CITATION ANALYSIS OF POST- GRADUATE DISSERTATIONS IN LIBRARY AND INFORMATION SCIENCE, MIZORAM UNIVERSITY

A Dissertation submitted in partial fulfillment of the requirement for the Degree of Master of Philosophy in Library and Information Science

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DECLARATION

I hereby declare that the dissertation entitled 'CITATION ANALYSIS OF POST-GRADUATE DISSERTATIONS IN LIBRARY AND INFORMATION SCIENCE, MIZORAM UNIVERSITY' submitted by me has not previously formed the basis for the award of any Degree or Diploma or other similar title of this or to any other University or examining body.

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CERTIFICATE

This is to certify that the dissertation entitled '**CITATION ANALYSIS OF POST-GRADUATE DISSERTATIONS IN LIBRARY AND INFORMATION SCIENCE, MIZORAM UNIVERSITY'** submitted by Ms. **Zohmingthangi Ralte** for the award of the degree of **Master of Philosophy in Library and Information Science** is carried out under my guidance and incorporates the student bonafide research. This is the candidate original work and is worthy of examination.

Aizawl, Mizoram   **(Dr. R.N. Mishra)**
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List of Abbreviations

1	BLIS	:Bachelors of Library and Information Science
2	CAS	: Current Awareness Service
3	CSIR	: Council of Industrial and Scientific Research
4	ICT	: Information and Communication Technology
5	IFLA	: International Federation of Library Associations
6	LIS	: Library and Information Science
7	MARC	: Machine-Readable Cataloguing
8	MLIS	: Masters of Library and Information Science
9	PGDLAN	: Post-Graduate Diploma in Library Automation and Networking
10	UBC	: Universal Bibliographic Control
11	UGC	: University Grants Commission

1.   INTRODUCTION

Citation Analysis principally denotes statistical or mathematical analysis of references or citations appended to at the end of each scientific communication in dissertation or thesis and it is an essential and integrated component of it. The author or the scholar of a scientific paper as an authentic source of information having research value customarily presents the bibliography or a reference or to substantiate the point of view or ideas expressed in the cited paper. Much useful information for location and identification of existing and emerging knowledge of a discipline comes to limelight through analysis both cited and citing papers. Baughman (1974) has viewed citation analysis as a systematic enquiry into structural growth of literature of the subject whereas, Eugene Garfield has advocated it as, an accepted practice in scientific communication to cite reference to works done earlier in that field (Parthasarthy, 1988). He, further, added that, citations are the formal, explicit linkages between papers that have particular points in common (Garfield, 1983). According to Martyn, citation analysis is the analysis of citations or references or both, which form part of the scholarly apparatus of primary communication (Roy, 1980). R.Paul Mohan Roy (1980) has opined that citation analysis is a modus operandi used to quantify quantitatively the assessment of documents through arranging the citations of documents in some kind of rank or order.

In view of the above discussions, citation analysis has now become an entrenched part of information research, and a quantitative approach to the description of documents is gaining ground both in research and practice. It is one of the areas of Bibliometrics which can be employed for discovering the core periodicals and for making out the characteristic features of a discipline such as, Authorship Pattern, Scatter of Literature in different bibliographical forms and subjects, etc. Citation Analysis, as a tool, was for the first time used by Gross and Gross (1927) to identify that core periodicals in a subject, based on counting the citation appended at the end of each article from a group of primary periodicals. Subsequently, the scholars and authors have inducted several such intensive studies in this field, based upon the citations found in dissertations, books, periodicals of primary nature, and reviewing periodicals like Chemical Reviews, the Sociological Reviews, and the Annual Review of Biochemistry etc. (Aravinda and Reddy, 1989).

1.1 ORIGIN OF BIBLIOMETRICS

The study of Cole and Ealey in 1917 on History of Comparative Anatomy is considered to be the first bibliometric study, where for the first time he used the term statistical analysis which again was changed to Statistical Bibliography in 1923 by Hulme who described the use and non-use of information. Subsequently, its parameters were extended by Dr. S R Ranganathan who used the term Librametry in 1948 to indicate the use of statistics for evaluating of an existing or proposed library services and resources. To trace a brief historical of the development of Bibliometrics, it was initially coined by Alan Pritchard in 1969 who defined it as an application of mathematical and statistical methods to study the references appended in books and other media of communication. Bibliometrics is a type of research method used in library and information science for analysis of scientific and non-scientific documents, library networks, indexing languages, information systems, communication systems etc. Other related terms were also subsequently minted later on such as Scientometrics, Infometrics etc. which imply the application of scientific methods to the history of science and application of mathematical aspects of information science respectively.

1.1.2 BIBLIOMETRIC USAGE

Researchers use Bibliometric methods for evaluation to determine the influence of single author or to explain relationship that exist between two or more authors or works. Bibliometrics can be used to study regional patterns of research or the extent of co-operation between research groups. The main derivatives of Bibliometrics are publication counts, citation counts, co-word analysis, scientific mapping and citations in patents.

1.1.3 BIBLIOMETRICS LAWS

A bibliometric research involves the application of bibliometric laws namely Bradford's Law of Scattering, Lotka's Law of Scientific Productivity and Zipf's Law of Word Occurrence. Bradford's law is used to determine the number of core journals in any given field. It states that journals in a single field can be divided into three parts, each containing the same number of articles: (1) First zone where a core of journals on the subject, relatively few in number that produce approximately one-third of all the articles, (2) Second zone containing the same number of articles as the first but a greater number of journals, and (3) Third zone containing the same number of articles as the second but a still greater number of journals. The mathematical relationship of

the number of journals in the core to the first zone is a constant n and to the second zone the relationship is n². Bradford expressed this relationship as 1:n:n².

Lotka's Law describes the frequency of publication by authors in a given field. It states that " . . . the number (of authors) making n contributions is about $1/n^2$ of those making one; and the proportion of all contributors, that make a single contribution, is about 60 percent" (Lotka 1926, cited in Potter 1988).

Zipf's Law is often used to calculate the frequency of words within a text. It states that in a relatively lengthy text, if you "list the words occurring within that text in order of decreasing frequency, the rank of a word on that list multiplied by its frequency will equal a constant. The equation for this relationship is: $r \times f = k$ where r is the rank of the word, f is the frequency, and k is the constant (Potter 1988).

1.2   SIGNIFICANCE AND SCOPE OF THE STUDY

Considerable numbers of citation studies have been conducted both in global and national level in the field of social science in general and library and information science in particular and the results of such studies have been tested with the bibliometric laws. However, till now no studies have been taken out in Bibliometrics in the Department of Lib. & Inf. Science, Mizoram University and as such, this is the first of its kind. It is almost remanded its virgin field of research. The present work is concerned with the citation analysis of a total number of 77 MLIS dissertations submitted to the Department of Library & Information Science, Mizoram University from 2004 to 2010.

The study finds its significance in the following areas concerning to,

• Ascertain the forms of literature referred by the students to prepare their dissertation work.

• Determine the relevance of the literature while shaping to dissertation;

• Find out the significance of URL sites visited by the students for writing dissertations.

The aim of the study is to discover the core list of significant documents required to fulfill the requirements of the students in LIS. Besides the work aims at preparing a ranked lists which may be helpful for collection development of the library under Mizoram University. The present study, therefore, includes literature exclusively in the field of LIS available in shape of books and periodicals and such other forms of documents under the preview of citation analysis. The present study also aims to

identify the core literature and/or group of authors concerned in the field of LIS. The work is, however, limited to the MLIS dissertations under Mizoram University. M.Phil and Ph.D. dissertations/ theses have been excluded from the purview of the study to make the study more microscopic. Moreover, the study is limited to test the inferences with Bradford's Law and other two laws such as Lotka's Law and Zipf's Law will be excluded to make the study more authentic.

1.3   REVIEW OF LITERATURE

The scholar made an extensive survey of literature available in the present area of investigation. Some of the analysis of the literature referred by the scholar has been mentioned below.

☞   **Singh, Neena and Dominic J. (2006). An analysis of Citation Pattern of Allopathic Journal: A Case Study.** *IASLIC Bulletin.* **51 (1); 37-41.**

Both the authors covered a total number of 687 citation appended to the 30 research articles published in four issues of Allelopathy Journal. From the citation count it appears that the sole research in Allelopathy is quite substantial only 35.52%.. About 64.48% of the research work/contribution is result of team research, the team size is small ranging from two to five. Of the citation count 89.69% relate to journal article, 6.11% to Thesis and 3.79% to conference papers. Indian citations have been found to be more with 65.65% and foreign citation 34.35% of the total citation. The study reveals that 30.57% of the total citations are author self citation and 16.16% are journal self citation. The highest percentage of year wise journal citation was found to be 33.18% in the period of 1981-1990.

☞   **Lokhanda, Rahul S. (2007). Citation Analysis of Doctoral Dissertations submitted to university of Poona in the subject Library and Information Science.** *ILA Bulletin.* **43(2), 12-18.**

The author took a bibliometric study of 35 doctoral dissertations in the area of Botany awarded during 1966-2004nand available in Pt. Ravishankar Shukla University Library in order to determine the use pattern of literature in the area. A total of 7,916 references were analyzed for identifying their bibliographic form, authorship pattern, ranking of journals.

☞ **Kanungo, Neena Talwar. (2007). Information Use Pattern of Social Scientists: An Analysis of Citations of Journal of Asian Studies. *IASLIC Bulletin* 52 (2); 69-81.**

Citation pattern of the citations appended in the articles covered in volume numbers 59-63 of journal of Asian Studies to determine the information use patterns of the social scientists were analyzed by the authors. The study has covered 108 articles with total of 9111 citations contributed by 114 authors. The results indicate that books are highly cited followed by periodical literature, government publications, newspapers and conference proceedings etc. The less number of electronic citations suggest that print literature is still the most preferred source of information for the social scientists. This study has also covered book reviews which have outnumbered the articles many times.

☞ **Paul, Dibyendu (2008). Bibliographic Control of Bengali Publishing: An Evaluative study of Books-in-print from West Bengal. *IASLIC Bulletin*. 53 (1); 55-64.**

The author in the paper presented the result of a quantitative study of the sample of bibliographic records extracted from four editions of the said books-in-print. The study has emphasized on to find out the features of comprehensiveness of this books-in-print, currency of entry and up-gradation of bibliographic information. This paper also shows the 'index-life span' of the titles indexed in this bibliography, subjects and pricing patterns of Bengali publishing as reflected in the editions under study.

☞ **Nandi, Amitava and Bandyopadhyay, Amit Kumar. (2009). Contribution in Physics Research: An Analytical Study with Special Reference to the University of Burdwan, West Bengal. *IASLIC Bulletin*. 54 (3); 131-146.**

Based on the theses submitted by the scholars during 1960-2000 in the Department of Physics at the University of Burdwan, the authors undertook a scientometric analysis of 67 theses and 610 articles scattered in eight subdivisions of Physics are analyzed and year wise productivity, authorship pattern and collaboration are studied. The department was most productive during 1986-1990 with 19 theses and 158 articles. The highest number of theses (18) was submitted in Radio Ph Laser Physics (8) respectively. The highest number of theses (18) was supervised by Prof. Baidya Nath Biswas. Authorship trend was towards multi authored papers. The degree of collaboration was 0.73. The most prolific author was Prof B.N. Biwas who topped the list with 108 papers during the period 1960-2000 followed by G.C. Bhar with 94

publications B.C. Sarkar with 81 publications, D.Neogy with 28 publications and B.C. Samanta with 26 publications. Most of the papers are published in journals emanating from India with 170 (26.86%) publications followed by U.K. with 153 (25.08%) publications, USA with 127 (20.81%) publications, Netherlands with 42 (6.88%) publications, and Germany with 39 (6.39%) publications and Japan with 8 (2.96%) publications. Among the six state universities of West Bengal, Jadavpur University has produced highest numbers (710) of articles followed by Burdwan University with 604 articles, Calcutta University with 492 articles and Kalyani University with 138 physics articles during the period 1960-2000.

☞ **Enger, K.Brock.(2009). Using citation analysis to develop core book collections in academic libraries. Library & Information Science Research. 31; 107-112.**

The author made an extensive presentation about the development of core books through the study. The study also presented an vivid description of the books helpful for library collection developments.

☞ **Kaur, Amritpal and Aggarwal, Sangeeta. (2010). Bibliometric Analysis of Research Publications of Department of Chemistry, Guru Nanak Dev University, Amritsar. *IASLIC Bulletin*. 55(1); 20-28**

The authors took a bibliometric study of research publications of department of chemistry, Guru Nanak University, Amritsar for the period 2002-2006. It analyses all the 269 research publications from 84 journals. It examines year wise distribution of papers, collaboration within the university and with foreign institutes, authorship pattern, journals in which authors published impact factor of journals etc.

☞ **Verma, Maya and Thakur, Kshama. (2010). Citation Analysis of Doctoral Dissertations in Botany submitted to Pt. Ravishankar Shukla University. *IASLIC Bulletin*. 55(3); 176-181**

In order to determine the use of information sources made by the scholars of the university, the authors took a citation analysis of doctoral dissertations submitted in the Department of Library & Information Science at Poona University, Poona. A total of 20 dissertations studied generated a total of 5252 citations. Distribution of citation by forms of documents, core journals, distribution of journals by frequency of citations, year-wise and country wise distribution of journal articles cited were analysed The

study reveals that journals is the most preferred sources of information used by the researchers in the field of Library and Information Science accounting for 45.16% of total citations. The journal Scientometrics has ranked the highest with 98 citations accounting to 4.13% of the total journal citations. Thus, the result of the study may be used as a means of evaluative tools for quality collection of the Poona University library.

☞ **Kumar, Narenda. (2010). Applicability of Lotka's Law to research productivity of Council of Scientific and Industrial Research (CSIR), India.** *Annals of Library and Information Studies.* **57; 7-11**

The author in the paper examined the applicability of Lotka's Law as a general inverse power ($\alpha \neq 2$) and as an inverse square power relationship ($\alpha = 2$) to the distribution of scientific productivity in Council of Scientific and Industrial Research (CSIR) India. Two data-sets of the research papers (6076-17681) contributed by CSIR's scientists during the period of 1988-1992 and 2004-2008 were collected from the SCI-CD-ROM and Web of Science respectively. A K-S Test was applied to measure the degree of agreement between the distribution of the observed set of data against the inverse general power relationship and the theoretical value of $\alpha \neq 2$. It was found that the inverse square law of Lotka did not conform as such.

☞ **Moed, Henk F. (2010). A new journal citation impact measure that compensates for disparities in citation potential among research areas.** *Annals of Library and Information Studies.* **57; 271-277**

The author presented a new journal indicator of citation impact of a scientific scholarly journal. It builds further upon Eugene Garfield's groundbreaking ideas presented in many of his early and later publications, by combining his concept of a journal impact factor with his notion that " evaluation studies using citation data must be very sensitive to all divisions, both subtle and gross, between area of research; and when they are found the study must properly compensate for disparities in citation potential." The proposed indicator is based on a tailor made delimitation of a journal's subject field, and takes into account the frequency and immediacy of citation and database coverage in a subject field.

☞ **Blessinger, Kelly and Hrycaj, Paul. (2010)Highly cited articles in library and information science: An analysis of content and authorship trends.** *Library & Information Science Research.***32; 156-162.**

The authors took a study of thirty-two highly cited articles that were influential to the scholarly communication in library and information science (LIS) in the latter part of the twentieth century and were examined. Journal distributions, major subject themes and authorship characteristics of these articles were discussed and compared to the majority of scholarly articles published in LIS during the same time period.

1.4   RESEARCH DESIGN
1.4.1   STATEMENT OF THE PROBLEM

Dissertations are the intellectual output of the research carried out by the candidate under the guidance of faculties spread over in multidimensional subject areas. The Dept of Lib. & Inf. Science, Mizoram University has total holdings of 77 dissertations as of now in MLIS level since its inception. The present study will enable to build up user based collection development which will be beneficial to the students, research scholars, faculties and the library as well. This is a sporadic attempt by the scholar to come up with a solution to the increasing literature. The problems associated with the study are mentioned below.

• Attempt for studying the various scientific approaches associated with bibliographies appended at the end of each dissertation has not been taken so far by any scholar either in the level of M.Phil or Ph.D.

• Scientific measures of the study lead to determine the core periodicals in the subject.

• Determining the obsolescence of literature is essential.

In order to meet the above problems, the research topic entitled Citation Analysis of Post-Graduate Dissertations in Library and Information Science, Mizoram University' is formulated.

1.4.2   OBJECTIVES OF THE STUDY

The objectives of the present study are primarily intended to:

• Identify the core literature and/or the group of authors central to the field of LIS.

• Study the forms of documents cited in the dissertation;

• Identify the most frequently cited periodicals and authorship pattern,

• Ascertain the geographical distribution of cited documents,

• Determine the year of publication of cited documents;

• Find out obsolescence of literature

• Implication of Bradford's Law of Scattering

1.4.3 HYPOTHESES

Hypotheses formulated to meet the above objectives are as follows.

• Periodical citation pattern in library and information science conform to the Bradford's Law of Distribution;

• Most cited sources for MLIS dissertations are still in printed forms; and

• E-resources are less used in MLIS dissertations.

1.4.4 RESEARCH METHODOLOGY

The present study is based on the MLIS dissertations available in the Department of Library and Information Science, Mizoram University from 2004 to 2010. The present study covers 77 MLIS dissertations available in the Department of Library and Information Science having a total number of 3719 citations and it constitute the total populations for the study and all the citations were studied taking into account the various facets. The study is based on library method where, the scholar retrieved the data from the citations of all 77 MLIS dissertations and record each citations to determine information such as, authorship pattern, forms of documents used in the citation, year of publication, geographical location etc. for scientific analysis. After gathering concerned data in the relevant area, the scholar has tabulated each component to determine the author(s) central to the publication, most preferred form of documents, core literature on the subject, obsolescence of literature etc which will facilitate the library for collection development and its use in the subject. The data so obtained is tested through Bradford's Law of Scattering and proper statistical package such as SPSS is used to determine the mean, mode, median year and median class.

1.4.5 CHAPTERIZATION

The study is divided into six chapters. While Chapter-1 of the study reflects the Origin of Bibliometrics, Bibliometric Usage, Laws of Bibliometrics, Significance and Scope of the Study, Review of Literature, Research Design comprising Statement of the Problem, Objectives of the Study, Hypothesis, and Research Methodology, Chapter- 2 of the study focuses on Citation Analysis- the basic issues, Conceptual View, Need of Citation Analysis, Citation Pattern, Direct Citation Pattern, Co-citation Pattern, Self-Citation Pattern, Half-life, Corrected Half-life, Apparent Half-life, Item Half-life, Citation Counts, Straight Citation Counts, Impact Factor etc. Bibliometric, Informetrics, and Scientometrics in clear concept also have been dealt with in the chapter. Chapter- 3 of the study discusses on the Growth of LIS as a subject, the

historical perspectives of LIS education both in international and national scenario in general and LIS education in Mizoram University in particular. Information Use Studies, the various information sources which comprises, documentary, organization, human, information services and field sources also have been discussed in the chapter. The chapter also highlights on the growth of information in various forms including the bibliographic control in LIS. The role of Citation Analysis in Collection Development of LIS is specifically dealt with in the chapter. Chapter-4 of the study vividly narrates on Laws of Citation Analysis such as, Bradford's Law. Lotka's Law and Zipf's Law. The concept of Bradford's Law is dealt by the scholar lucidly. The justifications of laws with its mathematical approaches also have been discussed in the chapter. Chapter- 5 of the study presents a details account of analysis and interpretation. Analysis to various components such as, form of documents, authorship pattern, degree of collaboration, cited author distribution, citation of web sites, ranking of journals and their geographical distribution etc. are also discussed in the chapter. The chapter also shows the findings. Chapter-6 of the study discusses on the suggestions and conclusions.

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2. INTRODUCTION

Scientists writing articles refer to earlier articles which relate to the theme of the paper. These references are supposed to identify those earlier researchers whose concepts, methods, equipment, opinion etc inspired or were used by the author in developing own article. Citations are used to access the value, quality, impact, penetration, and originality, visibility of individual and corporate performance within and across disciplines. The fact that a document is mentioned in a reference list indicates that in the author's mind, there is a relationship between a part or the whole of the cited document. Citation analysis is that area of bibliometrics which deals with the study of these relationships.

2.1 NEED OF CITATION ANALYSIS

Citation analysis is the most widely used bibliometric techniques. It is used to study the citation links between scientific papers, technical notes and reviews. Core periodicals of a subject are determined on the basis of the structure of literature available on the subject for use. Citation analysis provides relevant measures of utility and relationship of periodicals whose basic function is to communicate research results. It helps in identification of documents and core lists of periodicals, clustering of documents according to common inferences and study of attributes of literature including the growth of obsolescence in citation practice. It helps in building a need based, balanced and user oriented collection in a library. User behaviour is studied using citation analysis tool and can be used to trace the chronology of events, relationship among them and relative importance. It is an accepted indicator of scientific communication processes and patterns.

2.2 CONCEPTUAL VIEW

Citation analysis began with the publication of the Science Citation Index (SCI) in 1961. Since then, the method has rapidly grown in popularity. In 1980, Hjerppe listed over 2,000 items in his bibliography on citation analysis and related topics, and there has been no diminution in the production of papers using citation analysis techniques since then. Anyone familiar with such journals as Social Studies of Science, Scientometrics, Journal of Documentation, and the Journal of the American Society of Information Science cannot doubt that citation analysis is a widely-used method. Citation analysis, however, is not without its problems. Early recognition of these

problems led to their enumeration and pioneering attempts to use citation analysis, such as those of Garfield and Cole and Cole were extensively criticized and, in turn, defended. Since these initial confrontations, some continue to claim that they recognize the limitations of the method and correct for problems, while others claim that those in support of citation analysis not only under estimate problems but even fail to recognize them. However according to Chubin, before considering problems in citation analysis, it should be stated that these problems are relative. What may be a problem in one theory is not in another. Consequently, all the problems we discuss must be considered against the background of the theory that informs most types of citation analysis. This is the normative theory, which maintains that bibliographies are lists of influences and that authors cite in order to give credit where credit is due; that is, when an author uses information from another's work, he will cite that work . The reason that scientists cite this way is that the norms of science require them to cite the work that they have found useful in pursuing their own research, and it is assumed that they abide by these norms. Consequently, the citation analyst begins with the assumption that references cited by an author are a roughly valid indicator of influence on his work. Variations on this assumption are repeated throughout the literature, but the assumption, whether explicit or implicit, is basic to most types of citation analysis.

2.3   CITATION PATTERN

The scientist have developed and applied bibliometrics in different ways. Roll and Stevens have described bibiliometrics as a qualitative science. This bibliometric is broadly divided into two groups. i.e. Descriptive Bibliometric or Productivity Counts and Evaluative Bibliometric or Literary Usage Counts. Further, the descriptive bibliometrics is specified to a particular geography and time period along with a particular descriptive whereas evaluative bibliography is synchronized to reference counts. Chubin and Moitra have grouped the citations in two ways, i.e. citing document and cited document. Different citation patterns are categorized as follows:

2.3.1   DIRECT CITATION PATTERN

A bibliography or reference presented by an author in a respective paper or dissertation or in any scientific communication is the most authentic source of information. A paper when cited by an author is known as cited paper and the paper in which citation is made is known as citing paper. Analysis of both cited and citing paper can provide useful

information and clue for location and identification of the existing and emerging knowledge of a subject.

Eugene Garfield (1972, p.471-9) has developed the idea of using direct citation pattern to study the variety of problems existed in cited and citing papers. As a sequence to this developed technique, a conceptual framework has been devised by Derek de J. Solla Price (1970). With regard to the relationship between these publications, it may be argued that the cited publications are those which are important to the research activity in the citing paper. Further the cited articles are indicative of the influence experienced by the citing author in his own field of study which in fact reveals that the material cited by the independent authors working on the same problem will be identical. According to B.K. Sharma, continuous increase in the rate of citation of paper in a field indicates the increase of activity in the field .

2.3.2   BIBLIOGRAPHIC COUPLING

Fano (1956) for the first time advocated the concept and techniques of bibliographic coupling in citation analysis. Kessler (1958) then enhanced the idea of bibliographic coupling which denotes that two documents are bibliographically coupled when both the document have at least one common reference. The number of such references represents the coupling strength but the common sharing of information or may not be same. The more the common citation between the citing paper, the stronger is the coupling strength.

2.3.3   CO-CITATION PATTERN

The co-citation pattern is complementary to bibliographic coupling which reflects time i.e., the frequency of citation between a pair of documents. The co-citation pattern was for the first time used by Small and Marshakova. Subsequently the idea was developed more by Small and Griffith. The philosophy of co-citation basically relates to the principle that, if two citations are quoted together in subsequent literature, they maintain a relationship between them. However, the co-cited documents commonly cited in papers at different times and co-citation links two or more documents, then the publications are very important. The citation analysis with some assumptions and methods are applied in it.

2.3.4   SELF-CITATION PATTERN

The self-citation is a common phenomenon in citation behaviour. Self-citation interlinks various publications and indicates the relationship existing between them. Initially, self-citation becomes high in the development of speciality. In course of time,

more scientists are inclined towards the speciality and participation in large groups which ultimately decreases the self-citation. Therefore, less the number of scientists in a group, the more number of self-citation and vice-versa. Self-citation contains self-citing and self-cited rates which are two basic elements to count the number of citations. Self-citation can be counted by subject, periodical or by author.

2.4.   HALF-LIFE

Half-life is one of the most important aspects of citation analysis. This phenomenon of citation is defined as a period during which one half of the currently cited measure of the rate at which scientific paper becomes obsolete. According to B.K. Sharma, the half-life of citation decay is same as the half-life for literature growth.

2.4.1   CORRECTED HALF-LIFE

Estimation of removal of growth of literature from median citation age is known as corrected half-life.

2.4.2   APPARENT HALF-LIFE

The time within which half of the citations in a citation study occurs is known as apparent half-life.

2.4.3   ITEM HALF-LIFE

The item half-life is connected with time since the individual time is taken care of where the actual or approximate time of the use of half the total of citation is judged.

2.5.   CITATION COUNTS

The number of citations are counted numerically over the documents or set of documents produced in a particular time. It determines the measurement of the individual scientific periodical. Garfield has advocated two kinds of citation data which are used to measure the scientific periodicals:

2.5.1   STRAIGHT CITATION COUNT

This refers to the total number of times a periodical has been cited in a given year.

2.5.2   IMPACT FACTOR

Impact factor signifies that the average citation rate of periodical articles which is published in a periodical in a given period of time.

2.6 BIBLIOMETRICS, SCIENTOMETRICS AND INFOMETRICS

The study of different characteristics of periodical literature in particular and publications in general through mathematical techniques generate the term like librametry, bibliometrics, scientometrics and informetrics. The statistical analysis is a technology for study of characteristics when applied to a field of activity generate new field which is derived out of fusion.

2.6.1 BIBLIOMETRICS

Bibliometric was first termed as statistical bibliography by E. Wyndham Hulme in 1923 which was later changed by Alan Pritchard in 1986 where in 'Bibliometric' is a conjugation of two words i.e., biblio meaning books, documents or written communication and 'metric' amounts to measurement. Bibliometric is the mathematical and statistical application to books and other media of communication. According to Potter, it is 'a measurement of the publication pattern of all written communication including their author. Therefore, bibliometric is a science of recorded discourse which uses specific methodology, mathematical and scientific in its research in a controlled body of communication. It is a body of literature and a bibliography, quantitatively or numerically or statistically analyzed when measurement techniques are applied to the document to explain the regularity of communication phenomena.' According to Ravichandra Rao (1983, p.216), bibliometric techniques are extensively used in the identification of trends in subjects such as the identification of core journals and the patterns of library use. They are also used to build models of the study of scientific communication. One of the sub areas in bibliometric research is distribution. The study of bibliometric distribution has led to the following important laws in bibliometrics. They are Lotka's law of scientific productivity, Bradford's law of scatter, and Zipf's law of word occurrence.

2.6.2. SCIENTOMETRICS

In 1969, Vassily V. Nalimov & Z. M. Mulchenko coined the Russian equivalent of the term 'scientometrics' ('naukometriya') (Nalimov & Mulchenko, 1969b). Scientometrics includes all quantitative aspects of the science of science, communication in science, and science policy (Wilson, 2001). Scientometrics has typically been defined as the "quantitative study of science and technology". Scientometrics is the application of quantitative tools to the study of scientific

communications (Loet Leydesdorff, 2001). According to Tague-Sutcliffe, "Scientometrics is the study of the quantitative aspects of science as a discipline or economic activity. It is part of the sociology of science and has application to science policy-making. It involves quantitative studies of scientific activities, including, among others, publication, and so overlaps bibliometrics to some extent". Scientometric research includes studies pertaining to scattering of articles over journals, literature, obsolescence of documents, circulation studies, author productivity, impact of research, distribution of publications by country, by language, by institutions, disciplines, types of documents, etc. In practice, scientometrics is often done using bibliometrics which is a measurement of the impact of (scientific) publications. Modern scientometrics is mostly based on the work of Derek J. de Solla Price and Eugene Garfield. Methods of research include qualitative, quantitative and computational approaches.

2.6.3. INFOMETRICS

The most recent metric term, 'informetrics', comes from the German term 'informetrie' and was first proposed in 1979 by Nacke to cover that part of information science dealing with the measurement of information phenomena and the application of mathematical methods to the discipline's problems, to bibliometrics and parts of information retrieval theory, and perhaps more widely. Informetrics covers the empirical studies of literature and documents, as well as theoretical studies of the mathematical properties of the laws and distributions that have been discovered. According to Egghe and Rousseau, Informetrics is generally related to information production and/or information production processes. Pao has summarized the general aims of Informetric studies as measuring activities and processes with respect to information, as completing the deficiencies in information systems, as planning and managing information services, so as to improve the designs of documentation and information retrieval systems and predict future trends and uses. Informetric studies in Library and Information Sciences are based on the mathematical expression of three principles relating to social life: the Principle of Least Effort, the 80/20 rule and the Principle of Success Breeds Success. These principles have been embedded in the laws of Zipf, Lotka and Bradford. These laws have been studied and expressed in mathematical form, so that they can be used in practice. Also some scientists such as Fairthorne, Leimkuhler and Simon have investigated the similarities of these laws to standard statistical distributions.

In short, the Bibliometrics is a formed scientific sub-discipline which comprises a complex of mathematical and statistical methods used to analyse bibliographical characteristic of documents while Scientometrics is a formed structural part of methodology, including the complex of mathematical and statistical methods used to analyse the quantitative characteristics of science as an enterprise. Informetrics on the other hand is a scientific sub-discipline where mathematical and statistical methods are used to investigate scientific and technical information on theoretical level and practical information activities.

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3.1 GROWTH OF LIBRARY AND INFORMATION SCIENCE AS A SUBJECT

From the dawn of civilization, man has recognized the need for collecting and preserving the records of human thought. Books and other graphical material are the records of human thoughts, actions and achievement and can serve as the basis for future achievement. Library and institutions serves as a purpose for collecting, preserving and dissemination of information resources. With the invention of printing in 1440 A.D., sharing of information and communication among individuals becomes much easier which gradually led to the evolution of books and periodical publications. Various disciplines all over the world have witnessed a tremendous growth in their respective fields in terms of scholarly publications like books, journals, magazines, conference papers, trade publications, and monographs. The steady growth in the output of various types of documents, the nature and complexity of the thought content of the subject matter presented in the various forms of documents etc necessitate distinct methods of information management for effective library and information services. With the rise of information technologies, the field of library and information science is no longer confined to four walls of classification and cataloguing but has been broadened to embrace new concepts like automation, information retrieval, digitization, metadata, blogging, podcasts, open access, and other web related technologies. Hence the need for library and information science education is much felt among librarians and documentalists.

Library Science refers to "The professional knowledge and skill with which recorded information is selected, acquired, organized, stored, maintained, retrieved, and disseminated to meet the needs of a specific clientele, usually taught at a professional library school..." (Reitz, J.M) whereas Information Science denotes " The systematic study and analysis of the sources, development, collection, organization, dissemination, evaluation, use, and management of information in all its forms, including the channels (formal and informal) and technology used in its communication." (Reitz, J.M). Library and information science is a combination of library science and information science. Very often, library science is considered traditional area of study and information science is regarded as modern field of study that deals with different aspects of information, involving application of information technologies.

Library and Information Science (LIS) education pertains to education for library and information professionals. The role of the 21st century LIS professionals is adapting to

changing technologies, information environment and customers expectations. Library professionals are increasingly responsible not only to provide traditional library information services but also to deliver online information services according to the actual user needs. Librarians need to keep up with their users' expectations to survive and service them. Librarians need to become information knowledge navigators who refine data into usable information.

3.1.1 HISTORICAL PERSPECTIVES OF LIS EDUCATION

The need for a library school was advocated in 1879 by Melvil Dewey in the 'Library Journal' and submitted his plan for its establishment in 1883 at Colombia College, where he was working as a librarian. (Gayasuddin, Sharma and Mani, 1989, p37). The first library school was set up in 1887 at New York City, which was later on shifted to Albany in 1889. The development of library schools in other countries began in 1915, when librarians' schools were founded at Leipzig and Barcelona (currently, as a faculty of the Universitat de Barcelona, the latter is the oldest library school in Europe). Many others were founded during World War II. The University of Chicago became the first library school to confer a master's degree in library science, which is now the standard professional degree, and later became the first to give a doctoral degree in the field.

The beginning of the 20th century has marked the beginning of LIS education in India with the year 2011 at its century. John MacFarlane, an Englishman, who happened to be the first librarian of the Imperial Library (now National Library, Kolkota) also, shares the credit for training librarians in our country. In fact, MacFarlane's training programme is the first case of LIS education in India reported in literature. It took place between 1901 and 1906 in the Imperial Library when training programmes were organized for its staff. The first LIS education movement was credited to the then maharaja of Baroda The first formal training course in library routines was conducted to impart professional training to librarians in Baroda. In 1915 LIS education was started for the first time at the university level in Punjab University, Lahore (earlier part of undivided India) with William Alanson Borden and Asa Don Dickinson as the first teachers. Basic library concepts like decimal classification, cataloguing rules, list of subject headings, dictionary catalogue, and open shelves were taught during a three months course. It was claimed as the second such school in LIS education in the world and the first in Asia; LIS education was first started in the U.S. The LIS education movement took its course towards the southern part of the country and in 1920, a school was set up by Andhra Desa Library Association where lectures were organized

on various topics related to the history, literature, and culture of Andhra Pradesh besides the library movement. The course was modified later to include more topics of library science. In 1929, Madras Library Association (MALA) started a School of Library Science for training college and school librarians in the state of Madras. This was the first certificate course of library science to be started by any state library association in India. Prof. Ranganathan acted as the Honorary Director of the school. The certificate course continued up to 1937and in 1938, the 3 months training course was replaced by a one-year full-time postgraduate course, leading to a diploma course in librarianship. The LIS courses got a enhanced in 1935 when Andhra University started a diploma course in library science owing to the efforts of Dr M.O. Thomas. The course was later upgraded as a postgraduate diploma in 1961. In 1938, a postgraduate diploma course in librarianship was started by Madras University by taking over the course earlier offered by MALA. Banaras Hindu University (BHU) was the second university after University of Madras to start a postgraduate diploma course in 1941. Following this, diploma in Librarianship started in 1943 by Bombay University. In 1945, University of Calcutta also started a one-year diploma course. In 1947, Dr. S.R.Ranganathan moved to University of Delhi and started the first postgraduate diploma course. Simultaneously, the PhD programme was launched by the university in 1949. University of Delhi was therefore the first university to start a doctoral programme in library science in the entire British Commonwealth. By the end of 1960, Library science courses were also started in five more universities-Hyderabad, Osmania, Punjab, Poona and Rajasthan. It is reported that there were about 12 library schools in 1960s, imparting library science education in the country at all levels except the M.Phil degree. The decade of 1960s saw some very important events taking place affecting LIS education in the country. Ranganthan conceptualized the premier education and research institute, Documentation Research and Training Centre (DRTC), Bangalore under the patronage of Indian Statistical Institute in 1962 for imparting a specialised training programme in documentation. Another parallel institution, Indian National Scientific Documentation Centre (INSDOC), now named as National Institute of Science Communication and Information Resources (NISCAIR), was established under the guidance of Council of Scientific and Industrial Research (CSIR), Delhi, in 1957. It started a course in Associateship in Documentation in 1964. Prior to this, it organised short-term training programmes for librarians which it continues to do as its objective of providing continuing education for LIS professionals.

These are two premier institutions in the country providing specialized training in documentation and information and have been providing national input and support to the development of the profession in the country. The Review Committee for LIS education in the country was set up in 1961 under the chairmanship of Ranganathan. In 1965, the Committee gave recommendations that had far reaching impact on LIS education. The Indian Association of Teachers of Library and Information Science (IATLIS) were established in 1969 which further helped in the growth and development of the discipline. It organised its first seminar in 1970 on teaching methods in library science. In 1974, University of Calcutta introduced two-year MLIS. There was a need felt to update the syllabi in view of the increasing importance of information. Karnataka University, Dharwad, organised a seminar to discuss the changes required in BLIS syllabi to accommodate components of documentation and information to enable the students to handle information related jobs. Microcomputers appeared on the scene in library activities and services during the 1980s. University of Delhi was one of the first to introduce an optional paper on computer application. A two-year integrated MLIS was introduced in the North Eastern Hill University (NEHU) and Madras University in 1986 and 1988 respectively. It was felt that two-year MLIS would put it on the same pedestal as the other Master's degrees and also the curriculum would be better spread if integrated over a two years period. In late 1980s, in addition to formal teaching courses, some universities introduced correspondence courses at various levels. Indira Gandhi National Open University, New Delhi, introduced BLIS in 1989. It has played a pioneering role in LIS education, and conducts BLIS, MLIS, PhD and PGDLAN (one-year postgraduate diploma). At present, 167 universities4 and their affiliated colleges/institutions are conducting courses in library science in the country. Eighty-seven universities/colleges at Bachelor's level and 89 at Master's level are conducting LIS education, respectively. While PhD (full time) is offered by 49 universities, PhD (part time) is also offered by three universities. Eight universities and 12 colleges offer certificate programmes and six universities and six colleges offer diploma programme under regular mode of education. LIS education is also being offered by the universities under distance mode of education. Five universities offer certificate and diploma courses education.

3.1.2   LIS EDUCATION IN MIZORAM UNIVERSITY

Mizoram University since its inception i.e, 2002 has introduced the Department of Library and Information Science under the School of Economics, Management and

Information Science. A one-year duration Bachelor of Library and Information Science (BLIS) programme was first initiated in 2002 covering library science subjects. In addition to this, in 2003 a one-year course of Master of Library and Information Science (MLIS) was again introduced emphasizing information science and IT application in its curriculum. With effective from July 2005, the university changed the programme into a two years integrated MLIS course which is at par with other UGC affiliated university courses. The course of study focuses on core library skills such as cataloguing, classification, reference, collection development as well as related areas such as the philosophy underlying the profession, information technology and management. National seminars and workshops relating to the discipline are frequently organized by the department on topics such as disaster managements, library automation, library consortia and digital libraries just to mention a few. The department now has offered both M.Phil and Ph.D degree courses in LIS as well.

3.2   INFORMATION USE STUDIES

The term 'information' is defined in Dictionary.com as 'knowledge gained through study, communication, research, instruction etc. According to BusinessDictionary.com, it is 'Data that (1) has been verified to be accurate and timely, (2) is specific and organized for a purpose, (3) is presented within a context that gives it meaning and relevance, and (4) that can lead to an increase in understanding and decrease in uncertainty.' The value of information lies solely in its ability to affect a behavior, decision, or outcome. The Online Dictionary of Library and Information Science defined information as: "Data presented in readily comprehensible form to which meaning has been attributed within the context of its use". So a specific data can be considered as information if it conveys a meaning to the person who receives it. Over time the term information need has been used in a variety of ways. Belkin and Croft (1992) suggest that a search begins with a problem and a need to solve it-the gap between these is defined as the information needs. Information need, then, leads to information seeking.

Information may be sought for different needs and purposes of the information seekers. The users may have different information seeking behavior, attitudes and tastes. To provide qualitative information, five major aspects should be borne in mind (Rajkumar and Gopal Krishnan, 1991, p55), which include,

• To whom the information is to be disclosed;

- Purpose of information requirement;

- Quantum of information to be provided with;

- Type of information; and

- Time duration for supplying the information.

It is crucial that the right information should be imparted to the right reader at the right time which can only be achieved through systematic collection, processing, storage and retrieval of the gathered information. Rojas (1984, p58-75) has suggested the following qualities for retrieval of need-based information to its target population. These qualities include,

- Accessibility, i.e., ease and speed of information;

- Comprehensiveness;

- Precision;

- Compatibility;

- Timeliness;

- Clarity;

- Flexibility;

- Verifiability;

- Free from bias.

3.2.1 Information Sources

The sources of information can be broadly classified into five categories (Rajan, Subbarao, Ramaswami, Yashpal, 1975, p111.1 and Parker and Turley, 1975, p4), namely,

- Documentary;

- Organizations;

- Human;

- Information services; and

- Field Sources.

3.2.1.1 Documentary:

By informational character, the documentary source of information can be divided into three categories, such as, 1) primary 2) secondary, and 3) tertiary.

⇨ Primary sources are original materials. They are from the time period involved and have not been filtered through interpretation or evaluation. Primary sources are original materials on which other research is based. They are usually the first formal

appearance of results in physical, print or electronic format. They present original thinking, report a discovery, or share new information.

⇨   Secondary sources are less easily defined than primary sources. Generally, they are accounts written after the fact with the benefit of hindsight. They are interpretations and evaluations of primary sources. Secondary sources are not evidence, but rather commentary on and discussion of evidence. However, what some define as a secondary source, others define as a tertiary source. Context is everything.

⇨   Tertiary sources consist of information which is a distillation and collection of primary and secondary sources.

3.2.1.2 Organizations:

Some organizations use to supply a guide to both national and international coverage providing information relating to various educational institutions, such as universities, institutions, deemed universities, colleges, libraries and archives, museums , learned bodies, professional associations, etc along with a subject index.

3.2.1.3 Human:

People happen to be the chief and potential source of information. Approaching people directly can be a quick way of obtaining information as well as getting access to their unpublished work. Attending conferences and seminars plays a vital role in information dissemination.

3.2.1.4 Information Services:

An information service is that agency or department responsible for providing processed or published information on specific topics to an organization's internal users, its customers, or the general public. It relates to those organizations which supply information or at least references directly to the users. Such services range from answering simple telephone queries to the supply of computer generated printout of references specific to the clientele's requests. Information services such as providing references, CAS, bibliographical services, appropriate search terms, search profile, abstracting and indexing services etc are some of the way that lead to reach the sources of information.

3.2.1.5 Field sources:

The field source of information include living persons, those who have the fund of knowledge about social conditions and changes that takes place over a considerate period of time. Data from these sources may be obtained through participation in observation, personal interview, conference, correspondence, questionnaires etc.

3.3   GROWTH OF INFORMATION

The literary sphere is facing publication deluge. This is due to the over flow of information. According to Nigam (1991, p11), the growth of literature is indicated by the following factors:

☞   Books;

☞   Periodicals;

☞   Indexing and Abstracting Periodicals;

☞   Learned Societies;

☞   Information Technology;

☞   News Agencies;

The proliferation of literature has taken various forms. Two centuries following the invention of printing press, publication was restricted almost entirely to the book, the monograph. Then, in 1665, with the inauguration of the Royal Society's Philosophical Transactions, the publication of periodical literature has risen steadily. Subsequently, the books and the journals were joined by the tremendous output of government publications, by great collections of historical sources and texts, and other varied types of records that pour into libraries. (Downs, R.B. p 498-499). The present era sees an unaccountable growth of literature owing it to the development of ICTs. The use of internet and its applications such as web pages, blogs, social networks etc made available easy access to input and output of information where one cannot entirely rely on the information credibility. Hence, information explosion is at stake and affects the quality control of literatures. As the amount of available information sources grows, the problem of managing the information becomes more difficult, which can lead to information overload.

3.4   BIBLIOGRAPHIC CONTROL IN LIS

The rise of information production has caused difficulty in proper and efficient distribution of the user need-based information. Therefore, it became necessary for librarians and information scientists to come up with ideas to control the production of literature so that redundant literatures can be avoided. The controlling of bibliographical records of the published documents was thus started and in the process have been developed an assortment of bibliographical tools for the convenience of providing quick answers to users query such as indexing, abstracting, subject bibliography etc.

"The term bibliographic control refers to the operations by which recorded information is organized or arranged according to established standards and thereby made readily retrievable." (Chan,1994). Bibliographic control according to Ghosh (1988) is a mechanism for the systematic listing of recorded knowledge in all forms including published as well as unpublished documents. It is the identification, description, analysis, and classification of books and other materials of communication so that they may be effectively organized, stored, retrieved, and used when needed. It is all the activities involved in creating, organizing, managing and maintaining the file of bibliographic records like materials held in a library or archival collection or the sources listed in an index or database. It is to provide information to the readers or users and includes scientific description and subject access by means of uniform catalog code, classification scheme and name authorities.

The earliest attempt for bibliographic control may have been traced back to Conrad Gesner of Zurich, in 1545, about a century after printing began, published his Bibliotheca Universalis. Universal bibliographies were made by Gottlieb Georgi about the middle of the 18th century, and by Jacques Brunet, a Frenchman, and Johann Grasse, a German, in the second half of the 19th century. Probably the most ambitious of all enterprises in general or international bibliography is the great Brussels union catalogue, sponsored by the International Institute of Bibliography, also founded in 1895. In 1969, IFLA sponsored an International meeting of Cataloguing Experts at Copenhagen. The meeting held a discussion on proposal for conforming to a universal standard bibliographical description for each item published in the country of origin. The programme was finally launched in 1974 with the objective of making an internationally accepted basic biographical data on all publications issued in all countries. (Mgaywa and Chakrabarty, 1992, p143). Thus the Universal Bibliographic

Control (UBC) was conceived, formerly known as the UBCIM (Universal Bibliographic Control and International MARC). UBC was part of an international effort to set up an information infrastructure. It aims to collect information on all documents published in the world and presenting them in standard format. Efforts are being made by several countries in maintaining records their countries' literature output. However, bibliographic control has its own limitation, as the execution itself involves a time consuming and arduous work. It would be difficult to contain publications under bibliographical control until there are one or more sources which follow up the previous research publication.

3.5   ROLE OF CITATION ANALYSIS IN COLLECTION DEVELOPMENT

Library collection development is the process of meeting the information needs of the users in a timely and economical manner using information resources locally held, as well as from other organizations. Collections are developed by librarians and information professionals by buying or otherwise acquiring materials over a period, based on assessment of the information needs of the library's users. Collection development involves the creation of policies to guide material selection. The frequency of the document being consulted or cited by the users is one of the parameter for evaluating the document value. Decisions whether to acquire or not to acquire a particular title or to continue or discontinue subscription of a periodical etc is influenced by the number of times the document is being used. Citation refers to the list of references to other works in a published work. "Referring" means mentioning in the proper context and giving an explicit bibliographical statement in a list of references. Typically, citation shows that a relationship exists between the work of an author and the previous works done in that field. Authors contribute to existing knowledge and demonstrate that they are current with activity in their fields. Smith (1981) suggests that citation analysis of theses and dissertations can have implications for both collection development and user services. She cautions librarians that citation does not imply quality or importance. It is a controversial methodology because it does not represent all the possible needs or uses for information (Haycock, 2004). Though valid criticism of citation analysis exists, several authors have shown that citations correlate with other methods of collection analysis, including impact factors, circulation statistics, in-house use, and user surveys (Tsay 1998, Blecic, 1999, and Fuchs et al., 2006).

Citation analysis in spite of its problems, limitations and criticisms still exists and has become an entrench part of information research. Citation measures have emerged from studies of citation databases. These include Journal Impact Factor and Relative Impact Factor. Today, bibliometrics and scientometrics make extensive use of citations to assess quality and trace patterns of scholarly communication. It also still accounts for the methods of book and periodical selection by knowledge institutions.

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4.   INTRODUCTION

The growth of literature in a subject needs a quantitative analysis for its better proliferation. Library and Information Science (LIS) is not an exception to it. A considerable growth of literature in the field of Library and Information Science has tempted the scientists in the field to have intensive studies. However, such an argument has not been accompanied by critical analysis of the subject and, also, of the direction of quantitative librarianship primarily because of the varied nature of libraries and their multifarious services. It, therefore, becomes inordinately difficult to devise a common statistical measure for its application in different type of studies in the field. The Libraries today are more complex than ever owing to following several factors as advocated by PK Rao.

⇨   The character and inadequacy of currently available data on various types of libraries and their services.

⇨   Information Explosion and Publication Deluge.

⇨   Manifolds increase in the size of the Library and the user community serves.

To tackle these problems and to control the rising cost library operations consequent to their growth, librarians have started using various quantitative techniques in their day-to-day administration, especially to evaluate the libraries and their relate services. In the process, the bibliometricians have identified certain empirical laws and models out of which, quite a few of them are mere speculation than anything else.

The Bibliometric laws helps in understanding some of the information prodigy and help in proper planning of library activities, as they indicate certain basic patterns and relationships that govern information items and activities. Basically, this study pertains to quantification of items and their pattern of distribution. Hyperbolic distribution and exponential growth are the prominent trends underlying information and document phenomenon. Such studies throw light on patterns of growth of literature, productivity and influence of authors, their interrelationships among different branches of knowledge, distribution of terms in information storage and retrieval, pattern of collection building etc. Laws of nature are of two basic forms: (1) a law is universal if it states that some conditions, so far as are known, invariably are found together with certain other conditions; and (2) a law is probabilistic if it affirms that, on the average, a stated fraction of cases displaying a given condition will display a certain other conditions as well. In either case, a law may be valid even though it obtains only under

special circumstances or as a convenient approximation. Moreover, a law of nature has no logical necessity; rather, it rests directly or indirectly upon the evidence of experience.

Unlike laws of nature, Bibliometric laws are empirical laws and hence, remain valid so long as the sociology, structure and pattern of information generation, communication and dissemination remain the same, and may not hold good, once the pattern of basic organizations changes due to social and scientific phenomena. Varied expositions and interpretations of these laws have also contributed to difficulties in their use since, these laws are based on the study of immense data employing specific parameters- their use in predicting current and future behaviour may not give the same results.

The objectives of such empirical studies other than the description of empirical phenomenon are to establish through laws and theories, general principles by which empirical phenomena can be better explained. An empirical law involves at least two variables representing minimum two different parameters. For example, if a law is from $y = a + bx$, where y and x are the variables measured and also the parameter (a and b) are measurable in the same scale, otherwise, a and bx cannot be added together (Rao, 1988, p. BBL24).

4.1. CONCEPT OF BIBLIOMETRIC LAW

Alan Pritchard within the framework of the scientific law developed the term "Bibliometrics" in 1969. Bibliometrics, an integral part of the information theory, basically attempts to analyse quantitatively the properties and behaviours of recorded knowledge. Bibliometrics is looked upon as an umbrella term used for studies when quantitative methods are used to investigate the scientific communication process by measuring and analyzing various aspects of written documents (Parthaasrathy, 1988,p.BBL 2)

The Bibliometric data are found to conform more closely to a number of scientific laws and mathematical distributions. The three laws most frequently mentioned in the bibliometric literature are, (i) Bradford's Law, (ii) Lotka's Law, (iii)Zipf's Law. Specialist like Fairthorne, Brookes, Leimkuhler, Bookstein, Price and many more scientists (Lawani, 1981, p 296) have reviewed these laws and their various mathematical forms. The three above laws are also known as Bibliometric Models.

Bradford's Law is concerned with the study of scattering of article on a subject in various periodicals where as productivity of authors in terms of scientific papers are

studied in Lotka's Law. The study of the frequency of occurrence of words in a text relates to Zipf's Law.

4.2. BIBLIOMETRIC LAWS

In course of time, a good number of bibliometric studies have been made in the field. The Bibliometric Laws are the scientific Laws that have actually laid the foundation of the bibliometrics. These bibliometric laws are the empirical laws because its inferences are based on empirical phenomena. It may be stated here that a proposition of science is called an empirical law, provided (Rao, 1988, p BB1, 24) it is capable of being observable or operationally definable. Thus, empirical laws are derived in complete from observations and not from any theoretical or any other conjectural hypothesis.

The three major bibliometric laws are best known as (a) Law of scattering, (b) Scientific Productivity, and (c) Words of occurrence respectively (Bookstein, 1979, p 151). Though all the three laws seem to be basically same, the variation rests on the type of data. Bradford noticed the scattering of articles on a particular subject flashed in various periodicals, Lotka viewed the productivity of authors in term of scientific papers and Zipf counted the frequency of words occurring in text. Each of these distributions were empirically derived and hence were similar to each other as special cases of a hyperbolic distribution (O'Connor and Voos, 1981, p. 10)

4.2.1. BRADFORD'S LAW (LAW OF SCATTERING)

In 1895, the first international conference on bibliography was held at Brussels, Germany. The essence of the conference was to establish a universal index for reorganization of the requirements of a standard subject classification for international co-operation. Samuel Bradford in 1927 through his scientific paper 'Bibliography by cooperation', accelerated the thoughts for accumulation of the usefulness of scientific and technical literature and its intensified link existing with the bibliographical work. The paper covering the lists of science subjects available in the science museum library, London was basically to create awareness among the readers about the need of information service in the field of science and technology.

Bradford, however, applied hypothetical view that primarily concerned with scattering of references appended to the periodicals. The inferences drawn by him was grouped under three zones, such as a, b and c, which resembled the production of more than 4 references a year, producing 1 reference or less a year respectively. He concentrated his studies on the data obtained out of literature of Applied Geophysics and Lubrication

and drew inferences that ultimately led to the formulation of Law of Scattering in 1934 (Lawani, 1981, p. 296).

Bradford observed that, the aggregate of references in a given subject, apart from those produced by the first group of large producers, are proportional to the logarithm of number of sources concerned, when these are arranged in order of productivity. The foregoing observations of Bradford led to the formulation of second diagram denoting the algebraic relation existing between them. In 1934, he described the scattering pattern of journals in the 'Applied Geophysics and Lubrication' where he plotted a partial sum of references against the natural logarithm of the partial sum of journals where he observed that, the resulting graph is a straight line (Rao, p.186). This in fact led him to deduce the law, which later on was recognized as the verbal part of Bradford's Law. The scattering phenomena suggested by Bradford in connection with linear relation is

$$F(x) = a + b \log x$$

Here, $F(x)$ is the cumulative number of references embodied in the first x most productive periodicals, where a and b are constant. Anyone, through figure hypothetical but typical can explain the long-linear curve, as described by Bradford, showing the aggregates of articles on a given subject corresponding to the number of periodicals. This type of curve is known as 'Bradford Curve' . Basing on a semi-long arithmetic graph, Bradford (1934. P.86) advocated, 'If scientific periodicals are arranged in order of decreasing productivity of articles on a given subject, they may be divided into nucleus periodicals more particularly devoted to the subject and several groups or zones containing the same number of articles as the nucleus, when the number of periodicals in the nucleus and succeeding zones will be

$$1 : n : n^2 : n^3 \ldots$$

In the same periodical, he published his 'Law of Scattering' that is universally known as Bradford's Distribution. From the above discussion, it is rightly deduced by Brookes (1977, p.181) that, the Bradford's law primarily is concerned with

a)   A finite set of activity sources (an assemble) whose activities are manifested by the generation or consumption of a specified type of item;

b)   Observation of those activities over a specified sampling period; and

c)   Items of some homogenous kind that is discrete and countable.

One of the points of analysis that has so far escaped is that, the statistical distribution of such an ensemble of activity must depend upon relationships between the number of active sources, the range, intensity of their activities, and finally, the period of observation which provides the sample data have been regarded as constituting a total population.

4.2.2.   LOTKA'S LAW (LAW OF SCIENTIFIC PRODUCTIVITY)

Alfred J. Lotka, a mathematician and supervisor of mathematical research in the Statistical Bureau of the Metropolitan Life Insurance Company (1924-1933) presented a paper in 1926 entitled, 'Statistics – The frequency distribution of scientific productivity'. The paper primarily based on productivity formula and later on came to be known as Lotka's Law (Kent, 198, p169 and Mitra, 1988, p.BBL 56)

 Lotka's Law provides the fundamental theoretic base for bibliometrics studies by inviting authorship. Aiyepeku also had shown earlier on the basis of data collected on geographical literature that Bradford's Law can be applied in analyzing the productivity of authors (Lawani, 1981, p.294-315). In fact, Lotka concentrated his study in ascertaining the part that contributed to the progress of science. To materialize the same, Lotka considered the volume of production of papers in Chemistry and Physics by individual scientists. He presented an analysis of the number of publications listed in Chemical Abstracts Index from 1907 to 1916 with the frequency of publications of the authors and counted the number of names against which appeared 1,2,3… etc.

Lotka proposed an 'Inverse Square Law of Scientific Productivity' based on his data as follows (Rao, 1988, p.BBL 17):

$$Y_x = \frac{6}{n^2 x^\alpha}$$

$$x = 1,2,3 \dots$$

$$\alpha > 0$$

Here, Y_x is the relative frequency of the authors publishing 'x' papers. The value of α was found to be 1.89 for Chemists and 2 for Physicists. If N is the total number of

authors, N_y gives the number of authors who have published single paper each. Thus, Lotka's equation determine in its general form by three parameters.

(a)   The number of scientists with minimal productivity (authors with single paper each- N_{Y1}

(b)   The maximal productivity of scientists (X_{max}) ; and

(c)   The characteristic exponent.

An increase of α in Lotka's equation implies an increase in the portion of low productivity of scientists. This implies that, for given n and for a larger value of α the portion of highly productivity scientists will decrease. Therefore it can be argued that the larger is the parameter α , the greater is the gap between productivity of individual groups of scientists.

Altogether 6891 names beginning with letters A and B were tabulated for the purpose (Kent, 1987and Lawani, 1981). Applying the same procedure, Lotka made a similar study using the name index Auerbach's Geschichstafelnder Phisik , which covered contributions by 1325 Physicists throughout history up to 1900 (Kent, 1987and Parthasarathy, 1988). From such data, properly calculated and plotted. Lotka in 1926 formulated a general formula for the relation between the frequencies y of person making x contribution as $'X\eta Y = Constant'$ which ultimately was known as 'Inverse Square of Scientific Productivity'.

Finding the value of the constant when $n = 2$, Lotka drew his inferences that the number of persons making 2 contribution is about one-fourth of those making one contribution ; the number making here contributions is about one ninth, etc the number making in contributions is about $1/n^2$ of those making one; and the proportion of all contributions that make a single contribution is about 60%. To state the law differently, Lotka found that the productivity of scientists conformed to Inverse Square Law in such a way that, for 100 authors contributing one article, 25 will contribute two articles, 11 will contribute three articles, 4 will contribute five articles (Parthasarathy, 1988). Lotka's equation suggests that, the portion of single paper author (K) is the function of α. It can be diagrammatically represented as follow:

$$K(\alpha) = [\sum_{x=1}^{x\,max} \quad where \quad 1/x]$$

Lotka's law has been subjected to empirical verification and various information collections pertained to various scientific fields, make it possible to regard it as one of the accepted bibliometric regularities of the distribution of scientific output.

Thus it is widely recognized that, scholarly productivity as measured by number of publications produced, in an elitist phenomena, most authors contributing to a particular body of literature contribute very little, and the number of authors who are highly productive is very small indeed. Taking these phenomena into account, Lotka's Law of Inverse Square states that, if X author contribute one paper to each field, the number of contributing two papers would approximately $X/2^2$, the number producing three papers would be $X/3^2$ and so on. Lotka found that about 60% of the authors contributing papers to a field contribute only one paper, so the percentage of contributing two would be $60/2^2$, about 15% of contributing three papers would be $60/3^2$, or below 7% and so on. So the highly productive authors form a very small portion of the total publications (Lancaster, 1991, p.14).

4.2.3 ZIPF'S LAW (LAW OF WORDS OF OCCURRENCE)

George Kingsley Zipf was influenced on speech as natural phenomena. He detected that the distribution of words in English approximates with remarkable precision of a harmonic series and all mistakable progression according to Inverse Square which is valid more than 95% of the works used in the sample (Kent, 1987, p. 181). This principle was highlighted in the thesis entitled 'Relative frequency: a determinant phonetic change' It was published in Harvard Studies in Classical Philosophy in 1929. He also viewed the conspicuousness or intensity of any element of language is inversely proportionate to its frequency. Using X for frequency and Y for conspicuousness (rank), he deduced the following formula.

$$Y = \frac{n}{X} \text{ or } XY = n \text{ , where, } n \text{ is constant}$$

The formula provided the basis for his latter works. The outstanding work of Zipf came in the form of a book entitled, 'The psycho Biology of Language' published in 1935 which was based on statistical principles.

According to Zipf, if the number of words occurring once in a given sample and is taken as X, then, the number of words occurring two times, three times, four times, n times in the same sample can be represented as,

$$\frac{1}{2}2, \frac{1}{3}3, \frac{1}{3}2, \frac{1}{4}2, \dots . \frac{1}{n}2$$

respective of X number of words though not including the few most frequently used words, which is an unmistakable progression according to the Inverse Square and this is valid well over 95% of all the different words used in the sample (Mitra, 1988. P. BBL.53). From here, Zipf deduced the formula, $ab^2 = k$, where a is the number of words occurring $'b'$ times. He also concluded that the $ab^2 = k$ which implies that the relationship is valid only for the less frequently occurring words which, however, represent the greater majority of occurrence. But, frequency distribution of the rare words comes into the closest approximation of $ab^2 = k$ relationship.

In 1949, another book was published on Human Behaviour and the Principles of Least Effort' whose purpose was to establish that the principle of least effort as the primary principle that governs the entire individual and collective behaviour of human being. Zipf arranged 29,899 words of different types from the index of the book in a descending order of the frequency of occurrence by assigning a rank to each word. i.e., from $r = 1$ (most frequently occurring word) to $r = 29,899$(least frequently occurring). He further noticed that the numerical value for rank (r) can be found by multiplying the value with its corresponding frequency, to obtain a product $'C'$ otherwise, it is

$$rf = C \quad \text{where } f = \text{frequency}$$

Zipf (1949, p.1) has derived his law from a general principle of least effort of which would mean that a person solving his immediate problems would view these against the background of his future as estimated by himself. In other words, a person will tend to minimize the probable average rate of his work expenditure (overtime) meaning, thereby, he will use the least amount of efforts.

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5.   INTRODUCTION

Citation analysis is useful for understanding subject relationships between documents, author's effectiveness, user behaviour, publication pattern   and also for assessing collection development of a library or research institutions. All references (bibliographies) were photocopied and each reference was categorized according to the format or genre i.e., book, journal, report, conference proceedings etc. A total of 3719 citations were collected for bibliographic study.

Data collected from the MLIS dissertations have been classified, tabulated and analyzed to:

• Study from what forms of documents the students have cited.

• Identify the authorship patterns of the cited resources.

• Determine the half life of web resources referred by the MLIS scholars.

• Find out the most highly cited authors.

• Mapping the geographical distributions of periodicals accessible to the students while writing their dissertations.

• Determine core periodicals / most frequently cited periodicals.

• Test the validity of Bradford's Law of scattering among the cited subject specific journals.

5.1   FORM OF DOCUMENTS

With the availability wide information sources to this day, the students have the options of choosing sources of information from prints to e-books, e-journals and the Web. Most cited forms of documents for MLIS dissertations are given below in Table-1 supported with Graph-1 for a clear visualisation.

Table1: Form-wise Distribution of the Documents

Forms of documents	No. of citations	%	Cumulative citations	Cumulative %
Books	1837	49	1837	49
Journals and Magazines	1411	38	3248	87
e-Journals	115	3	3363	90
Websites	90	2	3453	93
References	77	2	3530	95
Handbooks	35	1	3565	96
Reports	17	0.45	3582	96
Conferences	06	0.16	3588	96

Unidentified	131	4	3719	100
Total	**3719**	**99.61 or 100**		
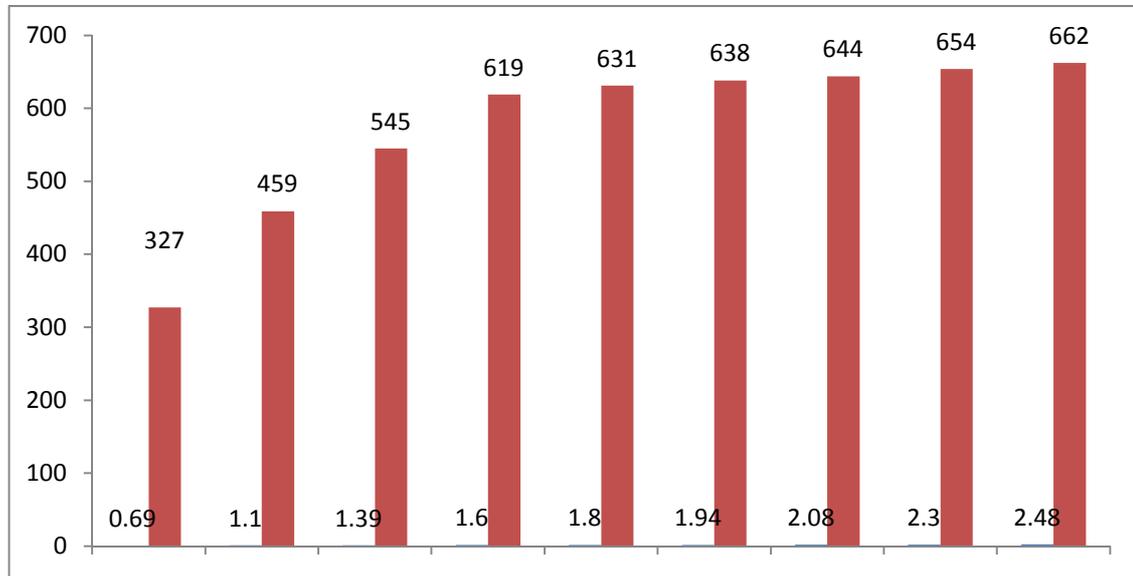
Graph-1: Form-wise Distribution of the documents

While analysing the forms of documents placed in Table-1, it was revealed that all the 77 MLIS dissertations reflect the highest number of citations i.e. 1837 (49%) are from books followed by 1411 citations from journals and magazines which come to 38%. The e-journals equally have been referred by the students which come to 115 (3%). Thus, in order of ranking, Books, Journals and Magazines and e-journals are ranked with 1st, 2nd and 3rd respectively.

This shows that books have a better priority for MLIS students, however, the journals also have a great importance while preparing the dissertation. Referring the e-journals for MLIS students is still in its infant stage.

5.2   AUTHORSHIP PATTERN

Citations from all the bibliography section of all the 77 dissertations were evaluated in order to study the authorship pattern. All authors irrespective of the types of documents were categorized into single, two, three and more than three authors. The authorship pattern of the citations is placed in Table-2 supported with Graph-2 for clear understanding.

Table-2: Authorship Pattern

Year	No. of Dissertations	No. of Citations	Single author	Two Authors	Three Authors	More than three Authors
2004	12	182 (5%)	133 (4%)	10 (3%)	01 (4%)	38 (29%)
2005	11	473 (13%)	399 (12%)	42 (12%)	01 (4%)	31 (23%)
2006	6	256 (7%)	228 (7%)	20 (6%)	00	08 (6%)
2007	12	960 (26%)	861 (27%)	87 (26%)	06 (23%)	06 (5%)
2008	12	599 (16%)	483 (15%)	86 (25%)	07 (27%)	23 (17%)
2009	14	708 (19%)	656 (20%)	36 (11%)	02 (8%)	14 (11%)
2010	10	541 (15%)	461 (14%)	58 (17%)	09 (35%)	13 (10%)
TOTAL	77	3719	3221	339	26	133
		% ⇨	87	9	1	4
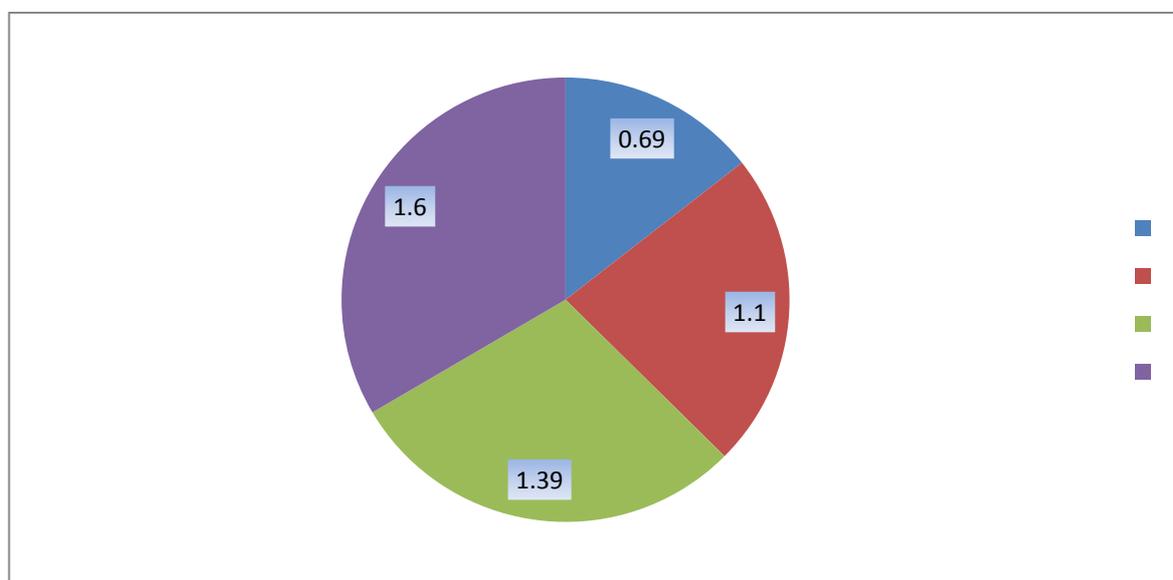
Graph-2: Authorship Pattern

The authorship pattern in Table-2 has been analysed according to year-wise which reflects the number of dissertations and corresponding citations. This also highlights the different patterns of authors such as single authors, two authors, three authors and more

than three authors. The analysis reflects that out of 3719 citations, 3221 (87%) constitutes the single author followed by 339 (9%) two authors and 133(4%) more than three authors. However, the authorship pattern for three authors constitute 26(1%) in the entire citations.

It is further noted that while going for a chronological analysis, 2004, 2007 and 2008 constitute the equal number of dissertations and reflects the irregular citations i.e, 182(5%), 960(20%) and 599(16%) respectively. It could be further noted that 2009 having the maximum number of dissertations i.e. 14 gives citation of 708 (19%). This is followed by the 11 dissertations in 2005 having 473 citations (13%).

5.2.1. DEGREE OF COLLABORATION: SINGLE vs. MULTIPLE AUTHORS

To determine the degree of collaboration in quantitative terms, the formula given by Subramanayam was used. The formula for being:

$$C = \frac{N_m}{N_s}$$

where   C = degree of collaboration in discipline,

       N_m = number of multi-authored papers, and

       N_s = number of single authored papers.

Hence, the degree of collaboration in library and information science is calculated as,

$$C = \frac{498}{3221} = 0.15$$

Again while making an analysis of the degree of collaboration i.e. single vs. multiple authors, it was observed that the degree of collaboration in the discipline is calculated as 0.15 and this shows the prevalence solo research in the field.

5.3 CITED AUTHORS DISTRIBUTION

Authorship patterns are studied among the cited LIS journals. Among the list of journals cited, a total of 419 authors are cited by LIS students in their dissertation work. Twenty two most highly cited authors are listed in decreasing order of their citing frequency. The ranking order of the frequently cited authors' distribution is placed in Table-3.

Table 3: Ranking of the Frequently Cited Authors

Sl.	Rank	Authors cited	Citing Frequency	Citing %	Cumulative Citing %
1.	1	Krishan Kumar	18	4.29	4.29
2.	2	Kaula, P N.	14	3.34	7.63
3.	3	Guha, Bimalendu	13	3.10	10.73
4.	3	Mangla, P B	13	3.10	13.83
5.	4	Sridhar, MS	9	2.14	15.97
6.	5	Singh, Sewa	8	1.90	17.87
7.	5	Vashish, CP	8	1.90	19.77
8.	6	Singh, SP	7	1.67	21.44
9.	6	Ranganathan , SR	7	1.67	23.11
10.	7	Vyas, SD	6	1.43	24.54
11.	7	Wilson, Thomas D	6	1.43	25.97
12.	7	Sethi, AR	6	1.43	27.4
13.	8	Goil, NK	5	1.19	28.59
14.	8	Haravu, LJ	5	1.19	29.78
15.	8	Iyengar, TKS	5	1.19	30.97
16.	8	Kapoor, SK	5	1.19	32.16
17.	8	Kumar, Girja	5	1.19	33.35
18.	8	Rajaram, Shyama	5	1.19	34.54
19.	8	Sen, BK	5	1.19	35.73
20.	8	Singh, Neena	5	1.19	36.92
21.	8	Subramoni, TK	5	1.19	38.11
22.	8	Umapathy, Setty K	5	1.19	39.3

The cited authors distribution in its ranking order is placed in Table-3 which reflects that Krishan Kumar is cited maximum i.e., 18 times (4.29%) followed by P.N.Kaula, 14 times (3.34%) and B.Guha and P.B.Mangla, 13 times each (3.10%) and thus it ranks 1st, 2nd and 3rd respectively. Further, the authors who have been cited up to 5 times are reflected in the table.

5.4   CITATIONS OF WEBSITES

The citations of websites placed in Table-4 deals with the contents of e-journals, and different URL sites for preparation of the dissertations by the MLIS students. The students prefer to visit different URL sites to download the required information. The scholar counted such URL sites available in the dissertation and placed year wise below in the Table.

Table 4: Citations of Websites

Year of access:	No. of URL cited	No of sites accessible	No of sites inaccessible	Av.% of sites accessible
2004	-	-	-	-
2005	-	-	-	-
2006	-	-	-	-
2007	51	4	47	7.84
2008	43	22	21	51.16
2009	4	0	4	0
2010	61	32	21	52.45

The analysis of Table-4 reflects that the students from 2004-2005 have not visited any URL sites. However students from 2007-2010 have visited different URL sites to download their required information. It is interesting to know that the students of 2010 have cited 61 URL sites which were in fact was visited by the scholar and found that 32 sites are still active out of 61. Likewise, in 2007, the students visited 51 URL sites and only 4 are still active. Again in 2008, out of 43 URL sites visited by the students, 22 remained active. This shows that most of the URL sites are not in static condition. However, the students are not used to visit organization sites which are static and update. It could be further noticed that the websites which serves as a convenient platform to share and exchange information sources has its downside being that the life-span of pages in websites is unpredictable. Some webpage or URLs from where information has been cited might have been removed as well which could have a setback on the relationship between documents. Many of the sites on Internet contain partial bibliographic information and no date viewed. Further, most URLs cited pointed to content pages with '.edu' , '.com' or '.org' domains and did not include a title.

5.5.   RANKING OF JOURNALS AND THEIR GEOGRAPHICAL DISTRIBUTION

Highly cited journals has higher impact factor which is a common parameter for measuring the relative importance of a journal. It is also useful in determining which journals are most resourceful for researchers. Citations in the dissertations are found across thirty eight LIS journals and are listed in descending order of their frequency of

citations along with their country origin in Table-5 with graphical presentation in Graph-3.

Table 5: Ranking of Journals with their Geographical Distribution

Sl. No	Journal Title	Place	Rank	Citations	%	Cumulative	
						Citations	%
1	Indian Library Association Bulletin (ILA)	India	1	183	26.06	183	26.06
2	Library Herald	India	2	144	20.51	327	46.57
3	Herald of Library Science	India	3	132	18.8	459	65.37
4	Journal of Library and Information Science (JLIS)	India	4	86	12.25	545	77.62
5	Annals of Library Science and Documentation	India	5	74	10.54	619	88.16
6	Library and Information Science Research (LISR)	India	6	12	1.70	631	89.86
7	ASLIB Proceedings	UK	7	7	0.99	638	90.85
8	Journal of Documentation	UK	8	6	0.85	644	91.7
9	Library Administration and Management (LA & M)	US	9	5	0.71	649	92.41
10	ALA	US	9	5	0.71	654	93.12
11	Information Technology and Libraries (ITAL)	US	10	4	0.56	658	93.68
12	Journals of Librarianship and Information Science (JOLIS)	UK	10	4	0.56	662	94.24
13	School Libraries Media Research	US	11	3	0.42	665	94.66
14	American Society for Information Science	US	12	2	0.28	667	94.94

15	Library Information Technology Association (LITA)	US	12	2	0.28	669	95.22
16	Inter-lending and Document Supply	US	12	2	0.28	671	95.5
17	Journal of Library Administration	US	12	2	0.28	673	95.78
18	Special Libraries	US	12	2	0.28	675	96.06
19	International Library Review	US	12	2	0.28	677	96.34
20	CLIS Observer	India	13	1	0.14	678	96.48
21	Association of College and Research Libraries (ACRL)	US	13	1	0.14	679	96.62
22	Libri: International Journal of Libraries and Information Services	UK	13	1	0.14	680	96.76
23	Indian Journal of Information Library and Society	India	13	1	0.14	681	96.90
24	UNESCO Bulletin for Libraries	France	13	1	0.14	682	97.04
25	Ligue dess bibliotheques Europeans de researche Bulletin	France	13	1	0.14	683	97.18
26	Journal of the American Society for Information Science and Technology	USA	13	1	0.14	684	97.32
27	Advances in Librarianship	UK	13	1	0.14	685	97.46
28	Issues in Informing Science and Information Technology (IISIT)	US	13	1	0.14	686	97.6
29	Library Quarterly	US	13	1	0.14	687	97.74
30	Journal of Education for Library and Information Science (JELIS)	US	13	1	0.14	688	97.88

31	Information Research	US	13	1	0.14	689	98.02
32	Library Journal	US	13	1	0.14	690	98.16
33	The Information Society (TIS)	US	13	1	0.14	691	98.3
34	Annual Review of Information Science and Technology	US	13	1	0.14	692	98.44
35	Journal of Information Science	US	13	1	0.14	693	98.58
36	Sarada Ranganathan Endowment for Library Science (SRELS) Journal of Information Management	India	13	1	0.14	694	98.72
37	Journal of Academic Librarianship	US	13	1	0.14	695	98.86
38	Library Administration and Management (LAMA)	US	13	1	0.14	696	99
	Total			**696**	≈100		
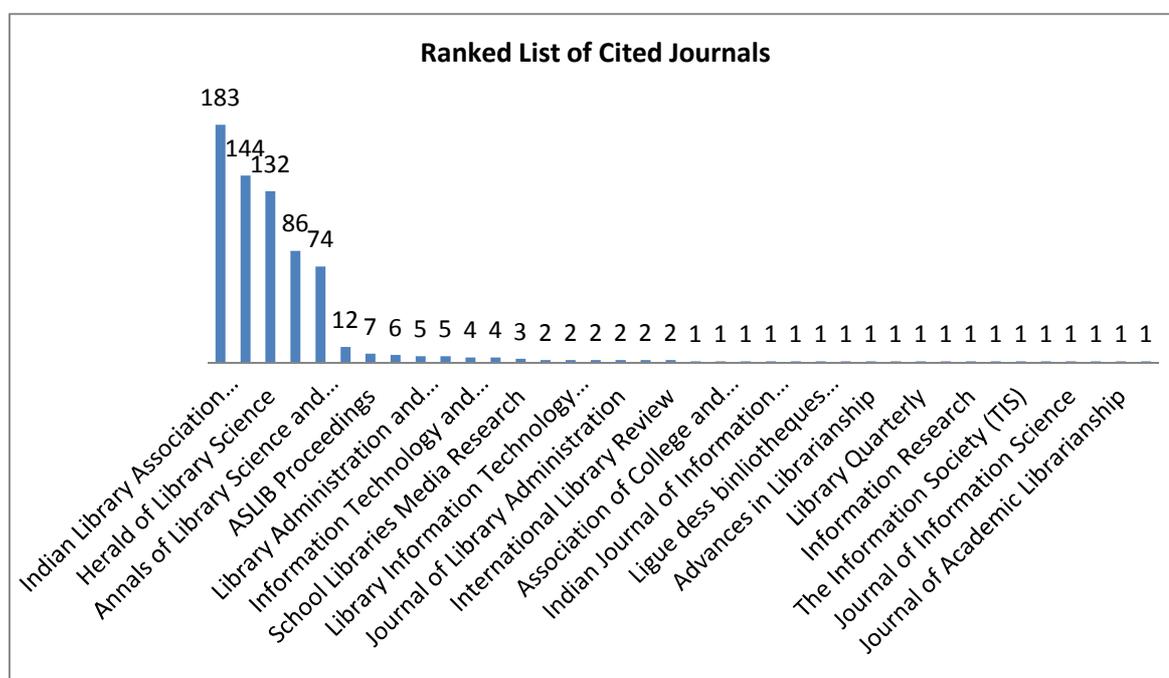
Graph-3: Graphical presentation cited LIS journal ranking

The scholar on analysis observed that out of the total 696 LIS journals cited while, Indian Library Association Bulletin (ILA) has 183 citations, Library Herald has 144 citations and Herald of Library Science has 132 citations and thus, it constitutes the top three top most frequently cited journals and ranks first, second and third respectively. Further, out of 38 subject journals cited by the students in their dissertations, 22 US based publications constitute 57.89 % followed by 9 Indian journals having 23.68% and 5 journals from UK that form 13.15% respectively. Mention may be made that, 2 journal publications are from France that contribute to 2.36% of the total publications. It is clear from the above analysis that, the students are more prone to use the US based journals due to the subject based contents and the central library of Mizoram University subscribe the foreign based journals which include both print and electronic. This is also very specific that, the students are guided to use the consortia based journals and hence, there is a chance to use the foreign based journals by the students of the department.

5.6   CHRONOLOGICAL DISTRIBUTION OF LIS JOURNALS

This is also one of the major components of the study to mention below the year wise distribution of the cited journals. The scholar placed below the chronological distributions of cited LIS journals in Table-6 supplemented with Graph-4 for clear understanding of the phenomena.

Table 6: Chronological distribution of total LIS journal citations

Sl. No	Year publications of cited journals.	No. of citations	%	Cum. citation	Cum. %
1	earlier-1960	4	1	4	1
2	1961-1965	4	1	8	1
3	1966-1970	37	5	45	6
4	1971-1975	17	2	62	9
5	1976-1980	62	9	124	18
6	1981-1985	88	13	212	30
7	1986-1990	120	17	332	48
8	1991-1995	143	21	475	68
9	1996-2000	117	17	592	85
10	2001-2005	95	14	687	99

11	2006-2010	9	1	696	100
	Total	**696**	101 or 100		
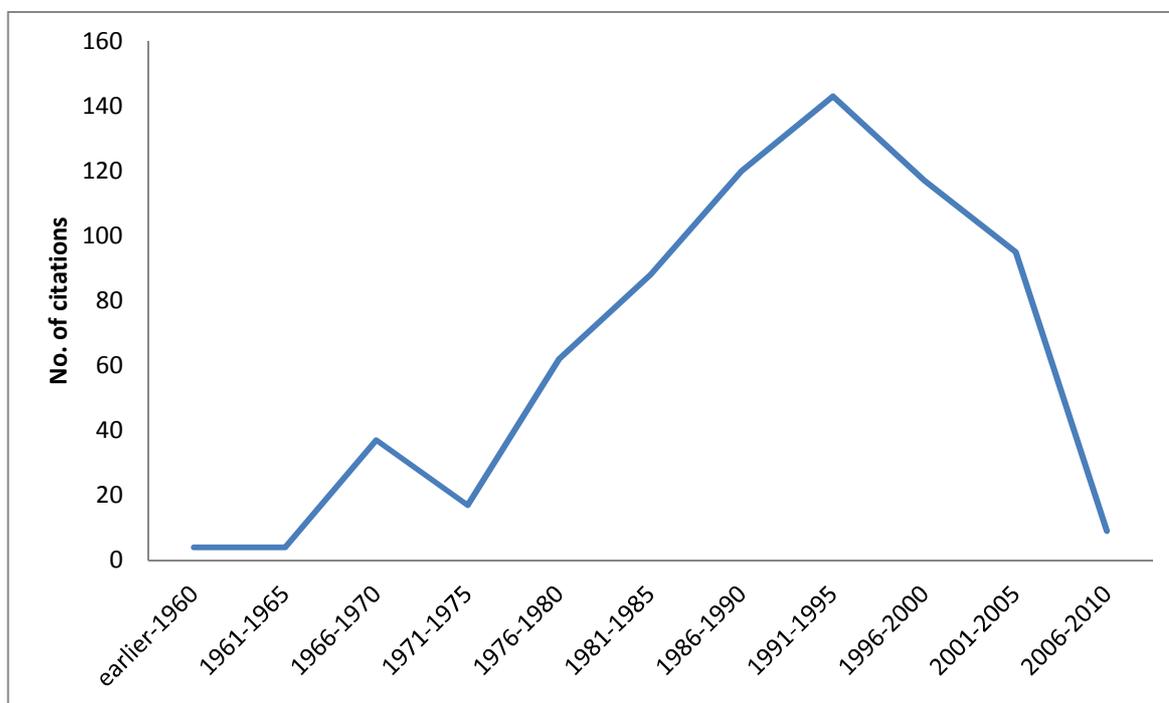
Graph-4: Chronological distribution of total LIS journal citation

In the dissertations under study, journals articles published between 1991-1995 are having the highest citation value which come to 143(21%) followed by the citation of the articles published between 1986-1990 that come to 120 (17%) and the citations of the articles between 1996-2000 constitute 117 (14%) respectively. This shows that, the articles are cited by the students taking into their dissertation topic and availability of materials in the library. Study reflected that, the articles published between 1986 to 2000 fit to their theme contents of the topic. This also depends on the number of students doing their dissertation work. More the number of students more the dissertation work. However, the citations of articles published during 1996 to 1985 are not adequate.

5.7 OBSOLESENCE OF LITERATURE

The median age of the journal articles cited under study are derived in order to find out the obsolescence of the articles. The current study is limited to 30 cited journal articles having the highest citing frequencies. This study applies the discrete analysis method to

calculate the median citation age for an article. To determine the median citation year for a single article, the publication year of the article is listed in the reverse chronological order *see* (a). The median year is derived from the lists of years the article cited *see* (b). The median citation age of an article is then obtained by calculating the difference between the median year and the year of publication of the article *see* (c) as shown in Table-7. Further, the total articles cited are grouped according to number of years after publication and their average median citation age is calculated in Table- 8 supported with Graph- 5.

Table-7: Median year and median citation age of cited articles

Articles No.	Year of Publication (a)	Median year (b)	Median citation age (c)
1	1967	1987.50	20.50
2	1976	1991.25	15.25
3	1979	1993.75	14.75
4	1981	1999.75	18.75
5	1982	1994.50	12.50
6	1982	1994.50	12.50
7	1983	1995.50	12.00
8	1983	1994.50	11.50
9	1984	2005.50	21.50
10	1984	1995.50	11.50
11	1987	1997.00	10.00
12	1987	1997.00	10.00
13	1987	1997.00	10.00
14	1988	1997.50	9.50
15	1990	1998.50	8.50
16	1990	1999.25	9.25
17	1991	1999.00	8.00
18	1991	1999.25	8.25
19	1993	1999.50	6.50
20	1994	2000.00	6.00
21	1994	2000.00	6.00

22	1995	2000.00	5.00
23	1995	2001.00	6.00
24	1995	1997.50	2.50
25	1997	2001.50	4.50
26	1999	2002.75	3.75
27	1999	2003.00	4.00
28	1999	2008.50	9.50
29	2000	2003.00	3.00
30	2001	2003.50	2.50

Table 8: Time-wise distribution of cited articles with average median citation age.

Time-wise publication year	Average median citation age
1965-1970	20.50
1971-1975	-
1976-1980	14.75
1981-1985	14.32
1986-1990	9.54
1991-1995	6.03
1996-2000	4.95
2001-2005	2.50

	1965-1970	1976-1980	1981-1985	1986-1990	1991-1995	1996-2000	2001-2005
Series1	20.5	14.75	14.32	9.54	6.03	4.95	2.5
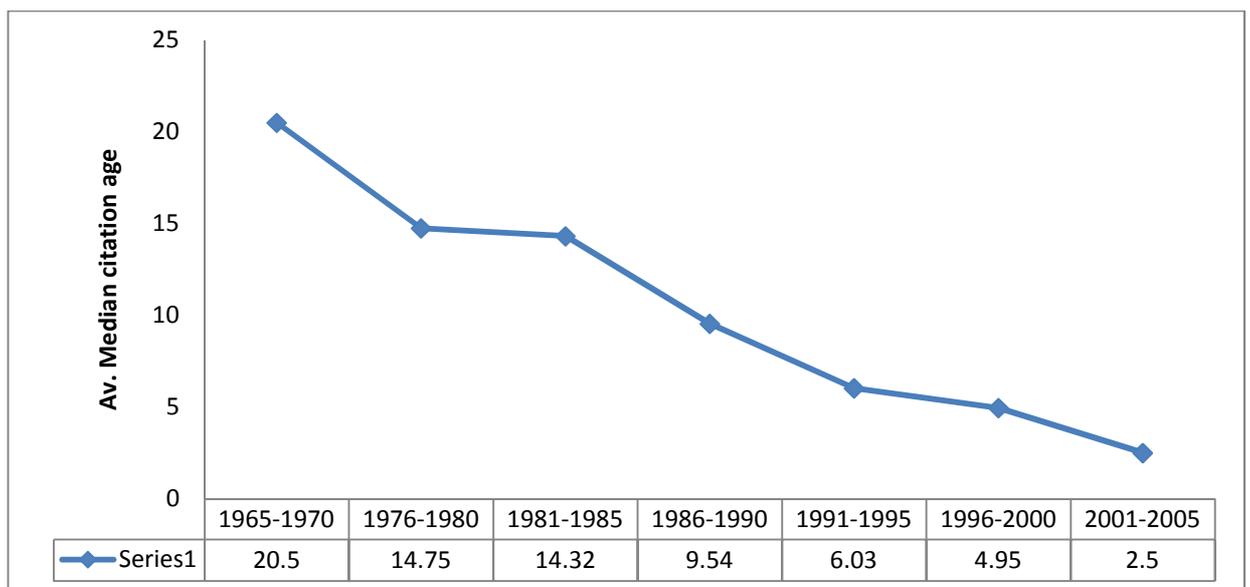
Graph-5: Time-wise distribution of cited articles with average median citation age.

From Table-7, the scholar noted that article no. 9 published in 1984 has the highest median citation age of 21.50 years followed by article no.1 published in 1967 with median citation age of 20.50 years. Article having the third highest median citation age is article no.4 published in 1981 with median citation age of 18.75 years. Articles having the least median citation age are article no. 24 and 30, published in 1994 and 2001 respectively. Both have median citation age of 2.50 years. It is observed from Table-8 that the citation age of the articles is directly proportional to the age of publication of the cited articles. It is shown from the table that cited sources under study age relatively slow.

5.8   APPLICATION OF BRADFORD'S LAW OF SCATTERING

Samuel Bradford formulated the law that if a group of journals are arranged in an order of decreasing productivity, i.e., the journal that yields the most relevant articles coming first and the most unproductive last, then the journals will be grouped into a number of zones each producing a similar number of relevant articles. To observe the appropriateness of the distributions of journals using Bradford's Law the following explanations were made and the results are presented in two parts where, the first part deals with the verbal formulation of the theory based on data consisting of periodical references taken under study which are arranged in the decreasing order of citations and the second part is examined through graphical representations of the data covered under study. Table-9 represents the details of journal citations such as, the no. of citations, cumulative citations, Log of cumulative citations and the percentage of cumulative citations etc. to test the verbal formulations of Bradford's Law as discussed

Table 9: Dispersion of literature in LIS cited among periodical titles

Rank	No. of Journals	Cum. no.jrls	No. of citations	Total citations	Cum. Citations	Log (n)	% of cum. Citations	% of periodicals
1	1	1	183	183	183	0	26.293	2.631
2	1	2	144	144	327	0.69	46.991	5.263
3	1	3	132	132	459	1.10	65.686	7.894
4	1	4	86	86	545	1.39	78.052	10.526
5	1	5	74	74	619	1.60	88.674	13.157

6	1	6	12	12	631	1.80	90.110	15.789
7	1	7	7	7	638	1.94	91.115	18.421
8	1	8	6	6	644	2.08	91.977	21.052
9	2	10	5	10	654	2.30	93.413	26.315
10	2	12	4	8	662	2.48	94.563	31.578
11	1	13	3	3	665	2.56	94.994	34.210
12	6	19	2	12	677	2.94	96.718	50.099
13	19	38	19	19	696	3.63	100.000	100.00

Verbal Formulation

For testing the algebraic interpretation of Bradford's Law, the 38 journal titles are divided into three zones. The distribution of journals and corresponding number of citations along with the cumulative number of citations are as shown in Table-10. The table reflects the marking of zones where the numbers of journals have been distributed. It is divided into three zones. The first zone reflects the data set where, 2 journals covers 327 articles while, in the second zone the next 4 journals cover 304 articles and in the third zone, the remaining 32 journals cover only 65 articles.

Table-10: Distribution of Journals into Zones

| Zone	No. of Journals	% of Journals	No. of citations	Cum. no. of citations
1	2	5.26	327	327
2	4	10.52	304	631
3	32	84.21	65	696
Total	**38**	**100**	**696**	

According to Bradford the zones identified will form and approximately geometric series in the form $1: n: n^2$. However, due to less citation counts on the third zone, all the three zones cannot have a uniform distribution of citations. It is found that the relationship of each zone in the study is 2:4:32. Here 2 represent the number of journals in the nucleus. Determining the value of multiplication constant 'n' for the entire three zones as 2, we get $2: 2X2: 2X2^2$.

i.e. 2:4:8. Therefore the finding does not fit into Bradford's distribution.

Graphical Formulation

The Graph-6 is the logarithmic plot of cumulative number of journal titles on the 'X' axis while, 'Y axis represents the cumulative number of citations. If the distribution conforms to Bradford's Law then , it would display the characteristics of three clear

distinct regions such as, (i) Rapid Rise for the first few points , (ii) a major portion of linear relation between two variables and (iii) a 'droop' at the end of the distribution indicating the incompleteness of the bibliography (Sudhier; 2010;3-14).
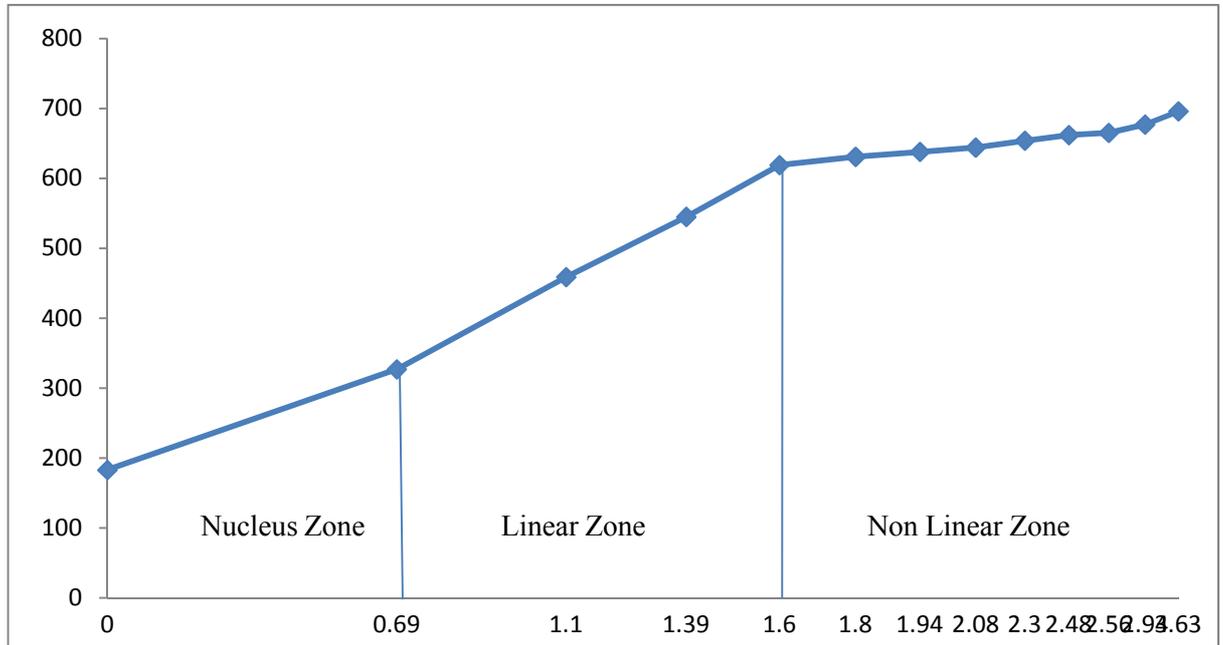
Graph- 6: Graphical Formulation of Scattering of Journals & Citations over Bradfords' Zone

The graph visualises a steep rise of initially as shown in the Table-9 and thereafter, an almost steady straight line is observed. The Bradford's 'groos droop' is partially present. This could be due to the fact that the citations covered in the study are less. The graphical presentation of Bradfords' zone is thus valid.

5.9   FINDINGS

From the above analysis, the findings of the study may be summarized as follows:

⇨   From the analysis of Table-1 it could be observed that, books are the most preferred shape of documents Printed documents are still a popular choice of MLIS students for their information resources. 96.9 % of the citation sources were in printed form and the remaining 131 i.e, 3.1 % constitutes sources cited from websites and e-journals.

⇨   Majority of the cited articles are produced by single authors. It is shown that single authors constitute the highest percentage (87%) against two authors (9%), three authors (0.69%) and more than three authors (4%). This shows the prevalence of solo research in this field.

⇨   The most frequently cited author having cited count of 18 is Krishan Kumar followed by P.N. Kaula with citing frequency of 14 times. Bimalendu Guha and P.B. Mangla stood in the third rank with each being cited 13 times. These authors hence have the highest productivity rate.

⇨   Many of websites urls cited are either improperly cited or are invalid urls. Some of those accessible contained partial bibliographic information and no date view.

⇨   The most highly cited journal is Indian Library Association Bulletin (ILA) accounting for 26.06 % of the total citations followed closely by Library Herald with 20.51 % of the total citations. More than half of the cited LIS journals are of US publications i.e., 57.89 %. India contributes 23.68 % of the total publications, with UK having 5 publications i.e., 13.15%. Two publications are from France and contribute to 2.36% of the total publications. The core journals identified are hence ILA Bulletin and Library Herald.

⇨   Result shows that publications between the years 1976-2000 are mostly consulted by MLIS students when writing their dissertations. The average half-life of journals cited by LIS students is 9.45 years. This shows that LIS journals of old publications are still very much used for consultation.

⇨   The present study does not conform to the verbal expression of Bradford's Law of Scattering However, the graphical presentation of Bradfords' Curve is observed.

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6.1   SUGESSTIONS

Based on the findings, the scholar has put forward the following suggestions:

- ➢ Since most of the research references are obtained by students from university libraries, the user behaviour plays an important role in determining the collection development of a library. Citation analysis is a practical tool to evaluate how a library is meeting the needs of local users. The citation study can be used as a reference for libraries in deciding the books to be purchased or journals to subscribe and the forms of documents to be strengthened in the library.

- ➢ From the findings, it was concluded that the students have less or limited accessibility to e-journals which is an emerging trends in research professions. To promote the profuse use of e-journals for the academic works, it is advisable to orient the students with current trends of information and communication technology. This will not only enhance their skill power but also will help them in future studies. The students are to be alerted more about the use of e-journals and e-books available in open access and consortia based e-resources being subscribed by the university library. However, the findings of this study show a degree of inaccuracy in that as some of the journals cited by the students in their dissertations could have been e-journals that were passed as printed journals.

- ➢ The present study though is confined to only a small area of citation study pertaining to LIS, a more extensive study may be undertaken in future covering other fields or subjects as well. The findings will open avenues and encouragements to study the realistic approach of the documents evaluation.

- ➢ Other bibliometric techniques and applications of mathematical formula in analysing the validity of bibliometric laws has not been carried out so far, hence future scholars may consider taking up the test.

- ➢ Bibliographical errors when citing a document such as spelling mistakes, wrong year of publication, wrong titles etc are commonly found during citation study. Negligence of these errors is liable to give way to misinterpretation of data. As citation is an important device in evaluation of a journal or authors impact factor, therefore care should be taken when citing references.

➢ The study will not only add substantial result for the library to develop the user-based collection developments but also decide upon the procurement of the core journals relevant to the subject areas.

6.2. CONCLUSION

The culmination of one's research contribution to the academic world as a research student is accomplished via the dissertation. As a result, dissertations were analyzed because they serve as the best representation of the research interests. The bibliographical study of dissertations submitted by post-graduate MLIS students of Mizoram University is carried out to better understand the needs of the students in terms of information resources, their behaviour in selection of reference materials and their level of exposure to information and communication technologies such as the use of web based information systems.

Citation analysis is taken to represent the analysis of bibliographic references, which form part of the device of scholarly communication. Knowledge about citing behaviour and the characteristics of citations is crucial to determine whether it makes sense to use citation analysis in various areas of application. Although the function of citation analysis is much emphasized as a tool for assessing quality a literature or author, citation analysis has its own shortcomings. Critics have highlighted on various grounds the unreliability of using citation analysis as a parameter for judging the value of scholarly works. On the other hand, proponents of citation analysis alleged that these problems are comparatively diminutive.

Citation data are much useful in information retrieval. Citation studies help researchers to certain extent in finding precise information at the least amount of time. It assists in identifying the areas of research studies, the scope of researches which have been accomplished in a specific field and where research is still necessitated.

The citation analysis of Post-Graduate MLIS dissertations of Mizoram University serves as a cutting edge in studying the trends of information pattern within its subject field. The citation analysis statistics gives an idea of how and from where information resources are gathered and provides an insight to the characteristics of the sources of the citations.

Further, Bibliometric study cannot be confined to any one discipline. It can extend its domain to many disciplines. However, there are common problems such as (i) Self citations, (ii) Authors using initials mixed with full names, (iii) Field variations of citation amounts or purposes, (iv) Fluctuation of influence and use and (v) Human errors. In general, all of the basic Bibliometric techniques work can be applied well with many types of information entities such as, authors, journals, organizations, departments, universities.

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Sl. No	Dissertation Title	Name of the Student	Year
1.	Impact of libraries on society	S. Lalnunpuia	2004
2.	Library committee (its composition, nature & function) of university library with reference to Mizoram university	C.Lalrozauva	-do-
3.	Management of university libraries of India with special reference to Mizoram university library	Diana Zodinpuii	-do-
4.	An user study of public libraries in Aizawl city	Lalramzawni	-do-
5.	Contribution of Dr. SR Ranganathan in the field of library and information science	Lalrokhawma	-do-
6.	Comparative study on colon classification and universal decimal classification	Sharon Lalmalsawmi	-do-
7.	Library legislation in India with special reference to Mizoram	R. Lalchhuanawma	-do-
8.	DDC: its origin, structure and development	Lalbiaknunga	-do-
9.	Organization, working and use of rural libraries in Aizawl city	Lianthangpuii	-do-
10.	Information Technology: its impact on university library system of India with special reference to Mizoram University Library	Irene Lalremsangi	-do-
11.	A critical study of the functioning of college libraries in Aizawl city	Lalengmuana Sailo	-do-
12.	Public relations in library	Lalrotluanga	-do-
13.	Contribution of NGO for the promotion of public libraries in Mizoram with special reference to YMA libraries	Rebecca Zonunusangi	2005
14.	A case study Mizoram university library committee	Ngurtinkhuma	-do-
15.	Library and information services provided by departmental library of Mizoram	K. Lalparmawii	-do-
16.	Modernization of Pachhunga University library : a case study	K.Laremsiama	-do-
17.	Mizoram Library Association : origin and activities	Zomuana Joute	-do-
18.	Role of village libraries in Mizoram : a case study	K. Vanlalhngaka	-do-
19.	Library and information services provided by special libraries in Mizoram	Rinengmawia	-do-
20.	Public library system in Mizoram : problems and prospects	Jerry Lalrintluanga	-do-
21.	Library and information science education in	Lalngaizuali	-do-

	Mizoram : a case study		
22.	Modernization of Mizoram university central library : a developmental plan	Lalthanmawii Sailo	-do-
23.	Growth and development of college libraries in Mizoram with special reference to Govt. Hrangbana College	Zohmangaiha	-do-
24.	Management of college library in Aizawl : a study	Biakthansanga Khiangte	2006
25.	Annotated bibliography of MLIS dissertations submitted by MLIS students in Mizoram University	Lalsangzeli	-do-
26.	Collection development of university library with special reference to Mizoram University Library	Malsawmdawngliana	-do-
27.	A study of growth and development of Lunglei District Library	Lalrammawii	-do-
28.	Public library in the development of Mizo society : a case study of Aizawl District Library	Lalbiaksanga Hnamte	-do-
29.	Developmental plan for university library with special reference to library building	P.C. Laltlanawma	-do-
30.	Design and development of database in Aizawl Theological College Library: a study	Thankima	2007
31.	The use of internet by the faculty members of Mizoram University : analysis	Julie	-do-
32.	Electronic resources in building an academic library collection : a study	Zirsangliana Sailo	-do-
33.	Development of college libraries in Mizoram: a study on UGC perspective	Lalnunkimi	-do-
34.	A case study of govt. Aizawl College Library	Ngursavunga Sailo	-do-
35.	Impact of planner 2006 conference on library and information professionals of Mizoram	Eddie Vanlalruata	-do-
36.	Growth and development of Pachhunga University Library : vision plan for the 21st century.	Romanzuali Renthlei	-do-
37.	Modernization of Mizoram Legislative Assembly Library: a case study	B.Lalhlimpuii	-do-
38.	Library resources used by the faculty members of J.Thanhlira College and Aizawl North College	Lalthanpuii Pachuau	-do-
39.	Study of Champhai District Library : problems and prospects	P.C. Lalhriatpuii	-do-
40.	User education and info seeking approaches in Mizoram University Library: a case study	Mary Zothansangi	-do-
41.	User's attitude towards college library in Mizoram	C.L. Lalchhingpuii	-do-

	with special reference to Hrangbana College, Mizoram		
42.	Library Softwares : a comparative study of Libsys and Nirmal	Lalthahmingmawii	2008
43.	Contribution of special libraries for the educational development of Mizoram: a case study of SCERT library	Saidingpuii	-do-
44.	Growth and development of Government Kolasib Library : a study	Vanlalhruaii Hrahsel	-do-
45.	Library services provided by Govt. Polytechnic in Mizoram : a study	Lalhmangaihzuali	-do-
46.	Reading habits of secondary students with special reference to Mizoram Institute of Comprehensive Education (MICE) school, Aizawl : a case study	H.Lalruatfeli	-do-
47.	Library services provided by Mizoram Law College: a study	Lalparmawii	-do-
48.	Library and information services provided by the college of veterinary sciences and animal husbandry : a case study	J. David Lalremtluanga	-do-
49.	Library and information services provided by DOEACC society, mizoram : a study	Margaret Laldingliani	-do-
50.	Library websites of IITs : a comparative study	S. Vanlalheni	-do-
51.	Comparative study of specialized search engines	Zohmingthangi Ralte	-do-
52.	A study of Lunglei Govt. College library : problems and prospects	Vanlalhmangaihi	-do-
53.	Automation of Hrangbana college library : a case study	Samuel Lalruatsanga	-do-
54.	Information seeking behavior of Apollo school of nursing	Jonathan Lalngaihdama	2009
55.	Automation of Mizoram University Central library : a case study	Lalhmuchhuaka Jongte	-do-
56.	Growth and development of college libraries with special references to Lunglei Govt. College	T. Lalmuanawma	-do-
57.	Availability of reference material prescribed in the syllabus of Arts Department in Hrangbana college : an analysis	Malsawmdawnga Chawngthu	-do-
58.	Preservation and conservation method followed by state museum with special reference to Mizoram	Vanlalneia	-do-
59.	Modernization of college library with special reference to Govt. Aizawl West College: a case study.	Lalthapuia Pachuau	-do-

60.	Attitude of faculty members in social sciences towards use of resources in Mizoram University Central Library : a study	Lalchhanchhuahi	-do-
61.	Modernization of Mizoram Polytechnic Library : a study on developmental plan	Lalrindiki Pautu	-do-
62.	Access and use of information by health care proffessionals in Aizawl : a study	P.C. Rebecca Lalhlimpuii	-do-
63.	Modernization of State Library : with reference to Mizoram	Lucy Rosangpuii	-do-
64.	Need and development of secondary school library in Mizoram: a study	Lalhlimpuii	-do-
65.	Library services provided by special libraries in Mizoram with reference to Industrial Training Institute : a study	Laldingliani	-do-
66.	Source and services provided by All India Radio Library to their user : a case study	Zodinsangi	-do-
67.	User studies of Post Gradate Science students in Mizoram University	Lalhmunmawii	-do-
68.	A study of the publication pattern in the area of malaria between 1981-2005: an analysis of MALPUB (malaria publication) database	Laldampuii	2010
69.	To map the productivity o major countries which are contributing to MALPUB database	Emily Lalmuanhlupuii	-do-
70.	Management and development of college library in Aizawl	Dorothy Lallawmsangi	-do-
71.	Library services to law students with special references to Mizoram Law College	F. Lalhmangaihzuali	-do-
72.	Information seeking behavior of the faculties of Govt. Hrangbana College	Lalrammawii	-do-
73.	Database creation of MLIS dissertation in Library and Informaion Science using CDS/ISIS	Nich Taku	-do-
74.	Library services provided by Aizawl Theological College : a study	Sangchhuankhuma	-do-
75.	Library and information services provided by Administrative Training Institute , Mizoram: a study	Joseph Lalthanmawia	-do-
76.	Collection development of ICFAI University Library, Mizoram: a study	Zarzoliana Khiangte	-do-
77.	Information source and uses in academic library : a study of Lunglei Govt. College and Govt. J.	C. Lalruatkima	-do-

	Buana College		