# 4. BIBLIOMETRIC AND CITATION ANALYSIS

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Chapter 4: Bibliometric and Citation Analysis

4.1 Introduction:
The exponential growth of scientific literature, interdisciplinary nature of research, and trend towards specialization has posed many problems both to the scientists and librarians. The extensive investigations and the abundance of literature being published and contributed to immense escalation of cost for the libraries, as the acquisition of published literature became an increasingly difficult task. Information is not only increasing exponentially but the growth rates also differ from one discipline to another. Bibliometric techniques are used for a variety of purposes like determination of various scientific indicators, evaluation of scientific output, selection of journals for libraries and even forecasting potential Nobel laureates (Zafrunnisha, 2012).

The Internet has become apposite sources of information communication for academics and researchers. With the emergence of the internet and convergence of the information and communication technologies (ICT), blurring of boundaries and transmutation of formats is taking place. Electronic publishing is the cutting-edge paradigm for communication of information. Electronic journals have made democratization of knowledge and information a near reality. Moreover, there is no competition for space as it is in the case of print-based journals. Web citations reflect greater geographic diversity.

The analysis of the citations cited in the Ph.D. dissertations has been the tool to evaluate the researchers’ information needs and the impact of ICT on LIS research.

Information is the output of processing data. It leads to unearth knowledge of intelligence. This knowledge in turns leads to innovation or development. Such innovation brings in further information which adds to the earlier knowledge, which helps in further development. This is the technological development cycle which plays an important role in the growth and sustenance of any discipline. An important and tangible component of studies in information science is citation analysis for assessing the extent of utility of research publication and other literature (Maheshwaran, 2009)
4.2 Bibliometric:

Bibliometric is of recent origin and relatively a new one, which has emerged as a research front in its own right in information science. Bibliometric has established itself as a viable and distinctive research technique for studying science of science based on bibliographical and citation data. In general it's statistically significant manifestation of recorded information regardless of disciplinary bounds. Bibliometric studies can be applied to any discipline to find out trends and growth of the literature and to assess the quality, maturity and productivity of a literature of publication in the given body of knowledge. Bibliometric studies are being used for a variety of purposes like determination of various scientific indicators, evaluation of scientific output, selection of journals for (Zafrunnisha, 2012) the libraries, forecasting the research potential of particular field and so on.

Bibliometric, a research method in LIS, is using quantitative measures for written and documented communication. Bibliometric studies have already described and evaluated universities, journals, specific research topics and specific disciplines. The purpose of present research is to do a bibliometric study on the Indian theses of Library and Information Science through examining the quantitative growth of theses by year; examining other trends so that areas of interest for LIS researchers and current trends may be explored.

A bibliometric study of research contributions is an appropriate way to carry out the analysis. Bibliometric is a type of research method used in LIS. It utilizes quantitative analysis and statistics to describe patterns of publication within a given field or body of literature.

Obvious use of bibliometric data is to improve bibliographic control, as it is clearly not possible to provide efficient secondary services without knowing the size and characteristics of a literature. Bibliometric has grown out of the realization that literature is growing and changing at a rate which no librarian or information worker equipped with traditional bibliographic methods and skills could keep abreast. The popularity in the adoption of bibliometric techniques in various disciplines stimulated stupendous growth in literature (Zafrunnisha, 2012) on bibliometric and its related areas.
Bibliometric studies are mainly employed to investigate the following areas (Manjunath, 2012).

- Scattering of Articles
- Author Productivity
- Citation Analysis
- Measures of Journal Productivity

4.2.1 Definitions of Bibliometric:
The study on the “The history of comparative anatomy Part. I: A statistical analysis is considered to be the first bibliometric study (Cole & Eale 1917) (Malav, 2013). The term “statistical analyses” was used for the first time in the literature. The historical development of the term statistical bibliography has been traced by (Witting, 1978) in a foot note. As the term was considered “very clumsy, not very descriptive and can be confused with statistics itself (Malav, 2013) on bibliographies on statistics”. Pritchard suggested the word bibliometric in 1969 in preference to statistical bibliography. Hence the term bibliometric has a very recent origin. Hulme was the first (Malav, 2013) to use the expression “statistical bibliography” in 1923 and later it was used by many others. According to Hulme the purpose of statistical bibliography is to “shed light” on the process of written communication and of the nature of course of development of a discipline by means of counting (Kumar, 2010) analyse its various facet of written communication. In 1948, Shiyali Ramamrita Ranganathan used the term Librametry to apply statistics in librarianship. Finally, Alan Pritchard in 1969 coined the term bibliometric for those studies that consider quantities in written and documented communication. Other terms used for it are ‘Scientrometrics’, ‘Informetrics’, and ‘Webometrics’, etc. Since then, many researchers have contributed in bibliometric studies and according to (Sam, 2008) the concept was developed to describe and evaluate countries, universities, research institutes, journals, specific research topics and specific disciplines.
Pritchard defined bibliometric as “the application of mathematical method of books and other media of communication”. The terms bibliometric introduced by Pritchard in 1969, stresses the method of undertaking the counting of books, articles,
publications, citations etc. According to Fairthorne it is the “Quantitative treatment of properties of recorded discourse and behaviour appertaining to it”. The British Standard Glossary of documentation of terms explained bibliometric as the study of “the use of documents and (Rajan, 2011) patterns of publication in which mathematical and statistical methods have been applied which is basically similar to Pritchard’s original definition. Bibliometric is particularly related to research in scientific communication. Schmidmaier, 1984 add reference and bibliography and discussed the history of bibliometric and demonstrated its relation to the concept “the science of science”, which is traced to lectures given by Carl Christian Friedrich Krause in 1929. In the former USSR was G. M. Dobrov’s investigation of the science of science from 1966 a pioneer work. More explicitly, (Sengupta, 1990) define bibliometric as the “organization, classification and quantitative evaluation of publication pattern of (Jayaraj, 2014) all macro and micro communication along with their authorships by mathematical & statistical calculus. Bibliometric study is a simple statistical method of bibliography counting to evaluate and quantify the growth of a subject (Tsay, 2000). Researchers may use bibliometric methods of evaluation to determine the influence of a single writer. The word “bibliometrics” is recent origin but bibliometric studies were performing much earlier since the beginning of 20th century.

Thus bibliometrics is the branch of information theory which analyses quantitatively the recorded knowledge to know its properties and behaviour. The recorded knowledge may be in the form of a book, periodical conference proceedings etc. The bibliometric studies can be divided into descriptive and behaviour studies.

4.2.2 Aim of a Bibliometric:

The basic aim of a Bibliometric study is to assist the users in locating the existing information or identify a book or any other material which may be of interest to him. It helps to avoid duplication in research and also serves as a tool for book selection, identification and utilization of information in terms of place of publication, subject and various forms (Sivasubramanian, 2000).

Bibliometric studies are used to identify the pattern of publication, authorship (Kumar, 2010) citations and secondary journal coverage which can give an insight
into the research and development of the area under consideration (Parameswaran, 2001).

Bibliometric is made up of methods for conducting quantitative analysis of science. Some of the methods serve to measure sociological aspects of one of the researcher's most important activities i.e. dissemination of research results in published form. Bibliometric is based on two assumptions:

1. The goal of researchers is to advance knowledge, and this means disseminating the results of their research and studies through a variety of communication media, including writing, which lies at the core of the academic tradition;

2. Scholars have to publish in order to build a reputation and advance their careers.

Fairly recent developments in information and communication technologies (ICTs) can influence bibliometric evaluation methods (Science-Metrix, 2004).

Bibliometric studies are mainly employed to investigate the following areas such as scattering of articles, author productivity, citation analysis, measures of journal productivity (Manjunatha, 2012).

4.2.3 Purpose of Bibliometric:

Pritchard coined the term Bibliometric and defined it as “the application of mathematics and statistical methods to books and other media of communication”. Its purpose was:

1. To shed light on the processes of written communication and of the nature and course of development of a discipline (Raju, 2009) (in so far as this is displayed through written communication), by means of counting and analyzing the various facets of written communication;

2. The assembling and interpretation of statistics relating to books and periodicals and to demonstrate historical movements, to determine the national or
universal research of books and journals, and to ascertain in many local situations the
general use of books and journals (Raju, 2009)

4.2.4 Scope of Bibliometric:
The scope of bibliometric includes studying the relationship within a literature (e.g.,
citation studies) or describing a literature (Simon, 1973). Typically, these descriptions
focus on consistent patterns involving authors, monographs, journals, or subject /
language (Kumar, 2010).

4.2.5 Importance of Bibliometric:
As per (Curtis, 2005) the importances of Bibliometric are:

- The research quality framework is likely to use some form of bibliometric to
  measure quality.
- National and international university ranking tables use bibliometric for both
  of these reasons and for internal strategic planning purposes our universities
  are increasingly turning to bibliometric to understand research performance.
  Bibliometric means literally “book measurement” but the term is used about
  all kinds of documents (with journal articles as the dominant kind of
document). What are measured are not the physical properties of documents
  but statistical patterns in variables such as authorship, sources, subjects,
geographical origins, and citations.

4.2.6 Bibliometric Measurements:
The bibliometric are derived from the concept of citation indexing. Citation counting
is a technique that determines how many citation a given document, author, journal
etc. has received over a period of times, originally used by Gross and Gross (1927).
The rational for this is that citations are objective indicators of use and therefore an
article, author; journal is more useful or productive than one that is less cited.

4.2.7 Bibliometric and its application:
Information managers have adopted quantitative methods in recent years in order to
evaluate library resources and services more objectively and effectively (Malav,
2013). Bibliometric as a technique has extensive application in identifying the research trends in a subject, characteristics of subject literature including structure of knowledge etc.

### 4.2.8 Teaching of Bibliometric:

Bibliometric, the scientific study of recorded discourse, offers much promise in the informational domain. This promise involves two dimensions of empirical knowledge, a theoretical dimension and a practical dimension, and so ought to interest not only researchers and educators but professional practitioners as well. This promise issues from the special nature of empirical knowledge, by which ideas about the world can be related to practical activity.

Bibliometric taken as theoretical knowledge is the quantitative characterization of the properties of recorded discourse. Quantitative characterization is the setting forth of probabilistically true ideas about selected phenomena. These ideas express patterns, tendencies and regularities that are said to be inherent in the phenomena. Such ideas, because they describe general qualities, form "empirical theory" or just "theory". Maccia, 1971 (now Steiner) put it this way: "understanding should lead to explanation, because understanding provides relationships or regularities which make sense of our happenings. To explain is to appeal to regularities, i.e., to appeal to theory. Thus, the objective of bibliometric as a scientific study is to produce ideas-that is, theory about recorded discourse and its various important properties.

In addition, Bibliometric is considered to have promise in the realm of practical knowledge, because theory permits control. More is involved, however, than simply theory. A developmental bridge is required by which theoretical knowledge is related to both the means and the ends of the proposed practice. It is not only the effectiveness of a practice that must be considered, but also its intrinsic merit; for a practice is a system of human acts devised to bring about an intended condition, and so involves values.

Thus as per (Chikate, 2010), bibliometric is defined as a branch of LIS which is concerned with the techniques of measurement and evaluation of library collection. Librametry and bibliometric show that librametry primarily aims at quantitative
analysis of the library work and bibliometric is limited to recorded knowledge. On the whole in both the cases analysis relates to library viz. document, personnel and users.

4.3 Metrics:
Metrics is the systems of measurement, particularly assessment of the usability and efficiency of electronic resources. According to Sen, bibliometric deals with documents and its components while metric studies pertaining to information is informetrics. Morales use the term informetric to cover almost all the aspects of bibliometric and librametric. All those four metrics have overlapping areas. The twentieth century may be described as the century of the development of metric sciences.

4.3.1 Librametry:
The term ‘Librametry’ was coined by S. R. Ranganathan on 18th September 1948 while giving remarks on the speech by Prof. Bernal, who had referred to library statistics in his lecture at the Leamington Spa, annual conference of Aslib (Aslib, 1949) no reference, add in bibliography too. The present impulse of Librametric (Ranganathan, 1969; and Subba Rao, 1993) no reference, add in bibliography too episode restricted to the publications output phenomena only is a very narrow kaleidoscopic view indeed. In practice, any given historical account must be limited by its choice of coverage, technique of analysis and objectives. Effective use of already available knowledge is as valuable as creation of new knowledge. Hence, present effort is to highlight it through librametric mapping and stimulate the target groups to open up and use the treasure trove of past experiences (Kalyane).

4.3.2 Informetric:
Areas of applications of statistics to various disciplines have given new names such as Econometric, Sociometric and Informetric etc. Informetric was formed to develop statistical and mathematical method in order to study and analyses the characteristics of all kinds of information. Example: text, digital image, videos, spoken documents and music etc.
The terms 'informetric' was introduced by Blackert, Siegal and Nacke in 1979 but gained popularity by launch of the International Informetrics Conferences in 1987.

According to Tague – Sutclife, “informetric is the study of the quantitative aspects of information in any form, not just records (Malav, 2013) or bibliographies and any social group, not just scientists”.

Egghe and Rousseau in the proceedings of the conference state that “the term ‘informetric’ was favoured rather that the terms (or beside) the terms bibliometric and scientometric.” Hence, in promoting a new name, it was decided to use the name ‘informetric’ together with the name ‘bibliometric’ in the title of the following conferences and in the title of the published conference proceedings also. The second meeting was thus named as ‘International conference on bibliometric, informetric and scientometric’ and the term ‘informetrics, continues to be used in this series of biennial conference (Amudhavalli, 1997).

The quantitative studies in LIS at different time period known by various names such as Statistical bibliography (1920s), Librametry (1940s), Bibliometric (late 1960s), Scientometric (1960s) and Informetric (1980s).

4.3.3 Scientometric:
The term was coined in 1969 by Vassily V. Nalimov & Z.M Mulchenko. According to Van Raan “Scientometric is defined as the quantitative study of science and technology”. Scientometrics studies are mainly applied for the following topics.

- History of Science
- Growth of science and scientific institutions
- Behaviour of science and scientists
- Science policy and decision indicators

4.3.4 Webometric:
Almind and Ingwerson coined the name webometric. According to Bjorneborn & Ingwerson “Webometrics is defined as the study of quantitative aspects of
construction and use of information resources, structures and technologies on the web drawing on bibliometric and informetric approaches" (Malav, 2013). There are four areas of webometric research as follows (Thelwall, Vaughan and Bjørneborn, Lennart. (2003) -

- Web page content analysis.
- Web link structure analysis.
- Web usage analysis (including log files of users' search & browsing behaviour).
- Web terminology analysis (including search engine performance).

4.3.5 Cybermetric:
Cyber as a prefix was used for the first time in the word cybernetics which was coined and used by Norbert Weiner in his book of the same name published in 1948. Weiner derived the word from Greek, meaning steersman wherein the idea of control is embedded (Sen). Over the years the meaning of the word has evolved and now embraces information technology, the internet and virtual reality (ANZAC).

Two distinct parts in the word 'cybermetric' are cyber and metrics. The combining form -metrics has been derived from the word metre which in turn has been derived from the Latin word *metrum* and Greek word *metron* which means 'measure' (Ingwersen, 1998). Basing the meaning of the two combining forms we can derive the meaning of cybermetric as the science of measurement involving cyber objects. In bibliometric, informetric, scientometric, etc. the application of mathematical and statistical methods are but quite common. The same will be used in cybermetric as well. This particular field will be related to bibliometric, informetric, and scientometric and will be quite close to them. In these three fields documents play a very big role. In cybermetric web sites will play the same role as that of the documents. Now, we can define cybermetric as that branch of knowledge which employs mathematical and statistical techniques to quantify web sites or their components and concepts; measures their growth, stability, propagation, and use; examines the authenticity of the content; establishes laws governing these factors;
studies the efficiency of cyber information systems, services, and products; and assesses the impact of cyber age on society (Sen).

4.3.6 Relation between different metrics:
A note on terminology (Furner, 2009) depicts that “bibliometrics” is not the only term that is used to refer to the quantitative study of document-related processes. Informetric and librametry may be defined in similar ways; scientometric, technometric, sociometric, and econometric are fields that overlap with bibliometric to greater or lesser extents (in the sense either that similar methods are used, or that similar processes are studied); and webometric and cybermetric are newer areas that focus specifically on the communication of information in electronic form (Furner, 2009). Historically, bibliometric was itself called “statistical bibliography”; and some of its elements, such as citation analysis, are important enough to be known by their own specific name. So, when exploring resources, be mindful that useful material will not always be labelled with the particular term “bibliometric(s)”

Thelwall, Vaughan and Bjorneboren in 2005 attempted to explained relationship between different metrics through the following diagram (Manjunatha, 2012).

Figure 4.1: Relationship between different metrics

The relation between different metrics as follows -

- The field of informetric embracing the overlapping filed of bibliometric and scientometric.
• Webometric is seen as entirely encompassed by bibliometric because web documents in their various forms such as text, multimedia are all recorded information stored on the web server.

• Webometric is partially covered by scientometric because many scholarly activities today are web-based.

• Cybermetrics completely covers webometric but exceeds the boundaries of bibliometric because some activities in the cyberspace are not normally recorded.

Ravichandra Rao stated that the research areas of following topics are called as librametry, or as scientometric or as bibliometric or as infometric (Manjunath, 2012)

• Quantitative aspects of LIS, especially use and user studies.

• Quantitative studies related to book usage, acquisition, age distribution of documents etc.

• Circulation studies.

• Citation studies / analyses (impact factors and other measures)

• Journal productivity (by coverage, by use, by citation, etc.) (Malav, 2013).

• Author productivity.

• Obsolescence and growth studies.

• Quantitative analysis of science (science indicators, country wise, language wise, subject wise etc.) (Malav, 2013).

• Identifying (Malav, 2013) relations among various disciplines

• Structure of subjects / disciplines

• Evaluation of scientific research (by institutions, by individuals, by countries) (Malav, 2013).

4.4 Citations:

Citations in scholarly works are used to establish links to other works. It is one of the most widely used methods of bibliometric or it is an aspect bibliometric, and studies reference to and from documents (Gooden, 2001). The benefit of bibliometric and citation analysis is expressed by (van Raan, 2003) which is reinforced by the studies
(Lal & Panda, 1996; Aksnes, 2006) that have used this method of research enquiry to evaluate a library collection. The primary function of citation is to provide “a connection between two documents, one which cites and other which is cited” (Martyn 1975).

An essential part of research papers, particularly in the sciences, is the list of references pointing to prior publications. As Ziman observes, “a scientific paper does not stand alone; it is embedded in the ‘literature’ of the subject” (Ziman, 1968). A reference is the acknowledgment that one document gives to another; a citation is the acknowledgment that one document receives from another (Narin, 1976). In general, a citation implies a relationship between a part or the whole of the cited document and a part or the whole of the citing document (Malin, 1968).

Citation analysis is that area of bibliometric which deals with the study of these relationships. As noted above, a citation represents a relationship between the cited and citing documents. The nature of this relationship is somewhat difficult to characterize, however, due to the many reasons authors cite, such as the fifteen enumerated by Garfield (Garfield 1997):

1. Paying homage to pioneers
2. Giving methodology, equipment, etc.
3. Providing background reading
4. Correcting one’s own work
5. Correcting the work of others
6. Criticizing previous work
7. Substantiating claims
8. Alerting to forthcoming work
9. Providing leads to poorly disseminated, poorly indexed, or uncited work.
10. Credit for related work (homage to peers)
11. Authenticating data and classes of fact-physical constants, etc.
12. Identifying original publications in which an idea or concept was discussed
13. Identifying original publications or other work describing an eponymic concept or term.
14. Disclaiming work or ideas of others (negative claims).
15. Disputing priority claims of others (negative homage (Stevens, 1965)

4.4.1 Citation Styles/Referring Styles:
The doctoral degree is the highest academic degree aspired by the students. Bibliography is one of the important components of a thesis or dissertation. In India, thesis is the research report submitted for award of Ph.D. degree. References cited in a Ph.D. thesis provide background material for the subject of the article and support for comments made or theories expanded, and they demonstrate to the reader that the expanded and they demonstrate to the reader that the researcher has researched the topic in question comprehensively. A reference list allows the reader access to related documents on the subject of the thesis in order to gain further information when required (Harinarayana, 2011).

There are certain guidelines referencing standards- to be followed in theses. Although the basic format is similar for most journals, there are minor, but significant differences between the various standards (for e.g. APA Reference Style, MLA reference style and Chicago manual of style etc). Referencing styles are established systems of referencing with consistent rules. Referencing style requirements cover the two elements of a referencing system.

- In-text citations such as author date citations or footnotes
- Reference lists or bibliographies.

There is a wide range of referencing styles, each with different origins and features. Some disciplines have developed their own style. For example, the American Psychological Association (APA style) was developed specifically for Psychology. Some disciplines have adopted a particular referencing style, while other disciplines may use a range of referencing styles. It is up to students to familiarize themselves with the referencing style requirements for each subject. Refer table no.4.1
### Table 4.1: Selective range of referencing styles

<table>
<thead>
<tr>
<th>Style name</th>
<th>Style features</th>
<th>Author organization</th>
<th>General application</th>
<th>Reference manual or guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvard</td>
<td>Author and date in text</td>
<td>Harvard University</td>
<td>Natural Sciences, Social Sciences and Education, Business</td>
<td>Simplified version of the Chicago style, as documented in Anderson &amp; Poole, <em>Thesis and Assignment Writing</em>. Library citing and referencing website.</td>
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<tr>
<td>IEEE</td>
<td>--</td>
<td>Institute for Electronics &amp; Electrical Engineers</td>
<td>Electronics, Electrical Engineering</td>
<td>Library citing and referencing website Style manual.</td>
</tr>
<tr>
<td>Oxford or footnoting system</td>
<td>Number in text, details in notes for each entry</td>
<td>Arts, History, English, Literature</td>
<td>Style manual for authors, editors and printers 2000, 6th ed., Canberra Ausinfo (see 'footnotes') Deakin University website</td>
<td></td>
</tr>
<tr>
<td>Vancouver</td>
<td>Number in text for each source</td>
<td>Developed at a meeting in Vancouver, 1988</td>
<td>Medicine, Humanities</td>
<td>'Uniform requirements for manuscripts submitted to Biomedical journals', in <em>British Medical Journal</em>, 6 Feb 1988, vol.296, pp. 401-405. Library citing and referencing website: Vancouver style</td>
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4.4.2 Citation Analysis:

Citation analysis has long been recognized as an important indicator of the communities and the disciplines (Price, 1965).
In his essay on citation analysis, (King, 2006) pointed out that scientists are drowning in a flood of information overload. Remarkably, thousands of scientific studies are published on a daily basis. Contributions to scientific knowledge are often crystallized in the form of a scientific article. Such contributions may take the form of new facts, new hypotheses, new theories or theorems, new explanations or a new synthesis of existing facts (Russell, 2002). In each case, a metamorphosis has taken place from an existing; say 'old' situation, to a 'new' one. The metamorphosis itself takes place in the head of the investigators with the help of scientific equipment and is usually invisible to outsiders but scientific tradition requires that an author refer to earlier articles, which relate to the theme of his/her paper. The author must clarify his/her starting point. Identifying those predecessors whose concepts, methods, discoveries, etc. have inspired or were used in developing 'the new things' that reveal 'the old things'. Viewed from another angle, the author acknowledges a group of inspirational articles written by earlier researchers by referring to them (Rousseau, 2008). Citation analysis reflects on citation practice (Leydesdorff, 1998). From an application point of view, citation analysis may be considered as collaborative peer effort to analyze and promote the quality of scholarly publication and research (Rousseau, 2008). Citation analyses study the patterns of citations in documents, an objective method for gathering data about information needs (Rethlefsen, 2007). It (Meho, 2008) has observed that citation analysis is actually a branch of information science in which researcher's study the way articles in a scholarly field are accessed and referenced by others. It has been used for the purpose of scholarly analysis and evaluation in several fields of human endeavor. Johnson pointed out that citation studies reveal much about scholarly communication and can be an effective tool to guide collection development in academic libraries (Johnson, 2000). It is against this background that in this study, citation analysis is employed in studying masters' dissertations submitted to the department of Animal Science, University of Ibadan, Nigeria (2000-2007) with a view to finding out citation practices in the dissertations and the impact of ICT (Olakotun and Makinde, 2009).

This bibliometric study emphasizes citation analysis. Citation analysis is a well known technique that has long been used to study scholarly communication. In citation analysis studies, citations in research articles, often published in journals, are
analyzed as artefacts of scholarly communication representing the citing author's use of the previously published work (Zhao and Logan 2002). As the web is becoming a new and powerful medium for scientific communication, citation analysis and other bibliometric techniques have been applied to the study of this new phenomenon in scholarly communication (Maharana et al.2006) (Saberi, Moghaddam, Mohamadesmaeil and Sedigheh 2011).

The primary function of citation is to provide “a connection between two documents, one which cites and other which is cited” (Martyn 1975).

Citation analysis is a technique of bibliometric. It is an important research tool understanding the subject, which we analyze the structure and direction of the subject. It measures the utility of documents and relationship between documents in the subject and relationship between authors and their documents. Paul and Roy (1983), defined citation analysis as, “citation analysis is one branch of bibliometric where the unit of analysis is document that is a document, which is being cited as a bibliographic reference or as a foot not in a citing document”.

It is one form of bibliometric study. It makes use of bibliographic references which are (Chikate and Patil, 2008) essential part of the primary scientific communication. The technique of citation analysis involves the process of collection, counting and analysis and interpretations of citations given in various types of literature and, thereby, helps in identification of significant sources of information, individuals, institutions and other aggregates of scientific activities. Citation analysis as a tool is used to identify the core references in a subject by counting the citations appended at the end of each scientific article. The author of a paper customarily presents references as authentic source of information having research value or to substantiate the point of view of ideas expressed in the cited paper.

With the progress of Internet, the full texts of many articles in the scientific journals are presented electronically and in open access form for researchers and hence the internet has become one the main communicational tools among researchers. E-books, e-journals, e-databases, e-theses and dissertations, e-prints of research papers, and the like have provided a scope for researchers and authors in various subject fields and
stimulated their research productivity. Consequently, citations to these internet resources as novel references have emerged and increased in number. As (Zhao and Logan 2002), have indicated, the main reason for such an increase in the number of web citations in scholarly papers is that the web has become the first choice for finding information on current research, for breaking scientific discoveries and for keeping up with colleagues at other institutions. On the other hand, there are a lot of open access resources and journals available on the web. This has led authors to refer to more and more web resources as part of their increased research productivity (Saberi, Moghaddam, Mohamadesmaeil and Sedigheh 2011).

and study the impact of ICT on LIS research.

Citation analysis is fruitfully applied to derive the benefits such as-

a) To lead the reader to further studies in the field.
b) For the preparation of bibliographies.
c) To study the use pattern of different types of documents
d) To study the scattering of subjects
e) To study the print citations and electronic citations.

It is basically a quantitative technique of citations analysis to measure the records of human communication through the process of collection, counting, analysis and interpretation of citations given in various types of literature and thereby helping in identification of significant sources of information. It also helps in planning and organization of resource sharing, networking and consortium. Therefore it is an emerging thrust unit of research in the field of LIS. The study has been taken up with the objective of finding the trends in LIS and the impact of ICT on research in LIS. Attempt has been made to identify the p- citations and e-citations to quantify the growth and diversification in various facets of research. The data collected are subjected to bibliometric analysis under the following trends such as,

a) University wise distribution  
b) Year wise distribution  
c) Region wise distribution  
d) Gender wise distribution
Using bibliometric method, a total of 315 theses were examined for discovering the trends. The modern era is facing a radical change in the way people find and use information resources. Although the information gathering and use pattern in the traditional print environment have been studied for many years, the electronic media presents a new and relatively unexplored area for such study. In this context (Bhat and Kumar, 2008) and to satisfy the objective no.2 i.e. to study the impact of information technology on doctoral research in LIS .The study describes a citation analysis of bibliographic references of LIS research. The analysis focus on the extent to which scholars are using web based sources in their research work. However to what extent web based sources as a whole have been accepted and used as alternatives and/or additions to traditional means in the LIS research is still unclear. In this context, the present study in the field of LIS for the years 1990-2010, is trying to investigate the extent to which web-based sources have been used in citations (Bhat and Kumar, 2008).This study analyze the different bibliographic forms, average number of citation per paper, different website domains and measures the web citations.

The essential purpose of this study is to measure the amount of web resources used for scholarly contributions in the area of LIS in India. It further aims to make an analysis of the nature and type of web resources. The entire web citations were scanned and data relating to types of web domains were collected. The data thus obtained were systematically analyzed, figurative representations were made and appropriate interpretations were drawn.

4.4.3 Citation Analysis Definitions:
It is worthwhile to study some of the famous definitions of citation analysis. These are as under:

i. Garfield, the father of citation analysis, he had specifically mentioned the meaning.

He said in his interview about citation analysis is as follows (Garfield, 2000):-
• I want you to know that every scientist should develop citation consciousness. For any paper or book that is citing should be aware who has cited that paper. This search will tell where and what have to know.

• Through citation analysis over many years we found hundreds and hundreds scientists who had never been publicly recognized.

• The paper, “Citation analysis as a tool in journal evaluation” mainly help librarians to choose journals for library.

• Citation analysis is like fishing started with a line and hook because for want of one fish. Then want to know which school of fish that one fish is connected to decides what size of a net to use; can expand search with a big net, but also can narrow it down using a small net.

ii. According to Rao, 1973 “citation analysis is one that can evaluate and interpret citations received by articles, authors, institutions and other aggregate of scientific activity” (Chikate and Patil, 2008).

iii. Curtis, Donnelly, 2005 has defined citation analysis as, “citation analysis is a method for understanding users, and you would not want to use it as your only research tool. However, studying the lists of references in faculty’s publications or student’s papers can show what they are reading (presumably), and the types of sources most commonly used and valued locally in their disciplines” (Chikate and Patil, 2008).

iv. “It makes use of bibliographic references which are (Chikate and Patil, 2008) essential part of the primary scientific communication.”(Encyclopaedia of Library and Information Science, 1998).

v. “Citation analysis is one form of bibliometric study. A major area of bibliometric research uses various methods of citation analysis in order to establish relationships between authors or their work. (Ane’s encyclopaedic dictionary of Library and Information Science, 2006) (Chikate and Patil, 2008).

The main objectives of citation analysis are to evaluate and to interpret citations received by articles, authors. Sum up these definition bring to light the important characteristics of citation analysis. Thus from the above definitions, citation analysis
is an evaluation method of scientific activities carried by researcher and research institution. It also highlights output of individual and organization which he is associated. It is also a method of understanding user, who uses references and cited in his research work. From these definitions it is the use of statistical method, used to analyze the body of literature, to know the historical developments in the subject field and pattern of authorship, publications and its use etc.

4.4.4 Citation Analysis Method:
When a researcher cites a given article he or she indicates that the article was somehow relevant to the research performed. The citing author calls attention to some useful price of influence included in that article a method, statistic result or whatever. And when an article is cited many times it can be considered to have had a significant impact on the conduct of research. If we take into account only the number of articles an entire nation's researcher authored, we get an idea of their level of productivity, that when we also consider the number of citations these articles received, we have a measure of their utility of impact (Chikate, 2010).

The measurement of literature use is a difficult task to achieve. The use can be measured by direct or indirect methods. In direct method the active participation of the users is essential, without which it is difficult to achieve dependable results. For example, in a study by Patterson, (Patterson, 1969) the questionnaire technique was used to find out the pattern of use of periodical literature. This is a direct method requiring active participation of users for dependable results. Sometimes combinations of different methods are used in the some study to achieve better results.

In a study by (Langlois & Von Schulz, 1973) three different methods were used in the same study to ascertain the periodicals use. The methods were:

a. For ascertaining current use, slips were attached to current issues of periodicals and users were requested to mark the use on the slips.

b. For non-current use, the users were requested to leave the consulted back volumes of periodicals on the tables and at suitable time intervals Library staff recorded the details of periodicals consulted.
c. For non-current use (indirect), references in reprints to available periodicals were consulted.

This shows that selection of a particular method will largely depend upon the nature of data to be collected. It is observed that citation analysis (indirect method) is the most frequently used method to ascertain periodical literature use. Whatever way the use is measured, one can at best obtain, not a measure, but an indicator of use and each indicator will have its own defects (Earle, 1969) Considering the defects and limitations of each method mentioned above and feasibility of its application in the present study, it was decided to use the citation analysis method (indirect method) to ascertain the indicators of use. The development of this method and its applications are described below.

4.4.5 Citation Studies:
Guha, 1983 has rightly said “citation studies being indirect in nature can completely ensure the elimination of bias inherent in most of the direct methods. Such studies are based on records which have already been created. At the same time citation studies can be much broader based than the library records, hence findings of such studies can be said to be valid within a context.” Wallace has raised some questions on citations studies which are:

- What motivates an author to cite a particular work?
- What is the relationship between a citing work and the works cited by it?
- Why are some works cited long after their publications while others are cited only when relatively new?
- Why are some works heavily cited while others are cited infrequently or not at all?
- How do citation practices and patterns differ among disciplines or families of disciplines?
- How can citation practices and patterns be used in the evaluation of information sources?
- How can citation practices and patterns be used to enhance information retrieval systems?
The assumption of most citation studies that can be considered as fundamental are:

a. The citing author has actually used the cited work and has cited all works used.
b. Citation of an information source is an indicator of its quality.
c. The citing author has provided references with the best possible works.
d. Content of the citing works is significantly related to the content of the cited works.
e. All citations are of equal value. Smith has provided a good summary of the rational for and problems of these assumption as part of an overview of the use of citation analysis.

Citation studies have also provided various bases for evaluation of librarianship. It provides a detailed framework on one side about citing and cited relationships and on the other side on evaluating contents of information sources. For instance, by the study the range of countries, languages, subjects, physical forms of documents, etc., cited by a group of sources, one can establish the boundaries of a subject literature. Again, descriptive citation studies can show how authors of a subject possess common features and how these can be bibliographically grouped according to their affinities. Citation studies can benefit in more than one way, like highlighting information by size and growth, identifying families of related documents, indicating subject, language, country, document from associations, presenting the structural characteristics of the literature and showing core documents for collection development etc. In short citation study technique is of value a) to evaluate collections, b) identify core collections, c) build usable library services and d) promote further research.

4.4.5.1 Advantages of Citation Studies:

- They rely only on empirical data.
- They are unobtrusive; do not require extra time from users.
- They analyze usage data within a scholarly cultural context.
4.4.5.2 Disadvantages of Citation Studies:
- They do not necessarily include all the literature an author has used.
- They do not necessarily reflect the use of library provided materials.
- It might be difficult to gain access to student papers for analysis.
- It is time consuming to compile and analyze the data (Garfield, 1972).

4.4.6 Originality/Value:
The present study was undertaken with a view to know the state of forms of literature used and the impact of ICT on the theses in the field of LIS.

The paper is the result of an original analysis of web citations undertaken in order to study the dependence of LIS researchers in India on web sources for their scholarly contributions. This carries research value for web content providers, authors and researchers in LIS.

Using bibliometric method, a total of 233 number of web citations were examined for discovering the p- citations and e-citations. Data were then entered in Microsoft excel software package and analyzed to observe different characteristics (University of Idaho Library, 2009) of the LIS research trends and impact of ICT. LCSH classification scheme have been considered for subject categorization of the theses in present study. The study revealed that 233 (9.40%) out of 2481 citations were web citations, proving a significant correlation between the use of internet resources and research productivity of LIS professionals in India. The highest number of web citations 65 (27.89%) was from .org type domain.

Thesis titles reflect the trends and emerging areas of research in a discipline. Also, the study of trends addresses a range of variables and the changes that occur to the variables over time. These include changes in the subject category, gender ratio, year, region, guide ship pattern, awarding universities etc. that points to the evolution of the theses as well as the discipline it represents. Results of this study will help the researchers to identify the prevailing trends and interests of LIS researchers in India. Areas of least interest can be focused for future research so that all areas of the profession can progress concurrently. Results for the growth of LIS theses awarded in
LIS will illustrate how library and information profession has progressed over the years in (University of Idaho Library, 2009) India. Thus citation analysis/ bibliometric study is used to measure the relative use of ICT as a source of research information and also for identifying the trends in LIS field.

The applications reflect two major themes-uses of citations as tools for the librarian and use of citations as tools to analyze research activity. As with any methodology, citation analysis produces results whose validity is highly sensitive to the skill with which it is applied. Perhaps the greatest potential contribution of citation analysis lies in the new insights which it can offer into this process.

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