers could be assigned to a social science field. 25% of the papers in the *American Sociological Review* (ASR) could not be classified as sociology while 6% of papers in Developmental Psychology could not be assigned to psychology.

Katz (1999) \[21\] in his article “Bibliometric Indicators and the Social Sciences” has examined that Social Science research is published in a wider variety of publication. The UK share of the world publications in the social sciences and behavioral sciences increased between 1981 and 1998. It has its largest percentage share of world papers in Geography & Development and its strongest growth in Management is 0.44% per year. The UK's strongest publication growth in the share of Psychology and Economics papers grew on average at 0.17% per year and 0.13% per year, respectively. Psychology publications grew from 7% to 10% and Economics publications grew from 10% to 13%.

Kannappanavar (2001) \[22\] conducted a bibliometric examination to investigate the authorship pattern involved in the International Monetary Fund (IMF) literature. Authorship data was collected from research activities of the IMF from January 1991
to December 1998, the total number of entries collected was 1,704 and each item was analyzed and tabulated. The results revealed that the team research is more favorable than the solo research and the degree of collaboration in IMF research ranged from 0.45 to 0.62 during the period of study, with an overall average of 0.56.

Koganurmath, Angadi and Kademan (2002)[23] analyzed 663 papers published by the social scientists of Tata Institute of Social Sciences (TISS) during 1990-2000 in diverse domains in the social sciences to study authorship pattern and collaboration. The results indicate that the collaboration coefficient of the 613 single-authored papers is 92.46 percent, followed by 6.33 percent (42 papers) for two-authored papers. Maximum collaboration coefficient was 0.13 during 1996-1997.

Johry (2003) [24] studied Bibliometric pattern of the ‘International Social Science Journal’ published during 1998-2002. The results indicated that contributions of single authors were 87.59% of the total articles, whereas two authors contributions were 11.25% and three authors were 1.16%. The geographical distribution of contributions had indicated that Indian social scientists were among the top four countries in the world, in terms of the contribution of the articles contributed in the journal.

Sangam and Keshava (2003) [25] studied that the growth of world Social Science literature in the six sub disciplines viz., Anthropology, Economics, History, Psychology, Political Science and Sociology were derived from the CD-Rom version of the Wilson Social Science Abstracts for the period 1983-1998. They examined that Psychology stands first (0.97) followed by History (0.60) and Political Science (0.40). Sociology (0.23) stands last. The analysis Psychology explains 4589.76 growth rates, the Economic stands second (1738.15) and History ranks third in order (1116.45). The growth rate of Sociology, Anthropology and Political Science was (134.53), fifth (104.67) and sixth (55.24) in order respectively.

Hicks (2004)[26] has studied the quantitative evaluation of research output in the Social Sciences and Humanities that face severe methodological difficulties. Bibliometric evaluations are based on international journal literature indexed in the SSCI, but social scientists also publish books, and write for national journals and for the non-scholarly press. These literatures form distinct, yet partially overlapping worlds in which each literature serves a different purpose. Each literature is more
transdisciplinary than its scientific counterpart, which itself poses methodological challenges. The nature and role of each of the literatures has been explored, and has been argued that by ignoring the three other literatures of social science Bibliometric evaluation produces a distorted picture of social science fields.

Eqbal and Raza (2005) [27] described was Bibliometric study on Personnel Attitudes and Job Satisfaction. Data was collected from Psychological Abstracts published from 1992-2001. Authors found to be maximum number of articles were written by two authors, i.e., 621 (29.08%), and single authors contributed 597, i.e., (27.96%) articles. It is followed by three authors, i.e., 323 (15.12%), four authors, 274, i.e., 12.83%, and five and above 320, i.e., 14.98%. Authors observed that 1562 items constituting 73.16% of total data were in the articles form. This is followed by other forms like survey report with 285 items, i.e., 13.34% and, case study, 128 items, i.e., 59.99% occupying second and third positions respectively.

Angadi, et al. (2006) [28] attempted to analyse quantitatively 358 publications published by the social scientists of Tata Institute of Social Sciences during 2001-2004 in various departments and research units for authorship pattern and collaboration trend. The authorship pattern of 358 papers studied. Single authored papers were 323 (90.22%) followed by two authored papers 21(5.86%), three authored papers 12(3.35%). Most prolific authors were Shalini Bharat (21), M.M. Koganuramath (18), Mallikarjun Angadi, (13), R. N. Sharma (13), Chhaya Datar, (12), Siva Raju, (12) and Sarthi Acharya, (10). The most preferred journals by the social scientists were Economic and Political Weekly, Indian Journal of Social Work and Indian Journal of Labour Economics with 4 papers each.

Sangam, Gupta and Kumar (2007) [29] discussed the application of growth model with an objective to study the growth, and dynamics of growth of Indian and Chinese publications in three sub-disciplines of social sciences namely. Economics, Psychology and Sociology. The application of selected growth models to the Indian and Chinese cumulative growth of publications in Economics (1969-97), Psychology (1974-98) and Sociology (1963-98) indicate that a number of growth models could explain their growth.

appended to 68 research articles. The findings reveal that 43.25%, citations were from books and 52.69% from journals. Journals are the most used bibliographic form accounting for 871 citations (52.69%) of the total citation 1653. The total number of citations of books were 715 (43.25%), theses with 10 (0.60%), lecture notes with 19 (01.14%) and conference proceedings with 38 (02.29%) citations. *American Economic Review* is the top cited journal with 66 citations (7.57%) and the next top ranked journal is *Econometrica* with 59 (6.77%) citations. 66.17% papers of *Economics Review* are single authored.

Goel (2009) [31] examined 10 peer-reviewed Indian Journals during 2004 and 2005 to know contribution by ICSSR supported research institutions and organizations. He observed that 16 ICSSR supported research institution contributed 76 papers (9.19%). Centre for Economic and Social Studies, Andhra Pradesh is the most prolific research institute in social science. Study analyses that maximum number of articles i.e. 395 (68.69%) were contributed by single authors. 135 (23.48%) articles by two authors; 33 (5.74%) articles by three authors and 12 (2.09%) articles by more than three authors jointly. It was observed that 625 (88.83%) authors contributed only one article in the source journals, 70 authors (9.54%) contributed two articles and only 12 authors (1.63%) contributed more than two articles.

Zafrunnisha and Pullareddy (2009) [32] analysed the authorship pattern and collaborative research in the field of psychology. The required data collected from 141 Ph.D. theses submitted to three universities during the period 1963 – 2003. The collected data included 22,565 citations, among these only journal citations was consider for the study. A total 14374 journal citations came out and were utilized for the present study. Authors determined that the multi-authored papers are more in number (52.87%) and single authored papers are 48.13% of total journal citations. The average number of authors per article in psychology as a whole was 1.67 and the corresponding figures for Basic Psychology and Applied Psychology were 1.77 and 1.63 respectively.

Holden, et al. (2010) [33] did bibliometric analysis of 322 articles in the *Journal of Research on Social Work Practice*. Results revealed that most of the articles were 15 pages long, had two authors, 28 references and 1,139 articles were cited in other journals.
Mathias and Cagle (2010)\textsuperscript{[34]} reviewed all articles published in five prominent social work journals over a 5-year period. Out of sixty-three outcome studies reviewed, 71% lacked information on control measures for the interventions.

Thanuskodi (2010)\textsuperscript{[35]} studied Journal of Social Sciences from the year 2003 to 2007. He observed that majority of the contributions appeared under Economics 41 (15.01%). The next position is taken by Business Administration 38 (13.91%). This is followed by Public Health 37 (13.56%) and Environmental Studies with 35 (12.82%). Author revealed that maximum numbers of articles were contributed by two authors with 121 articles (44.33%). This was followed by three authors who contributed 83 articles (30.40%), 58 (21.25%) articles have been contributed by single author and 215 (78.75%) articles were contributed by joint authors. Author observed that journals occupied the top position with the highest number of citations 1216 (55.98%). The second highest position is occupied by books with 458 (21.08%) citations. It is followed by reference books with 192 (8.84%) and others with 151 (6.96%) citations.

Gupta, Tiwari and Gupta (2014)\textsuperscript{[36]} examined the published data on four South Asian countries (Pakistan, Bangladesh, Sri Lanka and Nepal) in overall social sciences as well as across its five sub-fields from the Scopus Database (http:www.scopus.com) for 5 years from 2008 to 2012. The annual average research growth rate of these four South Asian countries in overall social sciences was highest (26.84%) in Nepal, followed by Pakistan (23.25%), Bangladesh (17.54%) and Sri Lanka (12.91%) during that period. The highest average citation impact per paper (1.76) in overall social sciences was achieved by Nepal, followed by Sri Lanka (1.48), Bangladesh (1.15) and Pakistan (0.86) during 2008-12. Pakistan, Bangladesh, Sri Lanka and Nepal published 1678, 720, .358 and 274 papers in social sciences. Among the four South Asia countries, the highest national publication share was reported that, Nepal in Social Science-general (82.78%), followed by Bangladesh (72.51%), Sri Lanka (68.71%) and Pakistan (62.59%). Pakistan contributed in Business, Management & Accounting (20.48%), followed by Sri Lanka (19.39%), Bangladesh (17.22%) and Nepal (8.76%)
2.1.3.3 Bibliometrics Studies in Other Subjects

Sen and Narendra Kumar (1986)\(^{[37]}\) reviewed Indian contributions relating to bibliometrics for the period 1958-1984. The study covered 191 published contributions made by Indians residing in India and abroad and analysed the year wise output to literature in India, subject wise activity and the most productive journals and authors in the field.

Sengupta (1989)\(^{[38]}\) reviewed different bibliometric parameters. He suggested three new bibliometric parameters that are capable of making a ranking list of any scientific discipline more authentic and need based as they arrange journals according to their scientific interest in relation to total number of articles published compactness of information content in a scientific journal and scientific value of the published papers in relation to compactness of presentation.

Birader and Premlatha (1998)\(^{[39]}\) made a bibliometric study on Psychiatric (alcoholism) literature. They concluded that the maximum number of citations were from periodical literature with 73%, followed by books with 16.328%. The two authored citations and single authored citation had almost similar number of citations with 28.3% and 27.5% respectively, whereas the three authored citations were 22.3% of total citations. This study found that the American Journal of Psychiatry with 6.54% and Archives of General Psychiatry with 5.252% of the total citations were the top ranked journals.

Ramesh and Hussain (1998)\(^{[40]}\) presented a bibliometric analysis of the periodical articles published in Herald of library science during the years, 1985-1994. The study included the feature wise analysis of the periodical; geographical distribution of articles; and the authorship. They found out that increasing encouragement was given by the periodical to progressive authors. A subject wise analysis of articles, book reviews, and pictures and the "notes and news", feature was presented.

Rana and Agarwal (1999)\(^{[41]}\) conducted a bibliometric study by evaluating the ‘Bibliography on Application of Telemetry Technique in Wildlife Science’ for the period of 1956 to 1994. The study attempted to identify the growth pattern of literature. They concluded that 56.66% of the studies were conducted on mammals. Although there had been a gradual increase in all classes and increasing trend in
collaborative research pattern as single authorship papers decreased from 44.44% in 1956-1964 to 31.89% in 1990-1994.

Rana (2004)\cite{rana} carried out a bibliometric study of mammal research in India. This study concluded that the contribution of highly productive authors was more than 20% of the total literature in Indian mammal research. Further, the overall length of period of contribution of highly productive authors was approximately inversely proportionate to the productivity of contribution.

Tapaswi and Maheswarappa (1999)\cite{tapaswi} carried out a bibliometric analysis of 38,886 references appended to 2475 research contributions in a multidisciplinary subject Oceanography published by authors from the National Institute of Oceanography (N10), Goa, during the period 1963 to 1992. The subject-wise distributions showed that Biological Sciences occupied first position with 41 percent of the total citations, followed by Earth Sciences (19%), Chemical Sciences (17%) and Physical Sciences (16%). Out of the total citations, 66 percent of citations were to journals articles, followed by books (16.71%), technical reports (7%) and conference proceedings (6%).

Sivasubrahmanian (2000)\cite{sivasubrahmanian} had done a bibliometric study of articles published in the *Journal of Indian Coffee* and analysed the authorship patterns, the range and frequency of references cited and examined year-wise distribution of papers. It also showed subject-wise break-up of the papers and average length of papers provided in the articles. Results indicated that the trend is towards single authorship and there exists a high degree of collaboration in coffee research.

Hazarika, Goswami and Das (2003)\cite{hazarika} made a bibliometric analysis of the 1402 research papers published in *The Indian Forester* from 1991 to 2000. The state-wise distribution indicated that Uttar Pradesh contributed maximum number of papers with 35.16%. Nagaland and Sikkim counted the lowest number of contribution with 0.14%. Multiple authorship papers were dominant in the field of Indian forestry with 64.55%, while single authored papers were 35.45%.

Nazim and Ahmed (2000)\cite{nazim} made a bibliometric study of research trends in the field of Information Literacy. They observed that a total number of 63.16% had single author, while 27.30% and 79% papers had two authors and three authors, respectively.
2.1.3.4 Bibliometric Studies of Theses/ Dissertations

Shailendra (1992)\textsuperscript{[47]} conducted a scientometric study on History of Science. Study determined scientometric indicators such as growth of the subject, authorship pattern, highly productive authors, content analysis and as well as citation pattern. He applied Lotka's Law and also Kolmogorov- Smirnov statistics test and found to be 0.035 at the 0.01 level of significance; this value being lesser than 0.534, so Lotka's Law is applicable. This study tested by Zipf's Law, then value of the products of rank of a word- type and frequency of occurrences of the word- type fluctuated between 300- 400 and it is observed log values is 2.38 to 2.6. Applicability of Zipf's Law to the data of History of Science studied in this study.

Arora (1993)\textsuperscript{[48]} made a remarkable bibliometric study on core journal of Immunology, data collected from the \textit{Annual Review of Immunology} for four consecutive years, i.e. 1983- 1986. He reveals very concentrations of literature in a few scientific journals. The first four core journals contribute 47.96\% of total citations while the first two top- ranked journals account for close to 30\% to total citations. He determined country, chronological, subject, language wise distribution of core journals and also physical format. The scattering of literature in Immunology is determined by applying Bradford's Law. The core journals in Immunology and other disciplines of biomedical sciences are also compared.

Rana (2002)\textsuperscript{[49]} made a remarkable scientometric study of literature on Wild Mammals. Study observed that 2883 journals covering wildlife literature from 1700 to 2000. A Total of 4694 articles were published in 141 journals in \textit{Indian Mammalian Fauna} from 1876 to 1999. The maximum growth rate of 37.85 articles found during 1990- 1999 per year. In term of growth of authors per year was 46.70 in1999 as compared to 28.80 in1974. Among the major area of study mammals conducted between 1876 and 1999, the highest output, 23.19\% of total occurrence was found in behavioural studies. In this study applied Lotka’s Law and found out that the index constant value of author’d productivity has been observed to be 2.09, which is very close to the inverse square value (i.e. 2) of Lotka’s law. It has been also observed that the average number of citation per articles was 8.01 in all four journals.

Rajneesh (2012)\textsuperscript{[50]} conducts a scientometric study of computer Science with reference to JACM journals. The journal of the ACM occupies first position for a
maximum 2416 (18.91%) articles. Study explore that the maximum (232.24) growth rate of articles belong to the 2004-2008 and minimum (33.80) growth rate was in the 1954-1958. It has been observed that the multi-authored articles have been more than 82% articles and 27.98% articles contributed by single authors. The journal has been most cited with 4566 (42.28%) citations and books cited with 1474 (13.64%) citations. The study explore that the “Computers and Intractability: a Guide to the theory of NP-Completeness” with 27 (1.85%) is the most cited book with 73 (1.05%) citations.

Singh (2013)\cite{51} carried out a bibliometric study on Gandhian literature for period 1920-2010. It is observed that total 6175 articles were published in 913 journals on Gandhian literature. Study found out that journal *Gandhi Marg* occupies first rank with 1170 (18.95%) articles. The study has examined that the total number of single authored articles claim maximum scores (95.20%). It is also observed that books occupy the highest position with 14377 (47.37%) and journals occupy the second position with (13.41%) citations. It is evident that *Gandhi Marg* is the highly cited journal with 187 (15.09%) citations.

Goel (2002)\cite{52} made a remarkable study on gender differences in the field of Psychology in India. He did a bibliometric analysis of Ph.D theses awarded in Psychology by Indian Universities during 1976 to 1985. This study provided valuable results that the 66.67% Ph.D theses were awarded to female scholars in the field of Women Psychology in comparison to male scholars (33.33%). Further, the Ph.D theses awarded in the field of Child Psychology had similar trend, 69.5% of theses were awarded to female and 30.49% to males. However, in the field of Educational Psychology, Ph.D theses awarded to females and males were 35.93% and 64.7% respectively.

Mangala and Seema (2002)\cite{53} conducted a bibliometric study of twenty-three doctoral theses in Economics submitted to Nagpur University during the period 1996-99. A total of 1646 citations were analyzed for identifying their authorship pattern, chronological distribution and ranking of cited documents. The finding reveals that nearly 43 citations were from books and 33 from journals. The authorship pattern study reveals that highest number of citations were from single author, nearly 68 in journals, 75 in books and 70 in conference papers. The subject distribution of theses
revealed that Industrial Economics and Agricultural Economics form 57 more than half of the total theses submitted during the period.

### 2.2 Laws of Bibliometrics

This is one of the oldest areas of bibliometrics. Quantitative relationships based on the empirical work related to the patterns in productivity of journals, productivity of individual scientists, or word frequencies in the literature fall under this category. These relationships go to by the names of Bradford’s, Zipf’s law and Lotka’s law are the best known laws dealing with important phenomena or “regularities” found in science communication. These bibliometric laws are empirically based distributions, and are not innate natural laws but essentially behaviour patterns of the users of the scientific literature. All of them can be used either as integrative research methods or as analytical tools to discover the deeper segments of a research field and to trace trends and developments that are not directly visible. By measuring the flow of textual materials in scientific communication these laws can help to monitor the primary literature in a scientific domain, as well as to evaluate the impact and quality of the information sources available.

These laws play a significant role in modern library resource management, because with decreasing budgets and the rapid growth of periodical, library managers are desperately looking for effective ways to manage their libraries.

These three laws most commonly used in bibliometrics are:

1. Bradford’s law of scattering which describes how articles are distributed over a corpus of journals.
2. Lotka’s law of scientific productivity which describes how papers are published by authors.
3. Zipf’s law of word occurrence, which describes how frequently used and infrequently words are uttered, respectively.

#### 2.2.1 Review of Lotka's Law

Radhakrishnan and Kernizan (1979)[54] conducted tests to verify the satisfaction of Lotka's Law, with the papers published in the area of Computer Science. They stated that in their first experiment, the assumption was made that "an author publishes exclusively through one scientific journal", but it was found that this
assumption was not valid. In the second experiment the authors considered all the papers published by the authors irrespective of the journal. A random selection of authors was made using the cumulative author index of Computer and Control abstracts and was repeated with JACM. The deviation from Lotka's Law was high.

Gupta (1993)\textsuperscript{[55]} also studied author productivity trends by analyzing a cumulative index of geophysics for the two important journals *Geophysics* and *Geophysical Prospecting* for the period 1936-1985. Author productivity trends were tested by applying K-S statistical test. Two files were generated out of this database: one of the period 1936-1985 and the other for the period 1936-1976 to test the time sensitivity of Lotka's Law. Lotka's Law did not apply as inverse square law but could apply satisfactorily with exponent value of 2.1 on author productivity distribution patterns of both the files.

Gupta (1998)\textsuperscript{[56]} conducted a study on the growth of Indian and World Physics Literature from 1900-1950. He explored the applicability of selected technology diffusion models to the growth of literature in Indian and world physics. He focused on the applicability and validity of two forms of Lotka's Law and negative binomial distribution model to the cumulative author productivity of data on Indian physics, looked at the linkages between inequality/concentration measures and development of Indian physics as a discipline. He explored the relevance and applicability of two well-known generalizations, price square root law and 80/20 rule to the cumulative author productivity data on Indian physics.

Suresh (2003)\textsuperscript{[57]} found that there exists an inverse relationship between productivity and its producers. The relationship is summarized in a power-law relationship, referred to as Lotka's Law. According to it, the fraction of authors in a given field who publish x contribution is proportional to 1/(x^-1) where x is the number organizations contributions and a is an index number. He counted the number of individual authors and their contributions in the Decennial Index of Chemical Abstract, 1907-16.

2.2.2 Review of Bradford Law

Sengupta (1973)\textsuperscript{[58]} fostered "an extension of Bradford Law of scattering; that during phases of rapid and vigorous growth of knowledge in a scientific discipline,
articles of interest to that discipline appear in increasing numbers in periodicals distant from that field".

Heine (1998)\cite{59} described the Bradford distribution and the relationship between "journal productivity" and "journal ranking by productivity". However, different ranking conventions exist, implying some ambiguity as to what the Bradford distribution is. A need accordingly arises for a standard ranking convention to assist comparisons between empirical data, and also comparisons between empirical data and the theoretical models. Describes 5 ranking conventions including the one originally used by Bradford, along with suggested distinctions between "Bradford data set", "Bradford distribution", "Bradford graph", "Bradford log graph", "Bradford model" and "Bradford's Law".

Narayana and Reddy (2000)\cite{60} stated that Bradford's Law in bibliometrics as consisting of two aspects, that of distribution, which is purely a mathematical pattern, and the relevance of such a distribution to bibliometrics. They discussed the methodology for estimating Bradford group within a given set of bibliometric data, and proposed a simple and easily adaptable statistical search method together with illustrative applications.

Gupta and Suresh Kumar (2001)\cite{61} described the broad characteristics of Theoretical Population Genetics (TPG) literature, such as age, form and its subject scattered in different fields, using citation data. They compiled the rank list of journals using both journal productivity and journal citation data. They studied the applicability of Bradford's Law in the distribution of citation data appearing in 1959, 1969 and 1979 source articles published in core journals in TPG.

2.2.3 Review of Zipfs Law

Sichel (1975)\cite{62} wrote "On a distribution law for word frequencies". He stated, "In the past, several attempts were made to represent word frequency counts by statistical distribution laws. Of the models suggested, none was singularly successful when applied to a variety of data over the entire length of the observed word distribution". He developed a new model to which "twenty observed distributions quoted in the literature were fitted and the results look most encouraging".

Wyllys (1981)\cite{63} studied and noted that Zipfs Law only approximates the relationship between ranked $r$ and frequency $f$ for any actual corpus. Zipfs work
shows that the approximation is much better for the middle ranks than for the very lowest and the very highest ranks, and his work with samples of various sizes suggests that the corpus should consist of at least 5000 words in order for the product \( rf \) to be reasonably constant, even in the middle ranks.

Tsay (1999) \(^{[54]}\) has described applications of the Zipf’s Law which is one of the three basic laws of bibliometrics. The Zipf’s Law explores the relationship between words and their frequency of occurrence in text. In addition, the following issues of the Zipf’s Law are also discussed, analysis and modification of the Zipf’s Law itself.

Ivanor (2002) \(^{[65]}\) has analyzed the flow of international communications using bibliographies of papers published by scientists. Study shows that distribution of scientific papers in journals is governed by Zipf’s Law.

### 2.3 Citation Analysis

Citation analysis is the major thrust area of bibliometric research. It deals with the analysis of the bibliographic references which generally appear at the end of the scientific communication. When an author cites a paper (say X) in his paper (say Y), then X is called the cited paper and Y is the citing paper. Thus, citation analysis presents a connection between cited and citing documents.

When one author cites another author, a relationship is established. Citation analysis uses citations in scholarly works to establish links. Many different links can be ascertained, such as links between authors, between scholarly works, between journals, between fields, or even between countries. Citation both from and to a certain document may be studied. One very common use of citation analysis is to determine the impact of a single author on a given field by counting the number of times the author has been cited by others.

Paul and Roy (1983) \(^{[66]}\) defined citation analysis as, “Citation analysis is one branch of bibliometrics where the unit of analysis is document that is a document, which is being cited as a bibliographic reference or as a footnote in a citing document”

Smith \(^{[67]}\) explained the two kinds of citation: “A reference is the acknowledgement that one document gives to another; a citation is the
acknowledgment that one document receives from another”. A relationship is implied between the cited document and the citing document, all or part.

2.3.1 Conceptual Review in Citation Analysis

It is reported that the “Concept of identification of the source of an idea or quotation, developed during Renaissance, (i.e. from 14th to 16th century) after the invention of printing. However, the precise origin of use of footnotes or references is obscure. It is mentioned that earlier examples of notes resembling footnotes are the Rheims- Douai version of the Bible (1763). The earliest example provided in the Oxford English Dictionary is William Savage’s a dictionary of the Art of Printing (1841), containing 88 bottom notes…or footnotes. The value of citation analysis became clear with the publication in 1873 of shepard’s citations, used since that time as the essential tool in providing stare decisis for the legal profession. Barr (1966) pointed out that notes in the margins function as references in John Wolfe’s (1582) printing of Thomas Watson’s Hekatompithaia: or Passionate Century of Love.

Gross and Gross (1927) [68] conducted the tabulation and analysis of footnote and bibliographic references.

Gross and Woodford (1931) [69] studied periodicals in the field of geology, to assess the relative importance of serials within the group selected, and to discover the extent to which researchers seemed to depend on varied or on few sources.

Price (1963) [70] documented the growth of scientific literature in his book Little Science, Big Science (1963). This book became a classic, suggesting that science is not a unified whole, but a mosaic of specialty areas. This new understanding fostered an effort to map the intellectual structure of science.

Webb (1966) [71] accepted the above features of citations and says that unlike the data obtained by interview and questionnaire, citations are unobtrusive measures that do not require the cooperation of the respondents and that do not contaminate the response i.e. they are non-reactive. So any document having the list of citations or references provides the raw material for citation analysis.
According to Malin (1968) [72] “Citation implies a relationship between a part or the whole of the cited document and a part or the whole of the citing document”.

Weinstock (1971) [73] observed that scientific tradition requires that when a reputed scientist and technologist publish an article, she/he should refer to earlier articles which are related to her/his theme. These references are supposed to identify those earlier researchers whose concepts, methods, applications etc. inspired or were used by the author in developing her/his own article.

Kochen (1974) [74] stated that it is not surprising that there is a great deal of arbitrariness in the way authors select references for their bibliographies. Undoubtedly, many documents, which the author does cites, are only slightly relevant. In spite of the uncertainties associated with the nature of citation relationship, the citations are attractive subject of study because they are both unobtrusive and readily available.

Martyn (1975) [75] reviewed the origin and application of citation analysis and according to him, prior to the introduction of Science Citation Index, citation studies were confined to the production of raw citation counts for preparing ranked list of journals or to determine -core' journals in a subject field. Shortly after the publication of Science Citation Index, studies began to appear which used citation devices for looking at the relationships between groups of journals or groups of authors, and by implication the relationship in and between areas of scientific activity.

Garfield et al. (1978) [76] describe citation analysis as an analytical tool which uses reference citations of scientific papers. According to Le Pair citation analysis is probably a fair evaluation tool for those scientific subfields whose journals are the formal channels of communication.

Shaw (1979) [77] points to a relation among authors as a measure of the extent to which they communicate indirectly through the literature which establishes by citation. The strength of this relationship between two authors may be computed by counting the number of times each author cites the other. He states that papers, journals and countries may also be related by the number of times each cites all other papers, journal and or countries.
Smith (1981)\textsuperscript{[78]} observed that Citations are signposts left behind after information which has been utilized and as such provide data by which one may build pictures of user’s behavior without ever confronting themselves. Any set of documents containing reference list provides the raw materials of citation analysis, and citation counts based on a given set of documents which are precise and objective.

Le Pair (1988)\textsuperscript{[79]} stated that "It is generally assumed that there is a certain positive correlation between the number of citations and the quality or the impact of the cited work" although the works are cited for various reasons.

Sandison (1989)\textsuperscript{[80]} asserts that a citation is not just a set of bibliographic data at the end of a paper as end notes, footnotes, etc., or extracted from a citation index. In fact, citation is the representation of a decision made by an author who wants to show the relation between the document she/he is writing and the work of another (at a particular point).

According to Egghe and Rousseau(1990)\textsuperscript{[81]} the existence of a cited document in a reference list indicates the facts that there is a relationship (e.g. similarity in the subject, topic or methodology, etc.) between the cited and citing documents from the author's point of view. They identify the area that deals with the study of these relationships as citation analysis.

Lancaster (1991)\textsuperscript{[82]} has depicted citation analysis to one of the very important group of Bibliometric studies, which relates what sources authors cite. He has stated that citation analysis deals with aspects such as: who are the links among the citations (i.e. who cites whom, which journal is cited by which journal, what subject fields are more cited in the literature of a specific discipline, and so forth).

Similarly Diodato (1994)\textsuperscript{[83]} describes citation analysis “as a major method of bibliometrics that considers the citations (both to and from documents) So citation studies may focus on the documents and or their authors, the journals (either as cited or citing source of publication, when documents are journal articles) and countries as the producer of those documents.
Snyder et al. (1995) \cite{84} emphasized that "citation establishes a relation among authors which is a measure of the extent to which they communicate indirectly through the literature".

Reitz (2004) \cite{85} has expressed that Citation means a written reference to specific work or portion of a work such as book, article, dissertation, report, musical composition etc. produced by a particular author, editor, and composer to identify the document in which the work is to be found. In short, Citation means, “a reference to a text or a part of identifying the document in which it may be found”

2.3.2 Empirical Review in Citation Analysis

Citation Analysis in Social Science

Small and Crane (1979) \cite{86} conducted a co-citation clustering of Psychology, Economics and Sociology 1972-1974 using the full SCI and SSCI. In examining the characteristics of the resulting clusters, they found strong evidence of transdisciplinarity in sociology compared with the other areas. For example, 97% (all but one) of the sociology clusters was considered interdisciplinary in that less than 2/3 of the citing papers were in sociology journals. In contrast, in Psychology and Economics a smaller proportion of the clusters were interdisciplinary using the same criterion (71% and 64% respectively). Examining co-citation links between clusters in the disciplines revealed that economics clusters were substantially more strongly linked to each other than were the sociology clusters. Examining links between clusters and other disciplines revealed that sociology clusters have more connections with other fields than doe’s economics.

Clausen (1988)\cite{87} studied the journal of Social Science History (SSH), 42 articles published in 1983 to 1984; authors cited SSH articles 32 times. Excluding (SSH) there are 378 citations. The leading citer is the Journal of Interdisciplinary History (44). Following are Historical Methods (26), the Journal of Economic History (24) and the Journal of Social History (22). There are 8 citations in History and Theory, 7 in the Journal of Southern History. The Social Science Citation Index, Journal Citation Reports for 1985 show very similar citing practices for five of the six journals, with 1 % to 16% of the citations being to articles published from 1983 to
I985. On the other hand, nearly half of the references are to articles published in the last ten years, I976 to I985, the period of the life of Social Science History.

Sangam (1989) \[88\] worked on citation study and information use pattern of research in the field of Psychology. According to his study, the psychologists referred more books (82.8\%) than journals (14.16\%). The subject-wise scattering of references was analysed and it was concluded that nearly 93.80\% of the documents were cited from their own field and the rest of the document citations were from the other different fields including Mathematics (2.82\%), Sociology (2.54\%), Medicine (0.70\%) and Economics (0.10\%). The top ten journals covered most of the literature, accounting for 71.11\% and the remaining twenty journals covered 28.89\% of the literature. The *Journal of Abnormal* and *Social Psychology* occupied the first rank, and covered 12.1\% of total literature.

Cronin et al. (1997) \[89\] constructed a database comprising 30,000 references from 90 books randomly chosen from those reviewed in top sociology journals and published between 1985 and 1993. Cronin et al. compared lists of the 26 authors most cited in the monographs and in the top 24 sociology journals. Authors found that nine authors featured on both lists. The five authors ranked 22 to 26 on the book list did not appear among the top 532 authors most cited in the journals.

Satish and Kabir (2001) \[90\] studied the citations patterns in *Quarterly Journal of Economies*. The bibliographic form-wise distribution of citations showed that journals accounted for 51.97\% of the total citations, followed by books (36), monographs (5.95), manuscripts (2.24) and others (2). English was the most preferred language of communication of research findings accounting for 99.42\% of the total citations followed by French (0.44) and German (0.012). The country-wise distribution of citations showed that USA occupied the first position with 60.8\% of the total citations, followed by UK (14.3) and the Netherlands (8.99).

Shokeen and Kaushik’s (2003) \[91\] study the citation analysis of *Indian Journal of Economics* concluded that majority of citations i.e. 64\% were single authored. The two authored and three authored citations were 27.53\% and 5.85\% respectively. The information use patterns revealed that the journal articles (81.11\%) were more cited
than books (13.84%), conference proceedings (2.79%), theses (1.57%), and others (0.6%) 

Kanungo’s (2007)\textsuperscript{[92]} study carried out on citation pattern of 108 articles published in \textit{Journal of Asian Studies} during 2000-2004 found that the social scientists heavily used books (65.44%), followed by periodicals (22%) and other sources like- government publications, newspapers, theses, conference proceedings, archival papers, unpublished sources and references sources.

Venkataramana and Sudhakar (2010)\textsuperscript{[93]} examined citation analysis of \textit{Journal of Rural Development} from 1999- 2008, their study observed that the books accounted for highest number of citations with 1574 (37.9%) followed by journal articles with 1363 (32.8%) and reports with 726(17.5%) citations. Seminars/conferences/ workshop/symposiums had 234 (5.6%) citations, Web Resources had 60 (1.4%) citations, and other sources had 6 (0.1%) citations. The authorship pattern showed that 54.1% of the citations are contributed by single authors and followed by two authors with 18.3% and corporate authors with 16.9%. Regarding core journals in the rural development, the first 8 journal titles account for 35.1% of citations followed by 85 journal titles with 33.2% and remaining 354 journal titles cover 31.7% of citations. The 153 journals published from India, out of 467 journal titles. It is very interesting to note here that the first rank is occupied by \textit{Economic and Political Weekly} with 248 citations.

Sharma and Rana (2016)\textsuperscript{[94]} evaluate the citation behavior of \textit{Indian Journal of Gender Studies} from 1994 to 2008. Study is to find out most cited sources, chronological distribution of journal, most cited journals and authorship pattern. Total 5529 citations appended in the186 articles which related to women’s issues. It is evident by the analysis that the highest number of citations recorded by books 3051 (55.18%) followed by journals with 1471 (26.61%) citations. Chronological distributions of citations shows that highest 2376 (42.97%) citations have occurred during the 1991-2000 and the period 1851-1860 have the least 3(0.05) citations. In the rank list of journals \textit{Economic and Political Weekly} scores the first rank accounting with 217 (14.75%) citations. The study analyses that 4456 (80.59%) citations are single authored. This study is dominated by solo authorship pattern.
2.3.3 Citation Analysis in other subject

Chakraborty (1970)\textsuperscript{[95]} studied the citations in the journal *Marine Geology* for the period 1966 to 1968. The results showed that 10 percent of citations were published from 1837 to 1936 and the remaining 90 per cent of citations were published from 1937 to 1967.

Raina (1983)\textsuperscript{[96]} analysed 1178 citations in *Journal of Geological Society of India* for the year 1980. The bibliographic form-wise distribution of citations showed that citations to journals occupied first place accounting for (68\%) of total citations, while (26.32\%) were citations to books and Ph.D theses. The authorship pattern showed that papers that were multi-authored were more in number (69.15\%) and single author papers constituted (30.85\%) of the total cited papers.

Nag (1984)\textsuperscript{[97]} analysed the citations in the *Indian Journal of Earth Sciences* for the period 1974 to 1983. The bibliographic distribution of citations showed that citations to journals occupied the first position accounting for 78\% of the total citations, followed by books (13\%), conference proceedings (7\%), theses (1\%) and others (1\%). Nag also analysed titles of Earth Sciences periodical literature of the *Journal of Geological Society of London*, *American Journal of Science*, *Geological Society of American Bulletin* and *Journal of Geology* for the years 1960, 1970 and 1980, to measure the total number of words per title, the total number of substantive words per title, and the proportion of substantive words per title.

Nijagunappa and Nijagunnappa (1985)\textsuperscript{[98]} studied 5608 citations in *Journal of the Geological Society of India* for the period 1978 to 1982. The analysis showed that 72\% of the total citations were from journals, followed by books (16\%), conferences (6\%), reports (3\%), dissertations and theses (2\%) and miscellaneous (1\%). The first 24 journals covered 60 % of total citations and remaining 40% of citations were scattered in different journals.

Sengupta (1989)\textsuperscript{[99]} studied the growth of knowledge and literature in the neurosciences by analyzing 5785 citations collected from the bibliographic database published in the source journal *Annual Review of Neuroscience*. The first nine journals in the ranked list contributed 50\% of the total citations.

Rana(1991)\textsuperscript{[100]} conducted a study on citation analysis of 4698 references cited in the articles published in the *Journal of Wildlife Management* during the year
of 1989. However, this study concluded that the wildlife scientists cited journals (59.98%), which was more than books (19.46%), proceedings of conferences/symposium/workshops (7.49%), theses (6.85%), reports (5.51%) and others (0.70%).

Lancaster (1992) has presented a bibliometric analysis of the citations to Ranganathan's writings over the period 1956-1990, using social sciences citations index and science citation index. The findings indicate that his influence has not diminished over the years. His books are more frequently cited than his articles. Citations to the prolegomena to library classification, colon classification, classified catalogue code, and five laws of library science account for more than a third of the total citations (630). Ranganathan has been cited in a wide range of diverse contexts. The five laws are seen by several authors as the basic philosophical framework of librarianship. Facet analysis and subject structuring get substantial reference, including in computer generation of thesaurus, deep structure indexing systems and expert systems design. In discussions on rules and codes for cataloguing, the classified catalogue code and canons have received substantial notice.

Arjunlal (1993) analysed 6273 references contained in the *Journal of the Indian Society of Soil Science* for the period 1985 to 1988. The bibliographic distribution of citations showed that citations to journals occupied (69.41%) of the total citations, followed by books (8.74%), govt. publications (8.40%), bulletins (3.7%) and conference proceedings (3.31%). The first 7 journals represented (60.54%) of the total citations from 376 journals.

Sahu (1994) studied 7751 citations collected from 61 articles of "Annual Reviews of Microbiology" during the period from 1993 to 1994. It is observed that among all documents journals account for 92.46 % of the total citations, followed by books (5.9%) and the rest (1.61%) for documents like proceedings, patents, theses, reports and workshops. Half life period of microbiology literature was found to be a period of five years from 1989 to 1994. In the ranking of journals, the *Journal of Bacteriology* is the most popular journal in the field of microbiology. The country-wise distribution of citations revealed that 48.7% of citations were from USA, followed by UK (14.2%), Netherlands (6.6%), Japan and West Germany (3.8 %each).
Das and Seth (1995)\textsuperscript{[104]} analysed the citations of the journal \textit{Hydrometallurgy} for the period 1990 to 1993. Out of 283 contributions, 161 were from universities and 122 from other institutes. The analysis showed that (76.9\%) of the total citations were from journals, followed by books (13.2\%) and proceedings (5.3\%).

Aravinda (1996)\textsuperscript{[105]} studied the characteristics of the literature of Physical Anthropology by analyzing the citations of \textit{Annual Review of Physical Anthropology} for the period 1980 to 1994. Out of the total citations, 59.33 percent of citations were to journal articles, followed by books (31.71\%), conference papers (4.66\%) and technical reports (1.19\%). The country-wise distribution of citations revealed that 66.88 percent of citations were from USA, followed by UK (17.62\%) and Switzerland (2.39\%). The half-life of the cited journal literature was found to be 14-15 years.

Biradar and Kumbar (1998)\textsuperscript{[106]} analysed 2993 references appended to 274 articles in the \textit{Indian Journal of Environmental Protection} for the years 1994 and 1995 respectively. The bibliographic form-wise distribution of citations showed that journals accounted for 59.97\% of the total citations and in this field research goes back to 20 years.

Dhiman (2000)\textsuperscript{[107]} studied 175 articles in the \textit{Ethnobotany journal} for the period 1989 to 1998. The institution-wise contribution of articles showed that research institutions/colleges occupied first position with 47.5 percent of the total citations, followed by universities (30.2\%) and others (22.3\%). The country-wise distribution of articles showed that India constituted (81.7\%) of the total articles, followed by Canada (2.8\%), USA (2.8\%), UK (2.8\%), Nepal (2.8\%) and Japan (1.6\%).

Dutta and Sen (2000)\textsuperscript{[108]} studied 743 citations appended to 41 research articles published from January to April 2000 issues of the \textit{Indian Journal of Pure and Applied Physics}. The articles were contributed by 124 authors (117 Indian and 7 foreign authors).

Ghosh (2000)\textsuperscript{[109]} carried out a citation analysis of 1374 citations from 117 articles published in \textit{Library Science with a Slant to Documentation and Information Studies} during 1995 to 1997. The results indicated that 63.26\% of the total contributions came from the working librarians/professionals and the teaching faculty contributed the remaining 36.34\% of the contributions. The contributions of single
author and two authors were 58% and 36% respectively. Journals with 48.33% and books with 31.51% citations shared a total number of 80% citations.

Jena (2001)\cite{110} analyzed 15,520 citations appended to research articles in the *Annual Reviews of Nuclear and Particle Science* for a period of nine years from 1990 to 1998. It is revealed that journals constitutes 7 (9.6%) of total citations followed by proceedings (5.58%), books (4.69%), reports (3.8%), theses (0.85%) and electronic media (0.2%). It was observed that multi-authored articles (having more than three authors) constitute (41.792%) of the total journal citations and period of obsolescence of literature in this field was five years. The *Journal Physics Review* contributes 2660 (26.531%) citations and topped in the ranking list of journals.

Gopalkrishnan and others (2002)\cite{111} studied 66 articles from the *Annual seminar on Electronic Sources of Information*, held at DRTC, Bangalore, March 2000 and the *Journal of Documentation* for the year 1999. The results showed that seminar volume accounted for (60.6 %) of the articles and the Journal of Documentation accounted for (39.4%) of articles. The citation pattern showed that journals accounted for (34.5%) followed by www (30.6%), books (13.7%) and others (21.2%).

Koley and Sen (2003)\cite{112} studied 457 citations appended to 26 articles published in the four issues of *Quarterly Indian Journal of Physiology and Allied Sciences* for the year 2001. The bibliographic-form wise distribution of citations showed that citations to journals occupied first position with (76.8%) of total citations, followed by monographs (18.59%), conference proceedings (1.53%), research reports (1.53%) and others (1.54%). The study of authorship patterns showed that papers with two authors were highest in number (30.89%) and single author papers constituted (23.58%) of the total citations.

Singh and Dominic (2006)\cite{113} carried out an analytical study of citation pattern of *Allelopathy Journal*. A team research had been quite substantial in the field as multiple authors contributed more than 60% of the total citations. The study also revealed that nearly 90% of total citations were from journals, followed by theses with 6.11% and conference papers with 3.79%.

Raut, Sahu and Ganguly (2008)\cite{114} studied 8716 citations appended in the journal *Strategic Management Journal* for the period of two years from 2005 to 2006. The bibliographical form-wise distribution of citations showed that journals
accounted for (76.46%) of total citations, followed by books (19.97%), other documents like proceedings, patents, theses, reports, working papers etc accounted for (03.35%). In ranking of journals, the first position was occupied by Strategic Management Journal accounting (18.68%) of total.

### 2.3.4 Citation Analysis of Theses/ Dissertation in Social Sciences

Sangam (1985)\[115\] conducted a study on a ranking of periodicals in Geography by using citations of Ph.D. dissertations accepted by Karnataka University, Dharwad, during 1964 to 1982. The results indicated that (95%) of the total citations were shared by the three periodicals, namely Geographical review (13.05%) and Annals of the Association of American Geography (12.43%) and Economics Geographer of India (9.23%).

Johan, Jessy (1997)\[116\] have conducted a citation study of 6260 citations collected from 37 Ph. D theses in Social Science accepted by the Kerala University, She revealed that Social Welfare is the most cited journal. Journal of Social Issues ranks second and Population Studies in the third position. Sociologists refer books (55.33%) as the main source of information for their research. Their second choice is periodicals (30.46%). She observed that single authorship is most cited. They have contributed (78.85%) of the total contributions, two authors are (15.50%) and the third position goes to (5.64%) of the total authors. Some periodicals like Economic and Political Weekly, Journal of Social Psychology and Journal of Educational Psychology are used by researchers in more than one discipline in social science.

Bandopadhyaya and Nandi (2001)\[117\] have carried out citation analysis of 9 doctoral dissertations of political science submitted at the Burdwan University from 1991-1995. They reveal that book is the most favoured form (56.2%) of literature. Next comes periodical publications (20.2%) and report literature is (9.51%). Twenty nine journals are required to satisfy (80%) of journal requirement of scholars. There are 103 titles in the ranked list. Economic and Political Weekly (24.797%) top the ranked list of journals.

Dorawamy and Pulla Reddy (2001)\[118\] studied citations in doctoral theses in Geography accepted by the Sri Venkateswara University, Tirupati, during the period 1991 to 2000. The findings showed that books were highly cited (41.89%), followed by journals (37.96%) and conference proceedings (20.15%). The country-wise scatter
of citations showed that India occupied first position with, (32.41%) of the total citations, followed by USA (8.63%) and UK (7.64%). The results revealed that the single author papers were highest in number.

Hirwade and Dankhade (2002)\textsuperscript{[119]} carried out a citation analysis of 23 doctoral dissertations in the field of economics, submitted to Nagpur University during the period 1996 to 1959. The bibliographic form-wise distribution of citations showed that books accounted for (42.77%), followed by journals (32.81%), corporate bodies (14.70%), newspapers (4.5%) and others (5.22%). The results revealed that the single author papers were most in number. The half-life period for journals was found to be 22 years.

Sasikala and Govinda Raju (2008)\textsuperscript{[120]} have carried out a citation analysis of 24,699 citations appended to 192 doctoral dissertations in the field of economics accepted by Andhra University. Authors have analysed that books (37.48%) and journals (35.39%) have been used by researchers in Economics. Books and journals constitute nearly (73%) of the total items cited. Reports and editorial works occupy the third and fourth places with (13.26%) and (4.07%) respectively. The researchers in Economics also cited nearly (3.89%) of citations to newspapers and magazines. Single author papers are the highest in number, comprising (83.42%) of the total citations, two authors papers occupy the second place with (13.14%). Thus, the multi-authored papers are in number accounting for (16.58%) of the total cited papers.

Nasir and Kumar (2011)\textsuperscript{[121]} conducted a study on doctoral dissertations in economics submitted to the Aligarh Muslim University during 1990-2010 and found that books are the most dominant form of citation. Single authorship prevailed in the citations. They also found that India ranked first in distribution of citations by country and Economic and Political Weekly is the most cited journals in the discipline of Economics.

Trayambak Rao, Dattatraya and Sonwane (2012)\textsuperscript{[122]} have examined the citations of Ph.D. theses in Economics submitted to Dr. Babasaheb Ambedkar Marathwada University, India during 2000-2010. The study has revealed that most of the citations were from books. Single authored citations are more in numbers. The geographical distribution shows that Indian literature is mostly used for research.
Zafrrunnisha (2012)\cite{123} did a citation study on sociology theses submitted to the Sri Venkateswara University, Tirupati and Osmania University, Hyderabad for the award of doctoral degree during the period 1981-2005 (SVU) and 1974-2005 (OU). The study revealed that books were the most used source. Single authored papers received the highest citations. In the ranking of journals *Economic and Political Weekly* occupied the first rank.

Singh and Bebi (2013)\cite{124} in their study examined 25 Ph.D. theses in the discipline of sociology submitted to the University of Delhi during 1995-2012. The study found that highest number of citations was single authored (83.94%) and (67.23%) of citations were to books and only (22.20%) citations were from journals. The country-wise scattering of citations revealed that less than half (45.52%) of citations were from India and the rest from abroad especially from USA and UK.

Singh, Bebi and Garg (2014)\cite{125} have analysed citation pattern of Ph.D. theses in Social Sciences awarded by the University of Delhi during 1995-2008. The analysis reveals that 51,889 citations were made to 259 theses in social sciences. They analysis that books are the most preferred source of citations in all disciplines except economics and constitutes about 55.5% of total citations. Authorship pattern reveals that single authored papers received highest number of citations which indicates that the papers in disciplines of social sciences are least collaborative. Maximum citations have been received during the period 1991-2000 i.e. 14838 (28.8%) followed by 1981-1990 i.e. 14468 (28.6%). In the rank list of journals, India's *“Economic and Political Weekly”* occupies first rank accounting to 2276 (22.7%) of the total journal.

### 2.3.5 Citation Analysis of Theses/Dissertation in other subject

Maheswarappa and Prakash (1982)\cite{126} analysed the literature use pattern by researchers in the field of Botany by analyzing 2726 citations appended to 15 doctoral theses accepted by the University of Mysore during 1973 to 1980. The bibliographic distribution of citations showed that journals occupied (75.61%) of the total citations, followed by books (12.42%), and conference proceedings (4.55%). The half-life of botanical literature was found to be 12 years. The geographical distribution of citations showed that USA occupied the first place accounting for (29.25%) of the total citations, followed by India (14.65%) and UK (13.29%).
Sangam and Biradar (1990)\textsuperscript{[127]} analysed 7576 citations appended to 145 M.S. dissertations in Surgery accepted by the Gulbarga University, Gulbarga, during the period 1982 to 1989. Out of the total citations, (54.23\%) of citations were to journal articles, followed by books (35.39\%), conference proceedings (5\%) and others (5.38\%). The geographical distribution of cited documents showed that USA occupied first position accounting for (41.71\%) of the total citations, followed by UK (28.45\%), India (26.38\%) and other countries (3.46\%). The half-life of the cited journal literature was observed to be 12 years.

Sahu (1993)\textsuperscript{[128]} analysed 1722 citations appended to doctoral dissertations in Library and Information Science accepted by Utkal University, Bhubaneswar from the beginning to June, 1993. Out of the total citations, journals occupied first position with (55.16\%) of citations, followed by books (25.51\%), conference proceedings (6.3\%) etc. The half-life of the cited journal literature was observed to be 11 years whereas in case of book it is 13 years.

Madkey and Rajyalakshmi (1994)\textsuperscript{[129]} studied citations appended to doctoral dissertations in the field of environmental science and engineering, which were consulted by the scientists working at National Environmental Engineering Research Institute, Nagpur, during 1977 to 1991. The results revealed that single author papers were most in number. USA occupied the prime place contributing (52.05\%) of the total citations, and half-life period for books and journals were found to be 17 and 18 years respectively.

Mubeen (1996)\textsuperscript{[130]} carried out a citation pattern of 22 doctoral dissertations in Chemistry and highlighted that the scholars cited (73\%) journals, (11.48\%) books, (9.24\%) patents and (6.28\%) technical bulletins, conference proceedings, theses and technical reports. The study also examined the authorship pattern and found that single author citations were (27.49\%) of total citations, followed by two authors amounting to (22.66\%), three authors amounting to (15.36\%) and remaining articles were contributed by four or more authors. The languages distribution of citations revealed that (79.4\%) of citations were in English and all other languages accounted for (20.6\%) of total citations.

Srivastava (2002)\textsuperscript{[131]} carried out a citation analysis of 74 doctoral dissertations in the field of Chemistry submitted to Banars Hindu University during the period of
15 years (1980-1994). The bibliographic form-wise distribution of citations showed that journals occupied the first position accounted for (85.23%), followed by books (7.47%), abstract (4.65%), dissertations (0.68%), report (0.54%) etc.

2.4 Authorship Pattern

Authors play vital role in the complex process of communication. Communication means the transmission of information, ideas, emotions, skills, etc., in documentary channel author is the most important pole. According to Harries and Hedges, author is ‘a creator of any intellectual and artistic work’. Due to the increasing facilities of research, emphasis on increase of production advances in the technology and the facilities for communication. According to Feather and Sturges ‘The person, persons or corporate body responsible for the writing or compilation of a book or other work, usually in textual form’. The author is usually distinguished from an editor, translator, copier, etc. In a wider sense the concept of authorship is creators of original content. The authors generate information in various subject fields and also publish it in various forms of literature such as books, journals, theses, dissertations, etc. The scientific productivity of such authors has been studied by various library scientists.

2.4.1 Review Based on Authorship Pattern

Chakravarty (1981)\textsuperscript{132} studied the patterns of multiple authorship. It is proved to be the trend for Geology from 1940 to 1970 ranging from 84.97 percent in single authors to 48.36 percent, the rest being two authors and multiple authors. The Indian contributions gained 76.74 percent in 1940, 52.56 percent in 1970 from the single authors. He also presented graphs and tables in pathology, paleontology.

Maheshwarappa and Mathias (1987)\textsuperscript{133} have studied the multiple authorship, authorship patterns and research collaboration in Biological Sciences in India during 1965-83. The authorship data has been collected from the Indian Science Abstracts of 1965, 1970, 1975, 1980 and 1983 as sample years. The findings revealed that proportion of single authored papers declined from 36.07% in 1965 to 14.31% in 1983 while multiple authorship showed increasing trend from 63.3 % to 85.69% with an increase in average number of authors per paper from 1.92 to 2.25. The variation in the degree of collaboration and the average number of authors per paper was found in
different disciplines, thus indicating the variation in the extent of collaboration in biology, botany and zoology.

Shailendra (1992)\textsuperscript{[134]} investigated to explore the information sources in history of science in India from the selected research journals and analysed them with the aid of suitable scientometric techniques, over a period of 1905-86. The literature in the history of science is extremely significant for determining the contribution of Indian scientists to the growth and development of scientific literature. The study presented the scientometric indicators, such as growth of the subject, authorship pattern, highly productive authors, content analysis, as well as citation pattern; also a machine readable data base on the history of science was created to facilitate analysis, proper control of the literature and its expeditious retrieval.

Humayoon Kabir (1994)\textsuperscript{[135]} analysed the authorship pattern and the extent of research collaboration in the field of bibliometrics literature, based on the data collected from LISA (1964-1990). The study revealed that single author contributions are maximum and team research is not popular among the researchers in bibliometrics. The ratio between single and multi-authored papers is 2.2: 1. Multi-authored papers were identified increasing slightly during the period. It was found that there was not even a single entry of bibliometrics in LISA up to 1968.

Rana and Agarwal (1994)\textsuperscript{[136]} studied on authorship and collaborative research patterns in Indian Wildlife and Fisheries, based on the data collected from ‘Wildlife and Fish Review’ published during 1980 to 1989. They observed that the proportion of single author papers had decreased from 63.68% in 1980 to 52.74% in 1989. During the same period, there was an increase in average number of authors per paper from 1.57 to 1.70. The degree of collaborative research also increased from 0.36 to 0.47.

Vimala (1997)\textsuperscript{[137]} examined authorship pattern of researchers in Biological Sciences by analyzing the citations in 200 doctoral theses in Biological Sciences submitted to Sri Venkateswara University, Tirupati. The study of authorship pattern showed that papers with two authors were highest in number (40.4%) and single author papers constituted (26.67%) of the total cited papers. The half-life period of journal citations was found to be 11.43 years and 12.79 years for book citations.
Bandyopadhyay, Amit Kumar (2001) \cite{138} examine authorship pattern of 92 Doctoral theses submitted to the Departments of Mathematics, Physics, Mechanical Engineering, Philosophy and Political Science, Burdwan University, from 1981 to 1990. They observe that multiple authored articles are found in physics (62.24\%). While (36.6\%) of the articles in mechanical engineering, (36.3\%) of the articles in Mathematics, (12.3\%) of the articles in Philosophy and only (3.85\%) of the articles in Political Science are multiple authored. Multiple authorship specific subjects, is highest in nuclear physics (72.52). The multiple authorship trends have increased steadily through decades (1950 to 1990) in Physics, Mathematics and Psychology.

Kherde (2004) \cite{139} discusses in his paper the detailed study of 521 research articles published in six major journals of library science from 1996-2001. He reveals that out of 521 research articles, 329 were contributed by single author. The percentage of it is 63.15\%. 156 research articles were contributed by two authors while only 29(5.57\%) contributed by three authors and 7 (1.34\%) by more than three authors. He observes that amongst 524 identified authors, 398 authors have only one research article to their credit while 80 authors have two, and 27 have three research articles on their credit, 75 female authors have one, 16 have two and 4 have three research articles on their credit. Multiple authorship trends are increasing steadily since 1999.
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