2. Review of Literature

2.1 Introduction

Similar to other science subjects, the discipline of library and information science does not merely rely on assumptions and opinions derived out of thinking and experience. It is looking forward to research based on quantitative measurement and objective analysis of data. Among several other such kinds of analytical scientific developments, one that has been inviting lot of attention and research activities is the field of ‘Bibliometrics’. Bibliometrics is emerged as a research front in its own right in Information Science. It is now being vigorously pursued and with the result, it has been found that one-fourth of all the articles published in Library Science periodicals are on bibliometrics and its related topics. Increase in the number of publication may have been due to the greater interest in the theory of literature structure.

Bibliometric technique are being used for a variety of purposes like determination of various scientific indicators, evaluation of scientific output, selection of journals for library and even forecasting the potential of a particular field. The popularity in the adoption of bibliometric technique in various disciplines stimulated growth of literature. Literature review can take on two roles, one is as a research method in itself and the other as preparation for further empirical investigation. " A literature review is a written document that presents a logically argued case founded on a comprehensive understanding of the current state of knowledge about a topic of study " (Machi and McEvoy, 2009). A critical discussion of all significant, publically available literature that contributes to the understanding of a subject is called literature review. To know the existing output in the field of our interest, it is necessary to go through relevant literature.

Literature review were made on following topic -

1. Genesis of Bibliometrics
2. Growth and Obsolescence of Literature
3. Problems and Limitations of Bibliometrics
4. Laws of Bibliometrics

5. Citation Analysis

6. Bibliometric Studies at National Level

7. Bibliometric Studies at International Level

2.2 Genesis of Bibliometrics

Cole and Eale’s (1917) study entitled "The History of Comparative Anatomy: A statistical Analysis" 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 the author and journal entries in the international Catalogue of Scientific literature, ranked the results according to the country of origin and resulted that Germany ranked at the top position in the production of scientific literature during the period of 1900-1913. In 1938, the term of ‘Statistical Bibliography’ was again used by Heckle in his paper entitled ‘The periodical literature of bio-chemistry’, Gosnell (1943) in his dissertation and later in 1984 in his article. Later the term of ‘Statistical Bibliography’ was used in 1948 and 1949 by Fusilier, Raisig (1962), Baker (1966), Pritchard (1969). This term was considered very clumsy, not so descriptive and can be confused with statistics itself or bibliographies on statistics. Dr. S. R. Ranganathan (1947) coined the term ‘Librametry’ to connote the use of statistics to evaluate an existing or proposed library service and resources. This term is a wider term which includes in it the concept of bibliometrics. But this term did not take its place in library science and was forgotten for many years. Later, it was called ‘Librametrics’. The Russian word “naukometriya” was coined by V. V. Nalimov (1969), although this field was not his main concern. In the work of this multifaceted and intriguing scientist and scholars, scientometrics was only of central concern for a short period of time. Nalimov wrote his basic book,
Scientometrics: Studying Science as an Information Process, explaining that “Scientometrics is a complex of quantitative methods, which are used to investigate the processes of science”.

The term ‘bibliometrics’ was first coined by Alan Pritchard in 1969. He defined it as, “The application of mathematical and statistical methods to books and other media of communication” (Pritchard, 1969). During 1970s, bibliometrics developed into a scientific tool for literature assessment and now it has been based mainly on the principles mathematical statistics. As Fairthorne (1969) says, “The field of bibliometrics is the quantitative treatment to the properties of recorded discourse and behaviors pertaining to it” (Fairthorne, 1969). Ravichandra Rao (1998) defined that “Bibliometrics is understood to cover the study of statistical distribution of the process relating to the activities of library staff and readers” (Rao, 1998). While J.M. Britain (2002) defines it as “The study of nature, use and non-use of documents only. It deals only with the document, that is the unit of analysis is the document and its characteristics. It does not deal with the user and his needs” (Britain, 2002). Simpson expressed that bibliometrics now include computer database, databanks and view data systems and also embrace statistical information relating to users. Bonitz (1982) defined it as “bibliometrics is a methodological sub discipline of library science, including the complex of mathematical and statistical methods, used for analysis of scientific and non-scientific documents, library networks, indexing languages, information systems, communication systems etc” (Bonitz, 1982).

2.3 Growth and Obsolescence of Literature

Changes in the size of literature over a specific period may be termed as growth of literature. The growth of literature may be of various types such as: Exponential, Linear and logistic etc. The number of scientific periodicals including abstracting periodicals are simple indicators of scientific growth. Price (1963) argued that scientific literature grows exponentially and computed the growth rate as 5% over the previous two centuries. Crane (1972) found linear growth pattern in the growth of literature in two sub-fields, "invariant theory and reading research". Tague (1981) et.al. explored the cumulative growth of literature as reflected in Chemical Abstracts
and Biological Abstracts. They found that the linear growth pattern fits best in the majority of the literature covered by the Chemical Abstracts. Wolfram (1990) et.al. explored the linear exponential and Power models applied to the growth of publications during a period of 20 years, as reflected in the databases of science, technology, social science and humanities. Maheswarappa and Ningoji (1993) studied the growth of literature in the field of applied sciences in India based on Indian Science Abstracts from 1965 to 1989. They observed that the relative growth rate had declined and it was heading towards saturation. The doubling time of literature has consistently increased.

'Obsolete' generally means out of date or no longer in use. The process of becoming obsolete is known as obsolescence. Obsolescence is one of the characteristics of Scientific and technical literature. The term obsolescence was used for the first time by Gross and Gross (1927). They analysed the references in the 1926 volume of the Journal of Chemical literature and observed that the number of references fell to one half in fifteen years. Burton and Kebler (1960) were the first to use the term 'Half Life' for documents. It is defined as 'the time during which one half of all the currently literature published' (Burton & Keblers, 1960, p.18). It is the period of time needed to account for one half of all the citations received by a group of publications. Brooks argued that if growth rates of literature and contributors are equal then obsolescence rate remains constant (Brooks, 1970, p.320). Gupta studied the relationship between growth rates, obsolescence and half life of theoretical population genetics literature (Gupta, 1998, p.335). He observed that the lognormal distribution fits very well to the age distribution of citations over a period of time. However Egghe and Ravichandra Rao showed that the Obsolescence factors is not a constant, but merely a function of time (Egghe & Rao, 1992, p.201).

2.4 Problems and Limitations of Bibliometrics

According to Lancaster (1991), following are some of the major problems and limitations of bibliometrics

1. Only formal publications and communications considered for bibliometric study hence scientific development can not be predicted.
2. Some citations in references are not in standard form of citations which causes problems in ranking of authors and detecting bibliographic form of literature.

3. In multi authorship format cited article seen only under the name of first author in each article so every article can not detect co-authorship format.

4. Self citations in collaborative work can not be detected easily.

5. Author intentionally cite author as a good will is called Hello Citations and which is a serious problem in citation analysis.

6. Incomplete citations or citations not proper to the contents of citing article is one of the problem in bibliometrics.

7. Occurrence of Implicit citations is one more problems in Bibliometrics.

( Lancaster, 1991, p. 40 )

2.5 Bibliometric Laws

The three fundamental laws which laid the formation of bibliometrics are:

1. Lotka’s Inverse square Law of Scientific Productivity

2. Bradford’s Law of Scattering of Scientific Papers

3. Zipf’s Law of Word Occurrence

2.5.1 Lotka’s Law

In 1926, Alfred J. Lotka devise his inverse square Law correlating contribution of scientific papers to their number of contributions. His law provided fundamental bibliometric studies involving authorship. He was interested in determining “the part which men of different caliber contribute to the progress of science” ( Lotka, 1926, p.317).

Lotka (1926) studied the productivity of authors by publication frequency as indicated in Chemical Abstracts from 1907 to 1916. Similarly, he studied the name
index of Auer Bach’s Geschichtstafeln der physic. It revealed that the productivity of scientists confirmed to inverse square law such that for every 100 authors contributing one article, 25 will contribute 2 articles, 11 will contribute 3 articles and 6 will contribute 4 articles and so on. The observed figures for single article authors were 57.9 percent for chemical abstracts and 59.2 percent for the physics. Lotka then plotted the graph on a logarithmic scale, the number of authors against the number of contributions made by each author and he found that in each case the points were closely scattered about a straight line, having a slope approximately two to one. On the basis of these data, Lotka deduced a general equation, for the relation between the frequency ‘y’ of person making ‘x’ contributions as follows:

\[ x^n y = \text{constant} \]

and for special case \( n = 2 \), the constant is 0.6079. Further he summarized result as follows:

“\ In the case examined it is found that the number of persons making two contributions is about one-fourth of those making one contribution, the number making ‘n’ contribution is about \( 1/n^2 \) of those making one and the proportion of all contributions is about 60 percent ” (Maheswarappa, 1997).

Lotka law also could be written as per Bookstein’s findings, after taking the logarithms:

\[ \log(y) = \log(k) - a \log(x) \]

where \( k \) and \( a \) are constant which have to be determined (Bookstein, 1976, pp.16-23)

### 2.5. 2 Bradford's Law of Scattering

Samuel Clement Bradford another pioneer of bibliometrics, should be considered for his classic paper “Sources of Information on specific Subjects,” which is the first paper published on observations on scattering. Bradford examined two bibliographies prepared in the Science library on Applied Geophysics (1928-1931) and Lubrication
(1931-1932) and he prepared list of journals arranged by decreasing order of source items contributed by the journals to the bibliographies (Bradford, 1934, pp. 85-86). He noticed that in each subject there were a few very productive sources, large number of sources which were moderately productive and still a large number of sources of constantly diminishing productivity. The whole range of periodicals was thus seen as “a family of successive generations of diminishing kinship, each generation being greater in number than the preceding, and each constituent of generation producing inversely according to its degree of remoteness” (Pritchard, 1969, pp.348-349).

In the list of periodicals ranked by diminishing productivity, Bradford identified three groups of periodicals that produced approximately the same number of articles on the subject, but the number of periodicals in these three equiproducive zones increased by a constant factor. Based on this he stated his law as follows:

“If scientific periodicals are arranged in order of decreasing productivity of articles on a given subject that may be divided into a nucleus of periodicals more particularly devoted to the subject and several groups or zones containing the same number of articles as the nucleus then the number of periodicals in the nucleus and succeeding zones will be as 1:n:n\(^2\)” (Vickery, 1948, pp.197-207).

Bradford also plotted graphs of cumulative number of source items \(R(n)\) versus the logarithm of the cumulative number of journals (\(\log n\)). Such graph is sometimes called Bradford bibliography (Leimkuhler, 1967, pp.197-207). In this study Bradford found out that, if a large collection of papers is ranked in order of decreasing productivity of papers relevant to a given topic, three zones can be identified in such a way that each zone would produce one-third of the total relevant papers.

<table>
<thead>
<tr>
<th>Zone</th>
<th>No. of Journals</th>
<th>No. of Papers</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>9</td>
<td>429</td>
</tr>
<tr>
<td>2</td>
<td>59</td>
<td>499</td>
</tr>
<tr>
<td>3</td>
<td>258</td>
<td>404</td>
</tr>
</tbody>
</table>
Thus Bradford concluded that in a given subject area periodicals can be categorized into 3 separate groups:

1. Those producing more than four references in a year.
2. Those producing between two to four references in a year.
3. Those carrying one or fewer references in a year.

The first group becomes the nucleus of periodicals in a subject field and necessarily contains more articles on that subject than periodicals that include articles on related subjects. The second zone contains a large number of moderately productive journals and the third zone contains large number of low productivity articles.

Mathematically, Bradford’s law stands as (Sengupta, 1985, pp.167-174).

\[ f(x) = (a + b) \log x \]

Where \( f(x) \) is the cumulative number of reference as contained in the first \( x \) most productive journals. \( a \) and \( b \) are two constants.

### 2.5.3 Zipf's Law

Zipf (Zipf, 1949) developed and extended an empirical law, as observed by Estoup, governing a relation between the rank of a word and the frequency of its appearance in a long text. It is based on frequency of occurrence of words in a text and their ranking in a descending order. If ‘\( r \)’ is the rank of a word and the ‘\( f \)’ is its frequency, then mathematically Zipf’s law can be stated as follows (Li, 1992, pp.1842-45).

\[ r f = c \quad \text{where ‘c’ is a constant} \]

His law states that in a long textual matter if words are arranged in their decreasing order of frequency, then the rank of any given word of the text will be inversely proportional to the frequency of occurrence of the word. In any communication, the words and, the, a, an, of etc. occur many times in a text, whereas measurable is rare. Therefore, in discussion about Zipf’s law such frequently appearing common words
are excluded. In other words, Zipf’s law addresses to those words that indicate subject content and not linguistic mandatory words. Zipf’s law can be effectively used in the generation of semiautomatic or automatic indexes useful for an information retrieval system (Fedorowicz, 1998, pp.285-293).

Its use has increased tremendously with the emergence of natural language indexing of textual matter especially in electronic form. Several studies aimed at finding out the pattern of frequency distribution of descriptors of a thesaurus and the distribution of indexing terms are available. Zipf’s law provides a measure of the richness in vocabulary of an author. This techniques can be used for deciding the correct authorship of disputed works. The law is also used for identifying words more frequently used in different foreign languages.

2.6 Citation Analysis

The tradition of providing citations at the end of technical writing is quite an old phenomenon. They have their own origin in the referencing practices of researches and writers (White, 1985). 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. According to Ziman "a scientific paper does not stand alone, it is embedded in the literature of a subject" (Ziman, 1968, p.58).

The primary function of citation is to provide “a connection between two documents, one which cites and the other which is cited” (Martyn, 1975, pp. 290-297). There are umpteen number of reasons for giving citations. Weinstock (1971), Lipetz (1965), Moravcsik and Murugesan (1975), Hodges (1978), Oppenheim and Renn (1978), Finney (1979), Frost (1979) and Thorne (1971) have all attempted to explore the possible reasons for giving citations. They include the positive and negative reason for inclusion. However, it has to be conceded that if the reason is positive, there is bound to have some connection between the citing and cited paper. The first recorded citation analysis was a study by P.L.K. Gross and E.M. Gross published in 1927 in order to determine the journals to be subscribed to and the back volumes to be acquired for the Library of the Pomona College. They studied the citation frequency in the references given in the Journal of the American Chemical
Society (Gross, 1927). Sandison (1989) emphasized that citation is not just a set of bibliographic data at the end of a paper as end notes, foot notes etc. or extracted from a citation index. Similarly Shaw (1979) stated that citation establishes a relations among authors who is a measure of the extent to which they communicate indirectly through the literature. Citation analysis is very often fruitfully applied to derive the following benefits (Vijaykumar, 1997).

1. To lead the reader to further studies in the field.
2. For the preparation of bibliographies.
3. To study the use pattern of different types of documents.
4. To find out the relative use of different languages.
5. To study the use of literature from different countries.
6. To study the scattering of subjects.
7. To decide the obsolescence rate of documents in different subjects.
8. To determine the interdependence and lineage of subjects.
9. To prepare ranked list of periodicals.
10. To study the rate of collaborative research.
11. For the analysis of scientific journals.

The main objectives of the citation analysis are to evaluate and to interpret citations received by articles, authors, institutions and other aggregates of scientific activities. Analysis of such citation can revel useful information like the relative use of different kinds of documents such as books, periodicals, reports, patents etc., the age of the documents which reveal the rate of obsolescence of literature, the most frequently used periodicals, scattering literature, language preference, etc., with different kinds of scientific communities according to subject, nationality etc. Guha (1983) has rightly said “this type of information can be utilized for acquisition of materials, selection of periodicals, titles, judicious distribution of library funds and so on. Guha (1983) further says “citation studies being indirect in nature, can completely ensure the elimination of bias inherent in most of the direct method. Such studies are based on record which have already been created. At the same time citation studies can much more broad based than the library record, hence finding of such studies can be said to be valid within a context.

Citation analysis reveals only a part. It cannot give us an insight into the functioning of the entire communication system and its components for e.g. citation
counting cannot reveals the use of secondary or tertiary sources nor the use of different channels of communication which are available to any user to get the primary sources. Such studies are based on individual citation practices of authors where variation is suspected to prevail.

2.6.1 Types of Citation analysis

Studies in citation analysis are categorized as follows

A. Citation analysis on simple counting methods
   1. Authorship Study
   2. Types of Document Used
   3. Language of the Cited Documents
   4. Ranking of Journals and books
      i. Ranking by counting the Number of citations
      ii. Ranking by impact factor
   5. Subject Dispersion
   6. Obsolescence and Half Life

B. Bibliographic Coupling

C. Co-citation Analysis

2.6.1.1 Authorship Study

This study find out single author and collaborative author contribution in particular subject. The authorship study also determines data related to individual authors productivity which is useful in determining status of author among collaborative work. Lotka's law of author productivity also determine relation between author and their productivity of articles. Authorship study includes rate of single and multiple
author citations, calculation of group coefficient value, verification of Lotka's law of author productivity and self citations. Authorship study can be carried out both for citing and cited articles. Authors are grouped as personal author, corporate body and anonymous publications. Collaboration is a major area of authorship study, which indicate how author work together in the creation of articles. Another area of authorship study is to find out the names of the organizations and the names of the country / state of the citing authors. This helps to know the productivity of individual authors as regards to their country and organisation where they are working.

Scientific productivity is frequently measured in terms of published output, since the data on the number of publications by the authors can easily be collected and also reliable. Narin reviewed the early studies of scientific productivity and concluded that "Scientific Talent is highly concentrated in a limited number of individuals". Price (1971) also claimed any population of size N contains an effective elite size $\sqrt{n}$ scientists. Egghe (2005) has generalized this law as "N$^\alpha$ scientists contribute 100 $\alpha$% of the total publications" taking the clue that elites in science is small and further assuming that exchange among scientists in general is a rare event.

### 2.6.1.2 Language and Types of Document used

Authors cite different types of documents for writing articles. The selection of a type of document for reference depends on various factors like the subject, year of publication, country, region of coverage, language and availability of source material etc. Language is one of the barrier in scientific communication. In Indian anthropology journal, 94.13 % of cited references were in English (Rana, 1982). Garfield and Welljam-Dorof (1990) derived a list of 15 top languages in which, it was reported that English was predominant language and most of the scientists cite literature in English. Among the type of document cited it was found that more books was cited than journal in Social Science subjects. In Science and Technology however, journals are cited in large number. Kundu (1980) analysed single journal of Indian Library and Information Science from 1954 to 1975 and derived that 37.1 % citations belong to books and 37.0 % belong to journal category. Now most of the journal publishing in various electronic format in online mode. Conference proceeding is also one of the document for research scholar to publish their articles.
2.6.1.3 Ranking of Journals and Books

Ranking of journals and books by counting the citations received by an article over a specific period is the most common type of study in citation analysis. The journal ranking can be done by three ways i.e. 1. Ranking by counting the number of citations 2. Ranking based on impact factor 3. Ranking based on Immediacy Index

Ranking based on Impact Factor

Impact factor is a measure of frequency with which an 'average article' in a journal has been cited in a particular year. The JCR impact factor is basically a ratio between citation and citable items published. It is a measure of relative size of the citation curve between second and third year of its publication.

\[
\text{Impact Factor} = \frac{\text{Number of current citations a journal receives to article published in the two previous year}}{\text{Number of articles published in those same years}}
\]

Thus 2014 impact factor of journal X would be calculated by dividing the number of all SCI, SSCI & AHCI source journals 2014 citation of articles journal X published in 2012 & 2013 by the total number of source items it published in 2012 & 2013. For ex. Nature published 1192 and 1176 citable items in 2012 & 2013 respectively and these items were cited 20173 and 15943 times respectively in 2014. Therefore 2014 impact factor of Nature is given by

\[
\text{If} = \frac{20173 + 15943}{1192 + 1176} = \frac{36116}{2398} = 15.525
\]

The Impact factor of a journal is indicative of its rank and to a certain extent its quality in the world. The higher the impact factor, the higher is its prestige. The quality of research papers published in such journals is ensured since the journals having high impact factor are in most cases rigorously refereed journals and getting a paper published in these journals, one can be assured of its quality.
Impact factor depends on several factors (Savnur, 2008, p.106). These are:

- Subject area of the journal
- Type of Journal (Letters, full papers, reviews)
- Average number of authors/paper
- Size of Journal
- Size of citation measurement window

### 2.6.1.4 Subject Dispersion
Subject dispersion means scattering of subject among the citations. The author refers to publication of various subjects which are relevant to a specific field of study while writing a research article. Therefore, citation analysis will reveal the specific subjects that are related to a field of study. This will show the most popular or key field in a subject.

### 2.6.1.5 Obsolescence and Citation Half Life
Obsolescence is the "decline overtime in validity or utility of information" (Line and Sandison, 1974). The Obsolescence study is one way of assessing utility or validity of a scientific literature. Brookes (1973) has evolved the concept of "Utility in relation to journal aging" for taking a decision as regards to discard the back volumes of individual journals on the basis of half-life calculation.

The concept of half-life has been borrowed from the field of nuclear physics to illustrate journal obsolescence. Half life refers to "Time require for disintegration of one half of atoms of radioactive substance: But half life of literature is the time by which one half of the currently published literature become obsolescent" (Narayana, 1991). The citation half life is related to the growth of literature. The value of half-life for a given subject is not constant for all the times.

### B. Bibliographic Coupling
Kessler in 1963 introduced bibliographic coupling as a measure of the subject similarity between two documents. Two documents are bibliographically coupled when both of them cite one or more references in common. The number of such common references determines the strength of bibliographic coupling. The strength of
bibliographic coupling is measured by the number of references that the two papers have in common (Egghe & Rousseau, 1990, p.235)

C. Co-citation Analysis

The concept of co-citation was for the first time suggested by Small in 1973. The number of times two papers are cited together in subsequent literature determines the co-citations strength of two cited papers. Two papers are co-cited if they are cited together by a third paper. The co-citation frequency is defined as the frequency with which two items of earlier literature are cited together by the later literature (Small, 1973).

2.7 Bibliometric studies at National Level

M. Grace and R. Jeyshankar (2015) revealed the research productivity in the field of infertility. During the study period they found "Journal of Human Reproductive Sciences" was the top most with 87 publications. Out of 160 institutes in research output of infertility in India, All India Institute of Medical Sciences gets rank one with 223 publications followed by National Institute for Research in Reproductive Health with 48 publications. It has been observed from study that researchers are finding the journals as their publishing medium to communicate their research findings. High levels of co-authorship exists among the two and three authorship pattern in Infertility researchers in India. The average collaboration co-efficient is 0.62 and average collaboration Index value is 3.6 (Grace and Jeyshankar, 2015, pp. 24-30).

Madhu K.N. (2015) analysed three volumes of Indian journal of Agricultural Research published between 2012 and 2014. During study it was found that majority of agricultural scientist conducting research in Agronomy, Irrigation Genetics, Plant Pathology, Fruits & Horticulture and Entomology subjects. Multiple authorship predominates in agricultural sector. Majority of the research articles in agricultural sector were contribution from Haryana, Uttar Pradesh, Andhra Pradesh, Tamil Nadu and Punjab. The author V. K. Sharma Obtained First Rank (1.80 %). Agricultural researcher preferred journal articles more frequently for their research work (Madhu, 2015, pp.27-35)
Jeyshankar and Vellaichamy (2015) were studied Indian research output in Lung Cancer. The study shows that 94% scientists preferred to publish research papers in joint authorship. They found that USA was the major collaborating partner of India with a share of 24.66% publications. Most productive Institution in India is Tata Memorial Hospital, Mumbai on Lung Cancer research with 16.90% contribution. Indian Journal of Cancer was the most productive journal of Lung Cancer research with contribution of 8.65% of publications (Jeyshankar and Vellaichamy, 2015, pp.24-35).

Jeyshankar and Vellaichamy (2014) analysed worldwide productivity of Cervical Cancer research output. For this study 18060 records were extracted from SCOPUS database for the period of ten years from 2003-2012. The study found that USA was productive country on Cervical Cancer research with 26.04% of publications. Indian researcher contributed 730 (4.04%) papers on Cervical Cancer research by securing seventh place. The study also revealed that Gynecologic Oncology (1079 papers) was the most productive journal publishing global research output on Cervical Cancer research and C.J.L.M. Meijer (119 papers) was the most productive author on Cervical Cancer research. National Cancer Institute (USA) was the most productive (13.61%) institution on Cervical Cancer research in the world (Jeyshankar and Vellaichamy, 2015, pp.298-302).

Maharana R.K. and Sethi Bipin (2013) analysed scientific research output of Sambalpur University during 2007 to 2011. They retrieve publication data of the University from Wen of Science database. They found Astrophysics and Space Science were most favored journals. During study of 170 papers of 707 author, Chemistry is the most favored research area followed by Physics and Prof. B. K. Mishra from Department of Chemistry was contributed 28 (16.47%) papers with securing first rank. Indian Institute of Technologies was the most prolific institution next to Sambalpur University (Maharana and Sethi, 2013).

Suresh Kumar (2014) analysed 137120 articles published on Human Computer Interaction (HCI) research in the journals index in Science Citation Index expanded during 1987-2011. He concluded that dispersion of journal titles in HCI literature does not satisfy the verbal formulation of Bradford's law of scattering. In HCI literature journal productivity shows the concentration of more number of articles in a
few journals. The number of core journals is increased from 10 during 1987-1991 to 29 during 2007-2011 which indicates the gradual expansion of the field of HCI research (Kumar, 2014, 223-231).

Garg and others (2009) evaluates malaria vaccine research carried out in different parts of the world during 1972–2004. Data downloaded from PubMed using keyword malaria, plasmodium or falciparum and vaccine. They found 2007 publications scattered over 352 journal titles originating from 40 different countries published on the topic of malaria vaccine. During study, 59 countries were involved in malaria vaccine research, among them 11 countries contributed 83.5 % and remaining 48 countries 16.5 % of total research papers. Citations of the research output indicates that 2007 papers received 35299 citations and average rate of citations was 18. USA contributed highest number of papers followed by UK and Australia. The majority of the prolific institutions are located in the USA, the UK, France and Australia. From study it was concluded that there is a need of encouraging research toward vaccine development (Garg and others, 2009, 22-31).

Maharana and Das (2014) examined the growth and development of library and information Science research carried out by Indian researcher based on the publications indexed in Social Science Citation Index and analyzes 140 documents with h-index of 7. They found USA contribution (46.79 %) as highest followed by England (11.87%) and India stood at the 13th place in the list with 140 contribution (1.11%). Among publication types journal articles (89.29 %) are at the top. In author contribution two author contribution (40.71 %) was more and degree of collaboration was 0.64. During study period M.P. Satija ranked as no. 1 with 7 (5%) publications. They applied Lotka's law of scientific productivity and observed that productivity frequency differ from expected frequency (Maharana and Das, 2014).

Thavamani (2013) presents a bibliometric study of library focused journal represented in the directory of Open Access Journals (DOAJ). A total of 151 library & Information Science journals were examined related to a number of issues: subject specific distribution of library journal, interdisciplinary aspects, country of origin, language used, number of titles first appearing in given years (Thavamani, 2013).
Debra and Steven (2008) employs bibliometric techniques to compare Industrial and Labor Relations Review (ILRR) intellectual bases across three recent periods: 1974-1984, 1985-1995 and 1996-2006. ISI’s Web of Science was used as data source for this study. They identified the "Invisible colleges" research networks that refer to each other in their publications of ILRR using co-citation and network analyses. ILRR authors majorly cited Economics oriented journals. Since 1947, ILRR published 1900 research articles and 4500 book review. Emergence of Academy of Management Journal at the top in latter period of study denotes that human resource management was the growing importance in the most recent years (Debra and Steven, 2008).

Jorg and Markus (2011) investigate the correlation between funding decisions in application-based research funding and the applicants’ past bibliometric performance, using the example of applicants of the DFG’s Emmy Noether Programme (ENP) in the fields of physics, chemistry, biology, and medicine. The ENP was set up by the DFG in order to prepare young scientists of excellence for a professorship by giving them the opportunity to lead a research group at an early stage of their career. They conclude that single bibliometric indicators are not sufficient for reproducing/predicting funding decisions. Extreme indicator values show a strong correspondence with funding decisions, extremely low indicator values as much as extremely high indicator values. The presence (or absence) of self-selection effects must be taken into account when comparing funding decisions or bibliometric indicator values among different funding programs. During study, comparisons of funding decisions with indicator values taken into account all available indicators when available, also non-bibliometric indicators should be included in the studies. The applicability of indicators in the various fields of research for the prediction of funding decisions differs strongly (Jorg and Markus, 2011, pp.31-46).

Mukherjee Bhaskar (2009) analyzed LIS open access electronic journals among 1636 articles published during 2000-2004 with an average increment of 23.75 articles per year. He indicates that team research has not been very common in LIS and in OA (Open Access) male authors were keener than female authors. OA e-journals was very vast and almost all facets of information and library science were covered in these articles. He concluded that OA e-journals in LIS are rapidly establishing themselves as a most viable media for scholarly communication (Mukherjee, 2009, pp.167-194).
Jennifer et.al. (2014) in his research article studied scholarly articles published by library and information science authors about open access. He found an open access rate of 60%, which was lower than expected considering 94% of these articles. They found linear growth of open access publications during period 2003 to 2011.

In research article "Library and Information Science Research : A bibliometric study of Library philosophy and Practice 2006 to 2012 " Idrees and Anwar (2013) found 701 papers published with highest contribution of Nigeria as 330 papers followed by India as 143 articles and USA with 104 articles. Most of the papers length was between 6 to 10 pages i.e. 343 articles. Author Dr. Khalid Mahmad and Dr. Rubina Bhatti from Pakistan ranked with 11 and 10 papers respectively. During the first year of the studied period, 2006, there was no collaborative effort and all 100 percent papers were contributed by single authors. As far as the time passed on, collaborations were increased and during the last three years, collaborative efforts were discovered to be in majority (Idress and Anwar, 2013, p.35).

Siwach Anil Kumar and Satish Kumar (2015) investigates the research contributions of Maharshi Dayanand University (MDU), Rohtak in terms of its publication output during 2000-2013 as reflected through Scopus database. MDU published 1247 papers during span of 14 years with highest number of collaborative papers of Guru Jambeshwar University of Science, Hissar (66 papers) followed by Kurukshetra University, Kurukshetra (45 papers). C.S. Pundir of the Department of Biochemistry comes at front with the highest number of publications. Uniform citation pattern was not observed in the results of the study (Kumar and Kumar, 2015, p.17).

Sudhir Pilai (2013) analyzed author productivity and the validity of Lotka's Law in the area of Physics research. Data source of the study were the journal citations in the doctoral theses of the University of Kerala, India. The total sample consists of 1,665 first authors as straight count method and 3,367 authors in complete count, appended in the 12 doctoral theses in physics, during the five year period. K-S test and chi-square test were applied to verify the applicability of Lotka's law of scientific productivity. The statistical tests show that the Lotka's law in its generalised form does not fit the author productivity distribution pattern prepared for the straight count and for the contribution of complete count of the University of Kerala theses citations (Pilai, 2013, p.457).
Sajiad (2012) analysed papers published in the Pakistan Development Review during the period 1973-2009 with the purpose to determine the authorship patterns (productivity, collaboration, and affiliation), the topics of the papers, the number of citations per paper and the size of the papers in terms of pages. He was found that a total of 1066 authors contributed to the journal during 1973-2009. A maximum number of authors contributed only one article each. M. Ghaffar Chaudhry was the leading contributor with 30 articles followed by A. R. Kemal and Sarfraz Khan Qureshi with 29 and 28 articles respectively. Single-authored articles (55.5%) were predominant followed by two-authored articles and three-authored articles respectively. Pakistan and USA collaboratively contributed 21 (22.34%) articles and ranked first in international collaboration. The volume of Pakistan’s collaboration with Canada, UK, and Australia was 19 (20.21%), 9 (9.57%) and 5 (5.67%) respectively. Pakistan Institute of Development Economics, the host institution, is ranked first with the contribution of 605 articles (Sajiad, 2012).

Saravanan and Dominic (2014) examined ten volumes of ecological journal from 2003 to 2012 for finding research trends in ecology subject. They analyzed 3359 papers and 164,369 references. Highest number of papers was published by more than one author hence multi author pattern was found with collaboration coefficient of 0.21. University of California at Davis ranked first with 183 publications. The United States of America topped with 2188 papers. Highest number of publications was recorded in 2010 (387 papers) while lowest was in 2011 (240 papers). Agarwal A.A. (30 Contribution) was the most productive authors in the journal ecology with securing h-index of 13 (Saravanan and Dominic, 2014, p.27).

Saravanan and Dominic (2014) bibliometrically analysed 'Review of Palaeobotany and Palynology' leading journals during year 2003 to 2012. Study reveals that 1821 authors were contributes 903 papers with multi authorship of 25.47%. USA stood first with 163 papers and collaborative coefficient was 0.69. Author productivity of present data set confirms Lotka's law.

Thavamani Kotti (2014) bibliometrically studied authorship pattern and collaborative research in Malaysian journal of library and Information Science during year 1996-2012. A total of 279 research papers of 6779 citations and 575 authors were examined. Average number of author per paper was 2.06 and highest number of author productivity was found i.e. 72 (12.52%). Study identifies the thrust areas of
research in Library and Information Science and also suggest grey area that requires attention from LIS researchers. The study concludes that multiple authorship research is predominant as compare to single contributions in case of Malaysian Journal of Library and Information Science (Kotti, 2014, p.1).

Patra and Chand (2006) bibliometricaly studied library and information science research literature in India abstracted in Library and Information Science Abstracts (LISA) during year 1967-2004. A total of 3396 records analysed to find out the growth of literature, author productivity pattern and core journals in library and information science. It was concluded that literature data follows Lotka's law. They identifies that core journals are mostly published from India and Indian authors contribution in international journals is very low.

Gangan Prathap (2014) used 3D bibliometric analysis to identify the leading countries, organisations and authors and also the most influential journals in the area of monsoon research. The citation data retrieved from the web of Science was used in three components i.e. quantity, quality and consistency. China became a leading player in monsoon research while India's output remained stable. The most productive organisations and authors from India and also the most influential journals in which they publish have also been identified. Chinese Academy of Sciences was ranked first in the leading organisation in other country while Council of Scientific & Industrial Research was ranked first in India. S. R. Shetye was ranked first in leading author and the Current Science was ranked first in leading journal in monsoon research (Gangan, 2014, p.191).

Rahimi and Chandrakumar analyzed quantitatively (citation count) similarities between traditional citation coverage (WoS and Scopus) and citations taken from the Web (Google Scholar) in Medical Science. It was found that number of citations, mean and median of Google Scholar citations was much higher than those obtained from WoS and Scopus database. The result shows that scholarly Open Access journal articles with more citations in the WoS database also have more citations in Google Scholar. There is a significant correlation between citation counts from Scopus and Google Scholar. Out of 15,845 total citations from WoS, 6,973 records are not found in the Scopus search results. Also 10,143 unique citations from Scopus (out of 19,015 citations) were not in WoS. The results also show that the citations overlap between WoS and Scopus is 51%. They conclude that a large amount of unique citations from
Google Scholar for the studied journals may be due to the indexation of a wider form of Web materials, which are not indexed by traditional bibliographic and citation databases such as WoS or Scopus. Hence, it infers that Google Scholar as a resource freely available to anyone can be considered as an important resource complimenting the other bibliographic indexes (Shahin & others, 2014, p.1).

Ramesh (2013) bibliometrically studied Annals of Library and Information Studies (ALIS) journal during period 2002-2012. During data mining researchers from 16 different countries contributed 310 articles containing 5307 references. Most of the research (65.81%) found pattern of joint authorship. Average article per issue was 7.04%. Among 16 contributing countries Indian author contribution was 87.61% followed by Nigeria 3.49% and Bangladesh 1.58%. Author B. K. Sen was ranked first with contribution of 4% articles (Ramesh, 2013, p.493).

Rao et.al. (2014) analysed Journal of Propulsion and Power based on 4047 articles published from 1985 to 2013. It was found that 1205 different institutions were involved in publication of these articles and multi authorship pattern was found. It was observed that highest number of 2672 articles were contributed by USA among which Purdue University contribution (377) was highest.

Banateppanavar (2014) investigated the research output performance of LIS Professionals and the citation analysis of all the journal articles published in the Library Management Journal during 2010-2012. During study 139 articles were found with 3053 citations. Mostly journals were cited and Bradford law was best suited for Library Management Journals. Maximum articles were contributed by single author with 52.94 percentage.

Gohain and Saikia (2014) examined 10983 citations appended in the 30 Ph.D. theses of Chemical Sciences submitted to Tezpur University, Assam during 2008-2012. The study aims to investigate type and form of literature cited, authorship pattern of citations, and ranking of core journals in chemical sciences.

Singh and Bebi (2013) analysed Ph.D. theses in Sociology submitted to University of Delhi during 1995-2010. During study 25 theses of 5766 citations were bibliometrically analysed. It was found that most of the citations are not in standard format.
Hussain (2013) analysed Annals of Library and Information studies journal during period 2006 - 2010. He found that maximum number of articles are in the year 2010 contributing 43 articles, with 25.90% contribution. Co-authorship format was the major among researchers and Scientometric journal occupied first rank with 90 citations (5.35%) followed by Annals of Library and Information Studies with 58 (5.45%) citations.

Alka Bansal (2013) analysed DESIDOC Journal of Library & Information Technology for two different period of study (2001 - 2006) and (2007 - 2012) which contains 391 articles of 5416 citations. Multi authorship pattern was found. Dr. B. M. Gupta published (26) maximum article in DESIDOC.

Pradhan and Chandrakar's (2011) analysed quantitative view of the growth of Indian scholarly literature in LIS versus the world as a whole during period 2000 - 2009. They found 228 articles published in international LIS e-journals contributed by 300 authors and Indian authors contribution was 246.

Gupta and Khare (2013) studied 35 theses in LIS in Dr. Harisingh Gour University, Sagar submitted till year 2010. They observed that 255 periodicals were covered with 2953 citations and time span 1986-1995 was the most productive years of cited periodicals. They concluded that most cited journal is IASLIC Bulletin and journal distribution pattern does not fit the log linear curve.

Sharma et.al. (2013) studied 58 Ph.D. theses in LIS in Universities of Uttar Pradesh during period 2001-2008. Highest number of theses awarded in 2002 (18 theses) and lowest number of theses awarded in 2008 (1 theses). Subject wise distribution of Ph.D. theses reveals maximum contribution by Information technology (10 theses) followed by Academic Libraries (6 theses). Total 16 research guide guided 58 Ph.D. research scholars and maximum 22 theses were guided by Prof. M. T. M. Khan followed by U.C. Sharma contributed with 11 theses and English was the predominant language by contributing 52 theses.

Pandey (2013) analysed paper presented in IATLIS conferences (from 2006 to 2010) and find out most productive author. State, Organization etc. He found that majority of the papers are of single authorship and among rank order Tripathi Tridib and M. P. Satija are highest scorer. He further concluded that solo research in LIS increased due
to API scoring pattern of UGC regulation 2010 wherein 60% of total score is shared by principle author and remaining 40% is shared equally by all other authors.

Harinarayana et.al. (2008) studied Indian authors contribution in foreign journals in LIS during 1970-2005 among 18 foreign journals. Indian authors published 303 articles in various 18 foreign journals in LIS. Scientometrics is the preferred foreign journal for Indian author because almost 44% of the articles published by Indian authors were found in Scientometrics. It was also found that only three authors contributed more than 20 articles. During span of 36 years (1970-2005), 17743 articles were published by 23942 authors.

Bibliometric study of 56 doctoral dissertations in LIS awarded in Annamalai University was carried out to determine use pattern of literature by Thanuskodi (2012). Among bibliographic form of documents Journal ranked first with 63.55% of citations. Ranking of cited Journals reveals that IFLA Journal stands first followed by Information Management Journal. It is found that about 13.89% of the journals used were found from United States followed by India 13.20%, Australia 9.52%, China 8.69% and other countries 36.49%. Authorship pattern denotes that majority of the contribution are from two authors.

Mulla and Dhanamjaya (2014) investigated 412 research articles published in 10 volumes of 40 issues in SRELS Journal of Information Management during period 2000 to 2009. They revealed that out of 686 contributors, 360 (52.48%) contributors contributed joint authored paper that amounts to 180 (43.69%) articles. Total 79.30% articles published by Indian contributors followed by USA. First rank among most prolific author obtained by Gopinath (3.35%) followed by Khaiser Nikam, Kannapanavar, Satija and Tadasad with 1.31% papers each. Institution wise distribution of published papers reveals that out of 686 contributors, the highest number 358 (52.19%) of contributors are contributed from Universities.

Journal is the most preferred medium of all cited forms and age preference by citing authors resulted that nearly 56% of all cited material aged less than 10 years and 28.05% of materials cited are aged between ten to nineteen years.

2.8 Bibliometric Studies at International Level

Wiysonge Charles et.al. (2013) identified 1,641 articles on childhood immunization indexed in PubMed between 1974 and 2010 with authors from Africa, which represent only 8.9% of the global output. Five countries i.e. South Africa, Nigeria, Gambia, Egypt and Kenya contributed 48% of the articles. After controlling for population and gross domestic product, The Gambia, Guinea-Bissau and Sao Tome and Principe were the most productive countries. Immunization research productivity in Africa is highly skewed, with private health expenditure having a significant positive association. However, the current contribution of authors from Africa to global childhood immunization research output is minimal. The lack of association between research productivity and immunization coverage may be an indication of the lack of interactive communication between health decision-makers. (Wiysonge et.al., 2013)

Lois Buttlar (2000) analysed 61 library science and information science dissertations. He found that males are cited more and single authorship pattern are prevalent. Among LIS journals College & Research Libraries and Journal of the American Society for Information Science used most and among forms of literature journal were ranking first.

Tsay (2008) reveled the relationship between Journal of the American Society for Information Science & Technology (JASIST) and other discipline by drawing citation data from references of articles of JASIST in 1980, 1985, 1990, 1995, 2000 and 2004. The result of this study explored that the production rate of JASIST literature doubled and the average number of references cited per paper is also increased 2 to 3 times in a period of about 25 years (Tsay, 2008).

Barry and Steven (2008) compared NRF (National Research Foundation in South Africa) peer review ratings of 163 botanists and zoologists with various bibliometric measures: h-index, m-index and g-index. Peer review ratings were correlated with the
bibliometric measures, they explained less than 40 percent of the variation in the scores. They propose a synergy between peer review and bibliometric scores that can improve the assessment of scientific quality, especially by benchmarking peer-review decision against bibliometric threshold. For young scientists who have yet to establish clear bibliometric patterns on the basis of citations, peer review will always remain as individual tool. Peer review is used by the NRF to rate young researchers of exceptional potential (Barry & Steven, 2008, p.161).

Kevin Wan et al. (2009) examined 82 bibliometric studies on single journals published between 1998 and 2008 grouped into Arts, Humanities, Social science (12 items); Medical and Health Sciences (19 items), Sciences and Technology (30 items) and Library and Information Sciences (21 items). The result show that Asian and African contribution is high (41.4% of total studies; 43.5% covering unique titles) followed by United States (30.4% of total; 31.0% on unique titles). A high number of bibliometrists are Indians and as such coverage of Indian journals is high and quality of journals and their importance either nationally or internationally are inferred from their indexation status. The LIS fields indicated more journal revisits. JASIST, J Doc and Scientometrics were revisited several times during the pre and post 1998 years reflecting their continued influence and importance in sustaining the interests of bibliometrists over the years. All journals during study are indexed and abstracted by major databases such as Scopus and/or the Science Citation Index and/or the Social Science Citation Index. Most of the Medical and Health related journals studies were indexed by Medline (Kelvin & Zainab, 2009, pp.17-55).

Koen et al. (2012) combines web usage mining, web link analysis and bibliometric methods for analyzing research activities in research organizations. The study finds that in the United States (UK), Germany and Spain the number of visits to the Expert Protein Analysis System (AxPASy) web server made by research organization is significantly positively correlated with research output in the field of bio-chemistry, molecular biology and genetics. The study combines Web usage mining with web link and bibliometric analyses. (Koen, Fellx & Isldro, 2012, pp.1374-1382)

Peng and Hul (2011) analyze scientific papers published by Chinese authors in nursing journals included in the Science Citation Index. All articles published in 62 journals that were related to nursing originating from China (ML), Taiwan (TW) and Hong Kong (HK) from 1999 to 2008 were retrieved from the PubMed and Institute
for Scientific Information (ISI) Web of Knowledge database. In total, 41,695 articles were published in the 62 selected nursing journals between 1999 and 2008 in PubMed. Of these, 1,015 articles (1015/41,695, 2.43%) were derived from the three regions under consideration. Publications from each of the individual regions were as follows: from ML (48/1015, 4.73%), HK (414/1015, 40.79%) and TW (553/1015, 54.48%). 62 nursing journals have Impact Factors (IF) ranging from 0.316 to 2.836. ML had the lowest average IF (1.253), followed by HK (1.443), with TW being the highest (1.446, P < 0.001; Table 1). The average IF in each of the three regions is higher than the aggregate IF of nursing category (1.123). In total, 443 articles were published from the three regions in the ten highest IF nursing journals. (Peng & Hul, 2011, pp.21-25) Emilio et.al. (2013) in his research article states that Google Scholar Metrics (GSM), a new product for evaluating the impact of scientific journals could be competitor to Journal Citation Report (JCR) as well as Scimago Journal Rank (SJR). They conclude that GSM is a hybrid product, bibliometric on the one hand and bibliographic on the other. GSM is a product which lacks transparency; it does not incorporate any scientific control regarding their selection policy or data processing, in contrast to the control exerted by JCR and SJR. GSM is a free product, it represents difference when comparing with JCR, SJR, Web of Science and Scopus (Emilio & Alvaro, 2013, pp.101-114). Cabezas et.al. (2013) examined reviewers ratings and bibliometric indicators by using Web of Science database during period 2002-2006. They found that correlation between peer review and bibliometric indicators was heterogeneous among most areas. Education and Social Science areas showed low correlations between bibliometric indicators and reviewers rating due to not well representation of these area in Web of Science database. They conclude that there isn't direct relation between bibliometric indicators and expert ratings. (Cabezas-Clavijo et.al., 2013) Louise et.al. (2012) studied bibliometric indexes to track changes in the producers, products and consumers of the journal Physical Therapy from 1945 through 2010. A total of 337 manuscripts in 56 issues of Physical Therapy were studied. More research (14 studies in 1945, 37 in 2010) was published by larger research concentrations from different affiliations (collaboration Index: 3.4 in 1945, 8.5 in 2010). Studies published in 1945 were authored from within the same country whereas 16.2% of 2010 articles were authored by multinational teams. No any studies were identifies in
the sample that used key words relating to aquatic physical therapy, hand rehabilitation, oncology and private practice at any time during the study period. (Louise et al., 2012, pp. 493-509)

Henk (2007) in his research article discusses the strengths and limitations of metrics and peer review in large-scale evaluations of scholarly research performance. He found that outcomes of citation analysis must be valued in terms of a qualitative, evaluative framework that takes into account the substantive content of the works under evaluation, this can be done by peers only. He conclude that proper use of bibliometric indicators at the level of individual scholars, research groups or departments tend to be more readily satisfied in a peer review context than in a policy context. He found that a peer rating system tends to generate a peer quality distribution that depends on the rating system itself and that is to some extent independent of the overall level of quality of evaluated departments. (Henk, 2007, pp. 575-583)

Mirza Naseer and Khalid Mahmood (2009) reviewed the use of bibliometric methods in LIS research in Pakistan. He highlighted bibliometric analysis in Pakistan. He concluded that bibliometric studies are very useful for LIS professionals for evaluating library services, collection development, policy making and refinement, decision making, resource allocation and analysis of curriculum. He find out that area of LIS research failed to get attention of LIS research in Pakistan hence various suggestion and recommendation given in his research article.

Chris belter (2012) suggest various open source softwares of bibliometric mapping. He pointed out that bibliometric maps indicate opportunities for future research because they show the existing relationship among publications within a research topic.

Yuh-Shan and Michael (2014) were identified 1857 highly cited reviews (HCR), cited at least 1000 times since publication to 2011 and hosted on the Science Citation Index Expanded. One third of HCR was published by a single author and English was the dominant language. Chemical Reviews was the most productive journal followed by Nature and Annual Review of Biochemistry. Sixty five HCRs were published in journal with Impact Factor >10 also most cited HCRs did not always appear in the highest impact journals. one percent of authors who published HCRs were Nobel
Prize winners in Physiology or Medicine, Chemistry and Physics. (Yuh-Shan and Michael, 2014, pp.372-385)

Elizabeth et.al.(2013) assess the scholarly output of grants funded by the agency for Healthcare research and quality (AHRQ) that published knowledge relevant to the impact of health information on patient safety and quality care outcomes. Data for study was retrieved from MEDLINE database. During study 38 different journals published 72 papers that acknowledged an AHRQ value grant. Using bibliometric method researchers present the impact to date of these grant’s scholarly output on the health IT knowledge base. They further categorized and reviewed the articles to explore whether the grants met the goals and priorities established by the funding agency. The grants produced 72 peer reviewed articles that correlate with the major goals and priorities of their funding agency. Few of the citations (21.5%) were self cites, indicating that other biomedical and informatics scholars perceived value in the evidence published by the value grantees. Citation analysis demonstrate that the grants produced knowledge were generally viewed to be of high quality. (Elizabeth et.al., 2013, pp.1-14)

Christine and Sara (2013) evaluated webometrics to access The National Minimum Dataset for Social Care (NMDS-SC) for adult social care services in England. They also access related traffic on relevant websites and bibliometrics to access the use of NMDS-SC data in scholarly publications and grey literature. Web metrics on the NMDS-SC showed increase in traffic from 2008 to 2011 on those pages offering research outputs from the data set. Articles twenty seven, Government reports and skills eighty five and sixty three (36 %) of 175 items were classified as communications. Data set includes telephone interview with 12 key user and online survey completed by 24 key users. There were references to the data set in 175 publications (15 % from academic journals, 50 % as policy/practice reports and 35 % as media communications). The quantity of document types retrieved was dependent on how easy they are to find in either databases or search engines. (Christine and Sara, 2013, pp. 294-302)

Fiorenzo et.al.(2013) proposes a novel approach for estimating a database's omitted-citation rate, based on the combined use of 2 or more bibliometric databases. The
basic logic used was the mismatch between the citations occurring in one database and another is evidence of possible errors/omissions. A statistical model was formed for estimating the "true" number of citations received by individual papers or sets of papers and defining an appropriate confidence interval. Feasibility of the proposed method was tested based on a sample of 343 papers issued by three scientific journals that is, Journal of the American Society for Information Science and Technology, Scientometrics and Journal of Informetrics in the year 2008. A survey of the cited/citing papers showed that the most frequent reasons for omitted citations are database mapping errors due to target-source article record errors. (Fiorenzo et.al., 2013, pp. 2149-2156)

Navaneethakrishnan (2014) identified the authorship pattern and degree of collaboration of Sri Lanka in humanities and social science research with a total of 1795 records of publications authored by 3521 authors during the period 1960-2012. Majority of the publications are contributed by multiple author and United States ranked first in collaborative contribution with 15.93%.

Marlies Olensky (2014) investigated automated data accuracy assessment as described in data quality literature for its suitability to assess bibliographic data in WoS and Scopus. During study automated assessment method was compared to manual. The result show that the accuracy assessment of bibliographic data should be carried out on a bibliographic data field level and not be accumulated per second. The main result was that the Levenshtein distance function was a good means to determine whether a data record contains discrepancies, but the score does not provide a true picture of how inaccurate a field was without the application of additional rules. Therefore modified assessment method was needed. (Olensky, 2014, pp. 19-38)

Adam (2014) discuss bibliometric 2.0 and Altmetrics in Medicine. Data used for measurement of science communication is called altmetrics. He said general digital change leads to profound transformation in research and publication processes. Today PLoS Article-Level Metrics, Impact Story, Altmetric and Plum Analytics were established services. Deriving from users’ perspective they were compared to a compiled list of criteria. Aspects of interest were coverage, usability, accountability and openness of the systems. In addition, the question was discussed to what extent Altmetrics were already being used in medicine. (Adam, 2014)
Jiang and Fred (2014) classified citations patterns of high quality and high impact publication into five mathematical types: lognormal type, exponential type, polynomial type, wave type and sleeping beauty. The data during study consist of five datasets: (1) high-quality publications (N21); (2) near high-quality publications (N82); (3) high-impact publications in SCI (SCI100); (4) high-impact publications in SSCI (SSCI100); and (5) high-impact publications in A&HCI (A&HCI100). At statistical level citations patterns are well fitted. They concluded that high-quality publications usually appear irregular citation curves and high-impact publications tend to show regular ones (lognormal-type, exponential-type and polynomial-type). (Li & Ye, 2014, pp.17-33).

Naseer and Mahmood (2014) analyzed LIS literature produced by 2609 authors in Pakistan over a period of 62 years i.e. 1947 to 2008. According to Lotka's law, the number of authors expected to produce two items was 514 but it is evident that only 221 authors contributed two items. Similarly three items must be contributed by 228 authors but 95 authors contributes three items. Hence the study found that Lotka's law was not applicable to Pakistani LIS authors.(Mirza & Khalid, 2014, pp.33-40)

Andres et.al. (2012) investigated how the Unasur (Union of South American Nations) region was developing in comparison to other countries worldwide in terms of bibliometric data. The publication output results reveal an increase in the scientific and technological activities in most of the Unasur countries (especially Brazil). As compared to the rest of the world, the citation impact trend was less favorable for all Unasur countries. The increase of the citation impact was mainly visible in Natural Sciences and Medical & Health Sciences however such trend was not visible in the area of Engineering and Technology.

Magali et.al. (2014) studied development of the field of knowledge organization by evaluating the use of artificial neural networks in the automatic categorization of documents in a constricted knowledge domain based on the analysis of the references cited by these documents. They suggest that instead of relying only on the presence of common terms, the identification of common cited references can be useful to define semantic relationship among documents. A domain analytic method was developed to generate clusters of documents, which uses self-organizing maps, in the scope of artificial neural networks, to categorize documents. The results obtained show that
this approach successfully identified clusters of authors and documents through their cited references (Magali, 2014, p.145).

Loet et al. (2012) distinguished and combined medical perspectives on the nonlinear processes of medical innovations using the Medical Subject Headings (MeSH) of the MEDLINE database. From this perspective, the current study was mainly exploratory. It taught among other things, that the second-level MeSH terms are too coarse for a representation of the research process itself. The usefulness of the base map from the perspective of innovation studies needs to be tested further. Thus, the study presented here provides with an agenda and heuristics for how one can study the nonlinear dynamics of emergent technologies from a bibliometric perspective. The address information in MEDLINE is less standardized than that in the WoS or Scopus and is mostly limited to corresponding authors. A specific routine would be required for interfacing this information with geocodes needed for overlays to Google Maps. (Loel et al., 2012, pp. 2239-2253)

Sabrina Petersohn (2014) studies bibliometric practices of academic libraries in the UK and Germany in a comparative perspective. The collected data consist of 28 experts interviews and different types of documents. Bibliometrics is an ideal field for academic librarians to develop and provide innovative services for both academic and administrative university staff. In so doing librarians make sure to take an active part in the development of new strategies and in fostering innovation. The distinction made in the category system between the academic bibliometric knowledgebase and the professional knowledge base with close ties to the topic of bibliometrics (such as practitioner journal articles or practitioner conferences addressing bibliometrics within the library) allows to look for shared ontological models and concepts between the academic knowledge base and professional knowledge developed and shared in the context of bibliometric practices. (Petersohn, 2014)

Har Singh (2013) analyzed articles published in the Chinese Librarianship: an International Electronic Journal between 2009 and 2012. The study found 55 articles with 903 citations. Indian author contribution was more and single authors contribution was major.

Erika and Erin (2010) collected fifty papers for citation analysis from two master’s programs i.e. Master’s of science in organizational management and Master’s of science in human services from Capella University, USA. Human Services learners may be using less peer-reviewed literature than other schools. Total 59% of the items
listed in Human Services bibliographies were peer-reviewed versus only 18% in Organizational Management. The Organizational Management bibliographies showed a much higher reliance on trade literature, Websites, and books. In Organizational Management, a full 28% of all citations were from books, and of those books, 62% of them were known textbooks. The total numbers were a bit lower in Human Services, with books accounting for 21% of citations, and 67% of those listed as textbooks. Very few bibliographies were consistently and correctly using APA style. Many Web citations lacked important details, such as author names and dates. The citation analysis insights influenced both Capella’s information literacy plan development cycle and a redesign effort for all guides, tutorials, and residency instruction sessions. (Erika and Erin, 2010, pp.425-442)

Yuxian and Ronald (2014) studied citations written by Nobel Prize winner in Physics. If new ideas (the ideas put forward in these Nobel Prize-winning articles) and old ideas (the status quo before the publication of these articles) are in conflict with each other, and, on one hand, lead to increased interest, then the citation curve will be concave at first. If on the other hand, new insights are so revolutionary that colleagues do not accept in them, the diffusion speed will be very slow. Interactions between old ideas and new insights may change the intensity of the citation diffusion process. By citation, we could not judge how good or how bad the knowledge formulated in the cited articles is because of the existence of positive citation and negative citation. (Yuxian and Ronald, 2014, pp.281-289)

Tsay and Lee (2013) revealed that publications in traditional Chinese (21.5%) and English (78%) language were the main source of citations in social science literature in Taiwan. Journals (64.8%) and Books (22.7%) were cited most frequently by social scientists while newspapers and research reports were cited the least and literature half life was 11 years in Taiwan.

Zhang et.al. (2013) investigated new framework for citation content analysis (CCA), for syntactic and semantic analysis of citation content which can be used to analyze socio cultural context of research behavior. Classical content analysis (CCA) is not a subjective interpretation of others works but an incorporation of both quantitative and qualitative methods. In library & Information Science Content analyses well suited to historical data and archival records, it offers set of mature and well documented procedures, it also inexpensive because not require to contact with people. CCA is a powerful and workable way to improve current citation analysis and it also
supplement for traditional citation metrics. In CCA topic and content similarities can be used to predict authors citing motivations and opinions on some specific topic so as to visualize future citing patterns. (Zhang et.al., 2013, pp. 1490-1503)

Lutz (2013) suggest that percentiles are the most suitable method for normalizing the citation counts of individual publications in terms of the subject area, the document type and the publication year. Publication sets from four universities were compared with each other to provide sample data. The higher the percentile for a publication, the more citations it has received compared to publications in the same subject area and publication year and with the same document type. The percentile for the respective publication is determined using the distribution of the percentile ranks over all publications. By categorizing percentiles in different percentile rank classes, however, percentiles permit a wide spectrum of analyses of great bibliometric interest. The statistical analyses in this study are based on the one hand on inverted percentiles and on the other on two different percentile rank classes that are often used in bibliometrics. (Lutz, 2013, pp. 587-595)

Maria Aives et.al. (2014) measured correlation between information needs of patrons and the Universidade Federal de Santa Catarina (UFSC) library collection. A total of 1732 references with an average of 216.5 references were cited in the dissertations. Study found that books and articles in books (44.4%) were highly cited and major language used was the Portuguese (72.7%) followed by English with 17.2%.

Elizabeth et.al. (2014) proposed a model based on a set of bibliometric indicators for the prediction of the ranking of applicants to an academic position as produced by a committee of peers. Study work involves a total of 27 selection processes with 174 candidates who published a total of 7,654 documents indexed in the Web of Science (WoS) in the 10 years up to their application. They proposed three model among which Model 1 includes nine indicators, Model 2 contains two indicators, hnf and the HCD, both somehow related with the impact of the published documents and Model 3 defined by three indicators, the NDF, HCD and NAm representing quantity, impact and collaboration. Success of these models was around 75% if count using pairs of applicants. (Elizabeth et.al., 2014, pp. 560-577)

According to Vadim et.al.(2013) citation analyses of lists of articles and their citations can help librarians to quickly identify the preferred journals in terms of the number of publications and the most frequently cited journals. They studied publication activity
and articles in the main bibliographic databases in the fields of biomedicine and geosciences during period of 2007-2011. The journals that published the researchers articles were partially correlated with the journals in the geosciences field, but this correlation was less obvious for biomedical journals.

Kausar and Mahmood (2014) analysed works of Dr. Syed Jalaludin Haider. Dr. Haider during span of 41 years published one book, 75 research article, six biographies, one editorial and one report. He wrote eighty seven item (95.83 %) in English while 9 items (4.16 %) in Urdu. He wrote his research article in 36 journals.

Alver et.al. (2012) studied the journal Scire: Representación y Organización del Conocimiento, edited in Spain which 292 articles during period 1996 to 2010. Study include most productive 25 institutions in Spanish, four Brazilian and three from different countries. The institutional network found low density.

Williams et.al. (2013) presents a method characterizing a spectrum of cross disciplinary research (CDR) designed to inform facilitation efforts that relies on bibliometric techniques and citation data. During study 984 articles from year 2005 were analysed. A method was developed that uses multivariate statistical analyses of transformed citation from published manuscripts to identify candidate areas of CDR and then overlays information from previous toolbox participant groups on these areas to determine candidate areas for further application. (Williams et.al., 2013, pp.1768-1779)

Xlaozhong et.al. (2013) bibliometrically analysed publication ranking of 28013 full text articles taken from 111 journals and 1442 conference proceeding or workshop proceeding on computer science. They wrote a list of regular expression rules to extract citations from full text papers. Each citation extracted from the publication text was associated with a reference i.e. cited paper reference. They found that citation extraction based on regular expressions is not a perfect solution because differences in encoding, format or citation style violate citation extraction performance. During study each citation or publication was represented by a probability distribution over a set of predefined topics and these topic was labeled by keyword. Result of analysis reveal that full-text citation and publication content prior topic distribution, along with the classical Page Rank algorithm can significantly enhance bibliometric. (Xlaozhong et.al., 2013, pp.1852-1863)
2.9 Conclusion

Bibliometric is a quantitative analysis of measuring of amount of literature published. Many studies were undertaken on concepts of bibliometrics in various subject at National and International level. Citation analysis is one of the concept of bibliometric, which were majorly studied in terms of authorship pattern, language wise and geographical contribution, half life period, types of bibliographic form of literature, impact factor, ranking of journal, ranking of websites, ranking of author and publisher. Reviews in bibliometrics benefited for knowing the measurement and growth of literature in any subject.

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